THINKING AHEAD ON *e*-SKILLS FOR THE ICT INDUSTRY IN EUROPE

Harnessing our Strengths and Diversity for the World Stage

Executive Summary

Council of European Professional Informatics Societies

December, 2006

1 Introduction

Information and Communication Technology is a major force in the European economy. The ICT market is estimated at being worth over €500bn in the EU (2005), and the ICT sectors between them now employ over 6m people. The Software & IT Services sector alone employs over 2.8m people, and in 2003 added over €150bn of value to the European economy. Member States' Software & IT Services industries typically win exports of some €60bn a year, the third most exported service[*]. The capabilities of people to create, deploy and use ICT have become a major component of economic activity.

The prime movers in this world are *ICT practitioners* – those who research, develop, design, manage, produce, consult, market, sell, integrate, install, administer, maintain, support and service ICT systems, devices and services. Official statistics confirm that there are more than 4m[**] ICT practitioners of different kinds working within the European Union, throughout all sectors of the economy. Between 1995 and 2005 over 1.7m of these jobs have been created around the EU, and although employment growth rates have slowed significantly since 2001, ICT practitioners will continue to make a major contribution to the European economy.

The wealth and jobs created in the wider economy also arise from contributions from Europe's *ICT users* – those who deliver the capabilities required for effective application of ICT systems, devices and services by the individual. There are approximately 180m people using ICT in the EU, and their contribution to the effective use of ICT (whether in the public or private sectors) has brought about the widespread innovation achieved in business operations in all parts of the economy.

This innovation has helped EU public and private sector organisations modernise and compete with enterprises around the world in an increasingly global economy. This has been achieved through the leadership of those with *e-business skills* – those who have the capabilities to exploit opportunities provided by ICT, notably the Internet, to ensure more efficient and effective performance of different types of organisations. Those with such skills also explore new ways of conducting business and organisational processes, and establish new businesses.

2 The Study

How will the availability of these three types of 'e-skills' support the future global competitiveness of the ICT industry in the EU? This study looks ahead at how the e-skills position could develop over the coming years, focusing in particular on the IT practitioner needs of the industry.

Contact was made with relevant experts within major ICT Industry players at the EU level, and early analysis was presented to the ICT Industry bodies in most Member States. An extensive literature review was carried out, and particularly careful analysis was made of the approach and outcomes of previous e-skills future research, both qualitative and quantitative.

The report contains a wealth of information and quantitative data on recent trends in ICT Industry employment in all Member States for which there are statistically robust figures available. A significant amount of additional information is provided that can help clarify the debate and foster constructive dialogue on e-skills at the European level.

[*] Eurostat (2006a)

[**] Structure of employment EU-25 (Source: estimates mostly from EU Labour Force Survey (LFS: 2005Q2), rounded):

	ICT Industry	User Sectors	Total
ICT practitioners	2.0m	2.2m	4.2m
Other Occupations	4.2m	208m	212m
Total	6.2m	210m	216m

The report examines the key trends that will play a role in influencing the supply and demand of each of the three types of e-skills, as well as the *off-shoring of ICT work* that is of growing political interest and could substantially affect future demand levels. It then examines, qualitatively and quantitatively, how things could develop. ***Ninety 'change drivers';*** covering social, technological, economic, environmental, political and values-related forces have been identified and examined.

The main impact of each *change driver* on demand for ICT practitioner skills is analysed, and three factors that are strong determinants of this demand, and that are impacted most significantly by the ninety drivers, were identified:

- **The rate of ICT innovation (technological change)**
- **Economic growth (both within the EU and beyond)**
- **The degree of off-shoring undertaken within the industry.**

2.1 Scenario Analysis

Future development of these *core-drivers* is uncertain, giving rise to the need for *scenario* analysis. In trying to assess possible future developments and sensible options for preparing for them, one of the most powerful approaches found so far, in both business and policy contexts, is to construct a number of possible futures ('scenarios') which can illustrate some of the range of situations that may confront us in the future and so open up group thinking by working through how each might look, and feel. Scenario exploration has proved very valuable for better understanding in a number of areas, and the project has developed, in response to the remit, six descriptive and quantitative scenarios that will help to inform thinking about the future of e-skills in Europe.

In highly complex areas like this, with a wide range of uncertainties present about future developments, the main benefits of the scenario approach are to help analysts and study users to:

- consider, in the light of possible developments, what sensible *contingencies* might be;
- reach their own views as to *what are the key factors* that need to be taken into account;
- think about '*early warnings*' of possible courses of development; and
- form a more accurate view of *how different parties might respond* to various developments.

Six scenarios using different combinations of the *core-drivers* are shown below: Summaries of the six scenarios is provided in 3.3 and each scenario is fully presented in the Report as a structured summary, with the situation described in relation to ten key contexts.

Scenario	Pace of Technological change	Economic Climate	Pace of Off-shoring
A :**Renaissance**	Rapid	Positive	Moderate
B: **Steady Climb**	Moderate	Positive	Moderate
C: **Global**	Rapid	Positive	High
D: **Fight back**	Rapid	Turbulence	Moderate
E: **Dark Days**	Moderate	Turbulence	Moderate
F: **Decline**	Moderate	Turbulence	High

Table i: The Six Scenarios

. The qualitative scenarios were presented and reviewed at a validation workshop, involving representatives from Member State ICT Industries, and feedback has also been received from major industry players at the EU level. Reactions from these informed observers indicated that Scenarios A, B and C were expected to be the most likely to take place.

Table ii shows the likely broad impact in the different scenarios of the prevailing conditions on Supply and Demand, assuming three levels of ICT practitioners low, medium and high, (where '-' indicates *decline or no increase*; '+' signifies *slow increase*, and '++' means *rapid increase*: all relative to the historical trend).

ICT practitioner Skill level	State of Skills within European Union (ICT Industry)	Renaissance	Steady Climb	Global	Fight back	Dark Days	Decline
Low	Supply of Skills within EU	+	+	+	-	-	- (+)
	Demand for Skills within EU ICT Industry	+	+	+	+	+	-
Medium	Supply of Skills within EU	+	+	+	+	- (+)	- (+)
	Demand for Skills within EU ICT Industry	++ (+)	+	++	+	+	+
High	Supply of Skills within EU	+	- (+)	+	- (+)	- (+)	-
	Demand for Skills within EU ICT Industry	++	+	+	++	+	+
Overall	Supply of Skills within EU	+	+	+	- (+)	- (+)	- (+)
	Demand for Skills within EU ICT Industry	++	+	++	+	+	+

Table ii: Summary of Broad ICT Practitioner Skills Impact of Conditions in Each Scenario

2.2 Mathematical Model

2.2.1 Modelling Approach and Scope

The Study also explored the broad *quantitative* implications of the six scenarios. However, while the *qualitative* scenarios showed additional possible developments arising from the impact of a number of other change drivers, the mathematical model was purely based on variations of the three *core-drivers* (+ an assumption about the development of real remuneration). Thus the numerical results of the six future trajectories estimated from the model are broadly coherent with, but not identical to, the conditions in the descriptive scenarios.

In considering the modelling approach, the consortium team studied the recent published forecasts of e-skills employment in some detail, as well as published approaches to modelling the impact of employment on some of the input values (in particular, off-shoring). An Annex to the report describes the modelling approach and model design from first principles. The over-riding priorities for model design were to maximise use of relevant sound data and to keep the model as simple as possible to increase chances of lay understanding.

The study developed a simple but powerful mathematical model, which can be used to explore a wide range of 'what-if?'s. The model's foundations lie in the power of software investment as an indicator with strong correlation to employment levels in the Software & IT services industry over an extended period. Software investment also forms part of Member States' *national accounts*, so that general economic outlook properties can be drawn upon. The model design was chosen for simplicity, communicability and for maximum exploitation of data availability, given the serious lack of desirable data for many variables[*].

[*] alternative model forms were considered, in particular in relation to handling areas with extreme lack of data (e.g. off-shoring), and an Annex explains the approach behind model form selection.

The model draws on data for software investment and employment from official sources for the EU-15, covering the *Software & IT Services Sector* (which employs over 85% of all the IT practitioners within the ICT Industry in Europe). In order to estimate the development over the coming years of total IT practitioner demand for the ICT Industry as a whole, these figures are grossed-up to cover the additional IT practitioners in the new Member States and within the *Broad (Electronics) Hardware Production*, and *Telecommunications* Sectors. The grossing-up is based on the fractions of IT practitioners employed by these ICT Industry sectors in the latest EU Labour Force Survey data. Table iii shows the distribution of IT practitioners between three main sectors of the ICT Supply Industry for the EU-15 and the EU-25 for 2005.

	Software & IT Services (NACE 72)	**Broad Hardware Production** (NACE 30+32)	**Telecomms** (NACE 64.2**)	**Total Hardware, Software, IT Services & Telecomms**
EU-15	1,300,000	110,000	118,000	1,528,000
EU-25	1,417,000	120,000	130,000	1,667,000

Core modelling scope (estimates from model projections)

Estimates grossed-up from core estimates in line with the most recent employment ratios

Table iii: Distribution of IT Practitioner Employment* Across ICT Industry Sub-sectors**
(Note: that these figures are a *sub-set* of the ICT practitioner totals)

While specific estimates of the future development of employment in the other two sectors within separate models would have been ideal, no evidence was found providing, for *Hardware Production* or *Telecommunications*, close correlation equivalent to that between *Software Investment* and *Software & IT Services* employment. As can be seen from the table, the Software & IT Services sector is so dominant, in relation to ICT Industry employment of IT practitioners, that the error introduced by possible changes over the coming years in the distribution shown in the table is unlikely to be significant.

2.2.2 Model Assumptions

- It was chosen to model rapid technology change in the EU-15 as a continuation of the historical *rapid* rate of increase in software's share of non-residential fixed capital formation. *Moderate* technology change was then modelled by increasing the variable at half the historical pace. This was based on the observation from US data that periods of rapid technology change are typically reflected in published national investment statistics. This data shows a ramp up in the share of all non-residential fixed investment accounted for by software, while periods of moderate change are typically reflected by slower growth in this variable.
- It was chosen to model a *strong* EU economy with 2.5% growth per annum, accompanied by an increase in the share of GDP going into business investment. A *turbulent* EU economy was modelled with a 1.5% annual rise in real GDP, accompanied by a fall in the share of GDP going into investment. Because a smooth transition from the OECD investment the turbulent economy view only turns negative after 2009. This was based on the evidence from both EU and US data that growth in investment in software is related closely to growth in non-residential investment. This is in turn related to both growth in GDP, and, by confidence in future growth prospects, this influences the share of GDP that is devoted to investment. For the period up to 2007, the consortium team adopted projections from the OECD's most recent *Economic Outlook* on GDP growth, and growth in investment relative to GDP.

** using adjusted UK data for disaggregation within NACE 64

*** levels for ISCO 213+312 occupations, source: EULFS (Eurostat holdings of Member State LFS – or equivalent – data) 2005Q2

- It was chosen to model off-shoring as the net percentage of EU-15 *Software & IT Services* sector (NACE 72) jobs lost to off-shoring each year, whether actually lost or not created. The data on current levels of outsourcing is too thin to provide a reliable estimate of the current value of this variable. A value of 0.5% per annum was chosen, which is consistent with the available information. This was held constant to represent *moderate* off-shoring, and ramped up towards 3.5% in 2015 to represent *rapid* off-shoring.

The *general logic* for the model is as follows:

- In the absence of off-shoring, changes in employment in NACE 72 will be a function of changes in investment in software and changes in the real cost of labour. For example, if software investment rises by 5% and real pay rises by 2%, then employment will rise by 3%.
- The main factors driving changes in investment in software are:
  - general changes in business investment; and
  - the rate of emergence or improvement of technologies relevant to business, that causes companies to decide to increase or reduce the share of their investment that goes into software.
- Off-shoring reduces the share of all EU-15 investment in software that is spent domestically, and therefore reduces the employment level supported by any particular level of investment.

In the model, a number of *variables are held constant,* explicitly or implicitly.

- The rate of increase in real pay is assumed to be constant at 1.5% per annum. This reflects the general economy-wide tendency of pay to increase beyond the rate of inflation. This is underpinned by whole economy increases in productivity, with an increment to reflect a shift in the skills mix required in NACE 72 in favour of higher level skills.
- It is assumed that there is no change in the share of ICT activity within the EU that is outsourced to NACE 72 businesses from businesses in other sectors.
- It is assumed that there is no change in the margins taken by NACE 72 companies.
- Aside from the influence of off-shoring, the share of software investment accounted for by imports remains constant. The share of NACE 72 output exported from EU-15 also remains constant.

3 Findings

3.1 Future Demand

This set of input assumptions to the model produces the trajectories for possible development of total employment (assuming adequate supply) in the Software and IT Services sector in the European Union* shown in Figure i below:

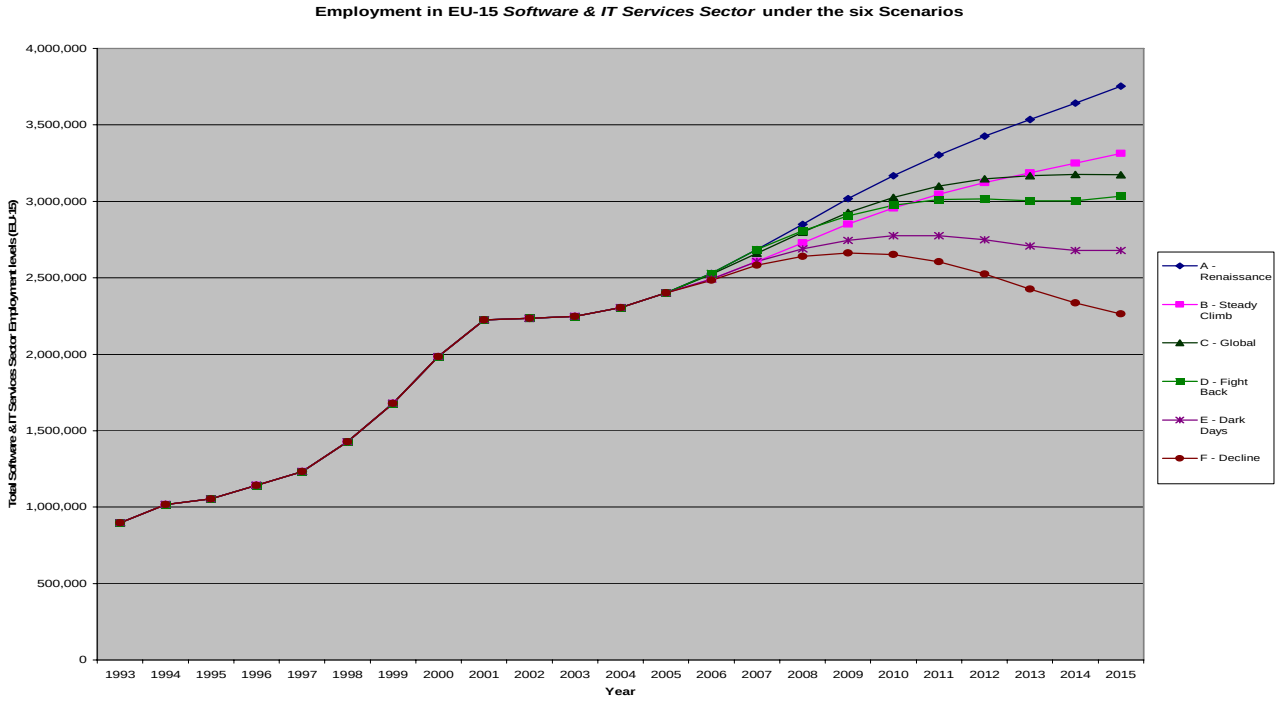

Figure i: Employment in the EU-15 Software & IT Services Sector

These trajectories are converted to estimates of annual net demand for IT practitioners for the whole ICT Industry in the EU-25 shown in Figure ii, based on assumptions about replacement demand and the fraction IT practitioner represent of industry employment, and grossing-up as shown:

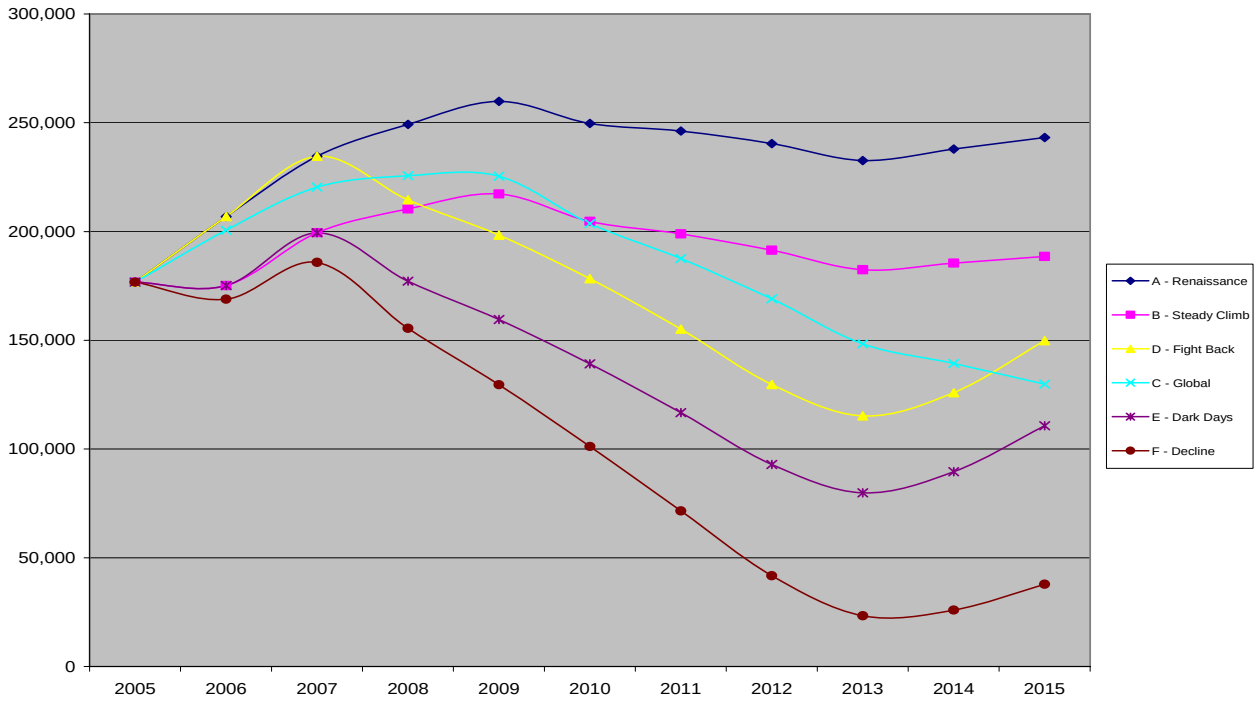

Figure ii: Estimates of 'New' IT Practitioners Needed Each Year in the EU-25 ICT Industry

* EU-15 data is used, as much greater historical evidence is available, as compared with EU-25

3.2 Future Supply

The levels of new demand shown in Figure ii assume that there will be supply adequate to fill the positions. The supply of new IT practitioners comes from a number of different sources, in particular:

- Graduates of Higher Education (HE) informatics/computing* courses, arriving onto the labour market, that can be recruited by companies in the Software and IT Services sector;
- Existing employees being 'trained up' by their employer to become IT practitioners (within the ICT Industry);
- 'Occupational migrants' entering IT practitioner work in the sector via some kind of conversion learning from other kinds of work;
- Graduates from non-informatics HE courses recruited by ICT Industry employers;
- New market entrants with IT knowledge from other parts of the formal education system (e.g. from secondary vocational-, or even general-, education courses);
- New IT practitioners entering ICT companies from *inward-migration* from outside the EU;
- IT practitioners re-entering the labour market (e.g. from unemployment or career-breaks);
- IT practitioners moving in from user sectors (in particular as a result of additional Outsourcing *within* the EU).

An *illustrative* supply projection was produced to complement each demand trajectory. Given the importance of the informatics graduate recruitment source of supply, and the fact that meaningful data is available for such graduations over recent years, this was separated out within the supply trajectories. To complement this 'core' supply, illustrative estimates were produced for the sum of supply from the six other sources. The supply and demand trajectories corresponding broadly to each qualitative scenario are shown in the Annex.

One compelling concern about supply is the reported decline in supply of good graduates from informatics courses. The most recent official Eurostat statistics for enrolments and graduations of Higher Education students on informatics courses suggest a growing supply of fresh graduates. However, there are clear declines in applications for mainstream ICT courses in some Member States and it is possible that classifications used for reporting national HE data to Eurostat include courses beyond mainstream informatics subject matter. Specifically, the ICT Industry reports serious concerns at least in Germany, the Netherlands, Sweden and the UK.

In this situation, it was decided, for the supply projections, to take the informatics graduate data to 2004 from Eurostat (latest available data), but assume, based on the growing reported concern from the industry, a fall-off in growth for 2005 and 2006 followed by a substantial decline in the years to 2015. While there is currently no statistical evidence for this, such an assumption is a conservative one. This approach is consistent with the *precautionary principle*, given the seriousness of the reports, and the importance of this source of supply for the future well-being, and particularly innovation capability, of the EU ICT Industry. As a result of expected demographic impacts, applications from EU residents would be expected in any case to fall by some 8% between 2005 and 2015, but the illustrative supply scenarios assume a significantly greater fall – a ca. 30% fall in graduations over the same period, assuming a continuation of the growing decline of interest in HE technology-oriented courses.

As well as taking into account the contribution to new IT practitioner supply of other sources, it is also necessary to recognise that not all informatics graduates who want to work as IT practitioners will be recruited by the ICT supply Industry. Significant numbers will continue to be recruited by the many large employers in the user sectors of the economy. The illustrative supply trajectories assume that, at the outset of the scenario period, the ICT Industry recruits some 75% of such graduates, and for higher demand scenarios, action by ICT Industry employers increases this share. However, strengthening recruitment, ever more actively, from other sources is the over-riding means of compensating for the continuing fall in availability of informatics graduates

* although Eurostat uses *computing* for the relevant HE subject category statistics, *informatics* is used in this study to refer to courses on informatics, computing, information systems, ICT, computer science, etc.

3.3 Scenario Projection Summaries

An overview of the quantitative aspects of each scenario is presented below and each presents how supply and demand might develop in each case:

3.3.1 Scenario A: Renaissance

In the ***Renaissance*** Scenario the:

- ***rate of ICT innovation*** is assumed to be ***Rapid***;
- ***economic climate*** is assumed to be ***Positive***; and
- ***pace of off-shoring*** is assumed to be ***Moderate***.

Figure iii illustrates how 'new' IT practitioner supply, and informatics graduate recruitment within that, might develop in response to the strong growth in new demand involved in Scenario A.

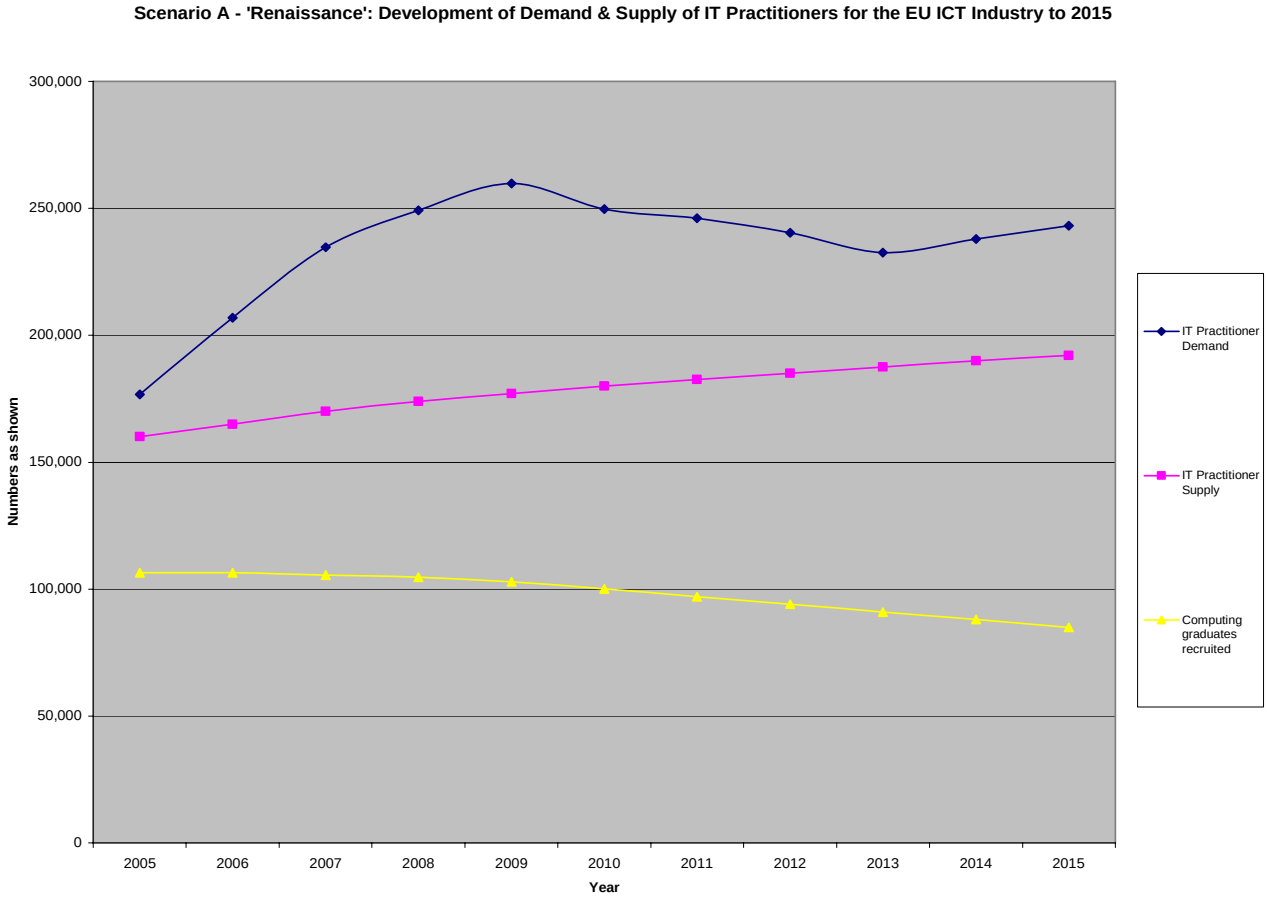

Figure iii: (Net, new) EU Supply and Demand Trajectories for A: *Renaissance*

This scenario sees the greatest rise, of all six scenarios, in new demand levels over the period to 2015. These will result in significant skill shortages, which will be further impacted by the growing fall in numbers of informatics graduates coming onto the labour market after 2007. The acute shortages quickly evident after 2006 result in action by employers to augment their ICT practitioner teams from other sources. The fall in flows of the technical graduates begins to take effect more strongly in 2009, but from then onward the illustrative projections involve stronger measures being taken by the ICT Industry, and sometimes substantial rising salary offers help the supply industry win an increasing share of the informatics graduates that are available. In some Member States the ICT Industry joins

with government to launch campaigns promoting work in the Industry, and overall, these measures result in steadily rising recruitment from sources other than IT graduates.

More detailed *Implications* of the scenario for the Industry and for various areas of policy are presented in Section 10 of the report.

3.3.2 Scenario B: Steady Climb

In the ***Steady Climb*** Scenario the:

- ***rate of ICT innovation*** is assumed to be ***Moderate***;
- ***economic climate*** is assumed to be ***Positive***; and
- ***pace of off-shoring*** is assumed to be ***Moderate***.

Figure iv illustrates how informatics graduate recruitment, and total IT practitioner supply, might develop, in response to developing demand as envisaged in Scenario B.

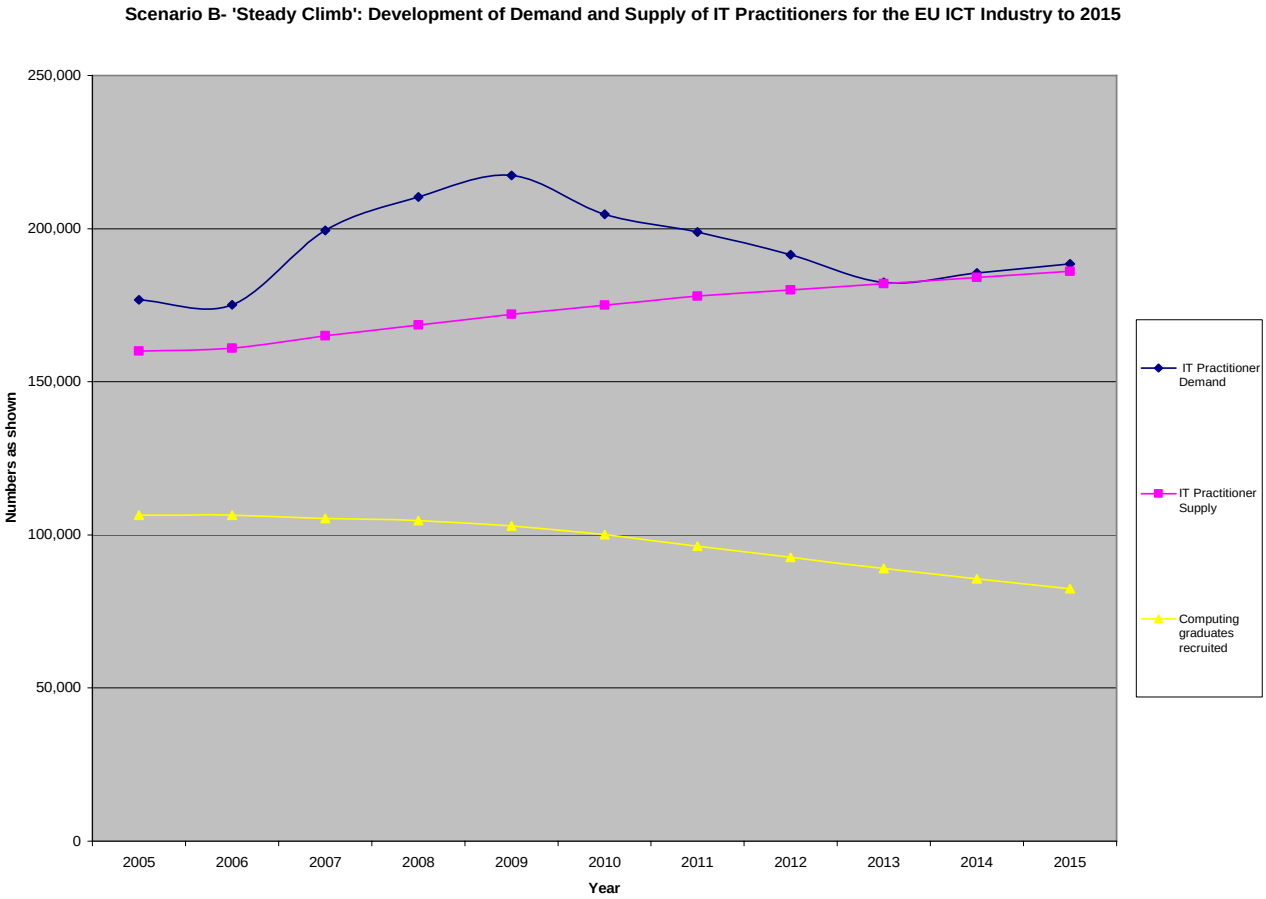

Figure iv: (Net, new) EU Supply and Demand Trajectories for B: *Steady Climb*

This scenario also involves initial growth in new demand for IT practitioners, but at lower levels than for 'Renaissance'. The fall-off in numbers of informatics graduates plays a role here, but the demand levels to which supply has to rise are not so great, as a result of which less dramatic recruitment action is required by the ICT Industry. Nevertheless supply can only be increased by accelerating growth from sources beyond informatics graduates, including increased training of existing staff and attracting in people from other supply sources, through increasing salary offers. As demand falls after 2009, efforts to strengthen supply result in the labour market being in balance by 2013. There are net skill shortages in 2010 and 2015, although notably lower than in Scenario A.

More detailed *Implications* of the scenario for the Industry and for various areas of policy are presented in Section 10 of the report.

3.3.3 Scenario C: Global

In the ***Global*** Scenario the:

- ***rate of ICT innovation*** is assumed to be ***Rapid***;
- ***economic climate*** is assumed to be ***Positive***; while
- ***pace of off-shoring*** is assumed to be ***High***.

Figure v illustrates how new practitioner supply and informatics graduate recruitment might develop, in response to the new demand conditions of Scenario C.

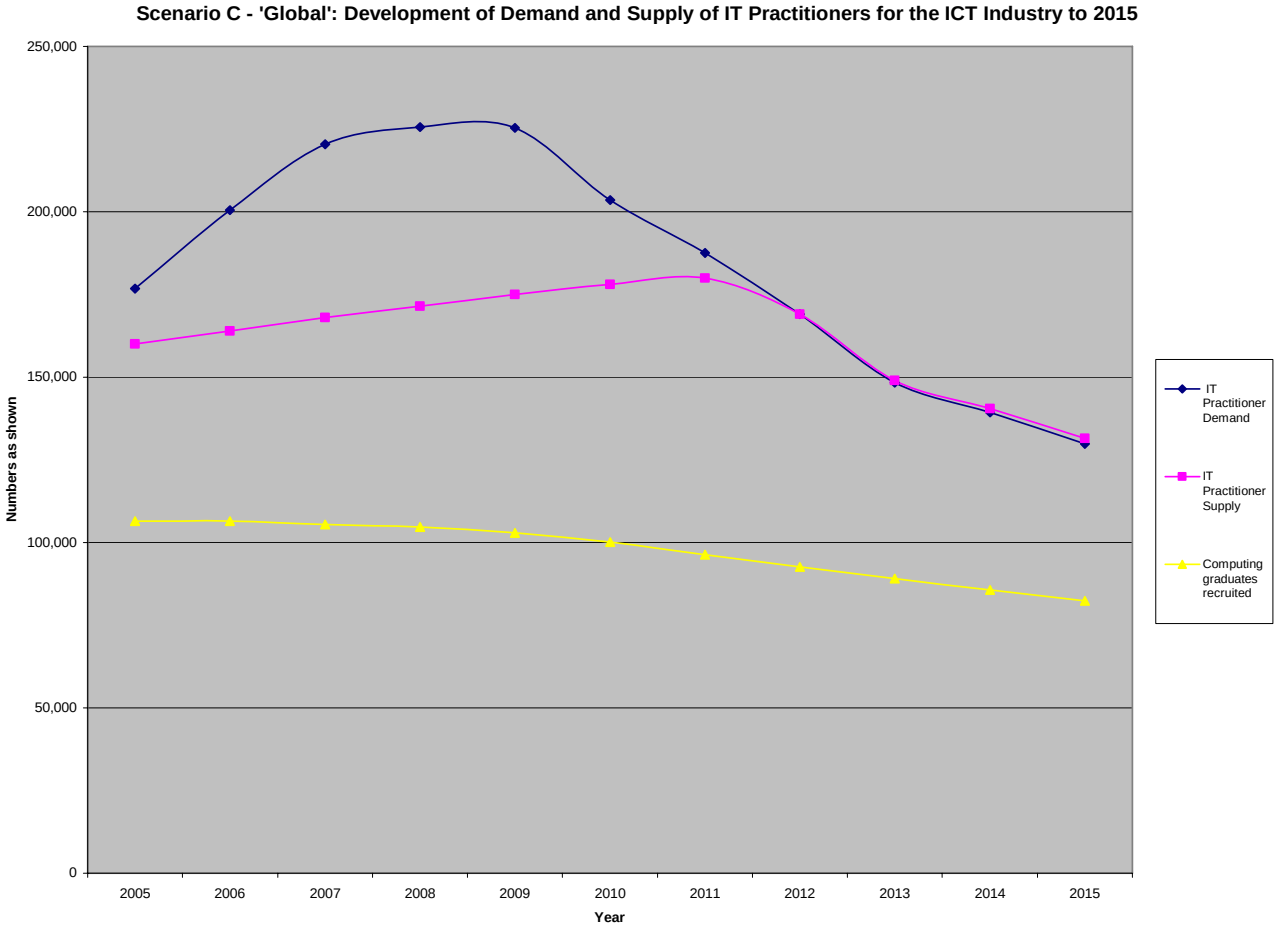

Figure v: (Net, new) EU Supply and Demand Trajectories for C: *Global*

Initial new demand is nearly as strong as in Scenario A, but this falls away strongly after 2009. Recruitment activity to augment IT practitioner teams from candidates beyond informatics graduates is thus strong up to 2011, after which net new demand falls steadily, and recruitment effort eases in response. A small residual surplus grows as candidates from non graduate sources fail to get recruited by the ICT Industry.

More detailed *Implications* of the scenario for the Industry and for various areas of policy are presented in Section 10 of the report.

3.3.4 Scenario D: Fight Back

Scenario D: Fight Back

In the ***Fight back*** Scenario the:

- ***rate of ICT innovation*** is assumed to be ***Rapid***;
- ***economic climate*** is assumed to be ***Turbulent***; while
- ***pace of off-shoring*** is assumed to be ***Moderate***.

Figure vi illustrates how informatics graduate recruitment and total new supply might develop, in response to the strong swings in new demand involved in Scenario D.

Figure vi: (Net, new) EU Supply and Demand Trajectories for D: *Fight Back*

Initial new demand grows strongly for the first two years of the scenario, but then falls away until 2013. Recruitment activity to augment IT practitioner teams starts strongly, and manages to meet demand in 2010. Thereafter, recruitment effort can ease as demand continues to fall, and a small but growing residual surplus emerges as candidates from non graduate sources fail to get recruited by the ICT Industry. 2013 sees a 'bottoming-out' of new demand, after which recruitment effort is strengthened, but cannot respond fast enough to prevent the re-appearance of shortages.

More detailed *Implications* of the scenario for the Industry and for various areas of policy are presented in Section 10 of the report.

3.3.5 Scenario E: Dark Days

Scenario E: Dark Days

In the ***Dark Days*** Scenario the:

- ***rate of ICT innovation*** is assumed to be ***Moderate***;
- ***economic Climate*** is assumed to be ***Turbulent***; while
- ***pace of off-shoring*** is assumed to be ***Moderate***.

Figure vii illustrates how informatics graduate recruitment, and total IT practitioner supply, might develop, in response to the less encouraging developments involved in Scenario E.

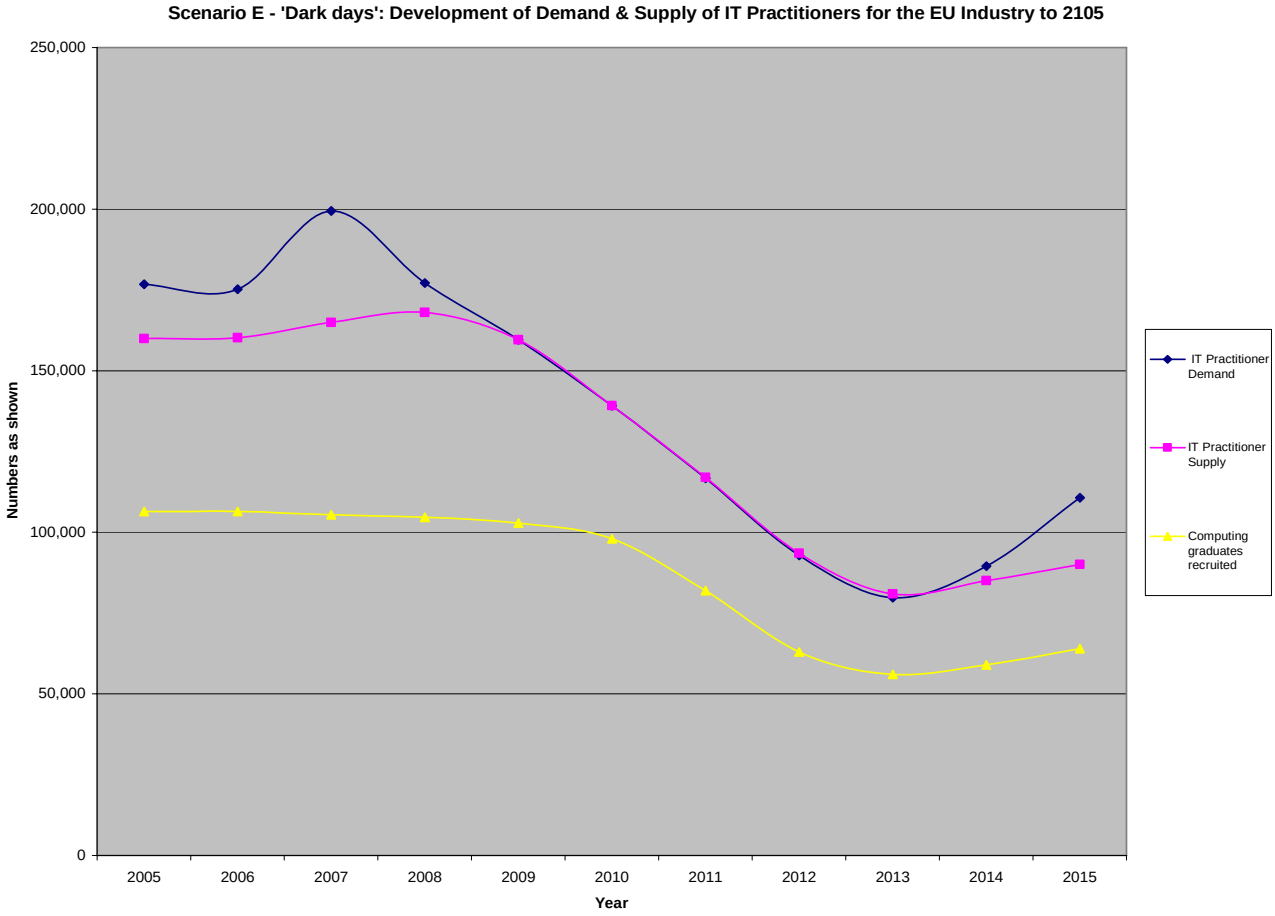

Figure vii: (Net, new) EU Supply and Demand Trajectories for E: *Dark Days*

In this scenario, net new demand really begins to feel the effect of the lower general economic confidence, and the slipping of ICT innovation rates. Growth is limited to 2006-2007, and 2008-2013 sees steady falls, to levels that begin to impact on the job prospects of informatics graduates. Recruiting ICT enterprises continue to seek experienced IT practitioners as part of their 'new recruits', so that the ICT Industry does not recruit as high a fraction of the emerging IT graduates as before as supply levels become very low. 2014 and 2015 see a pick up in demand, to which supply levels take time to respond.

More detailed *Implications* of the scenario for the Industry and for various areas of policy are presented in Section 10 of the report.

3.3.6 Scenario F: Decline

In the ***Decline*** Scenario the:

- ***rate of ICT innovation*** is assumed to be ***Moderate***;
- ***economic climate*** is assumed to be ***Turbulent***; and
- ***pace of off-shoring*** is assumed to be ***High***.

Figure viii illustrates how total IT practitioner supply and informatics graduate recruitment might develop, in response to the near-disappearance of new demand that emerges towards the end of the period under study in Scenario F.

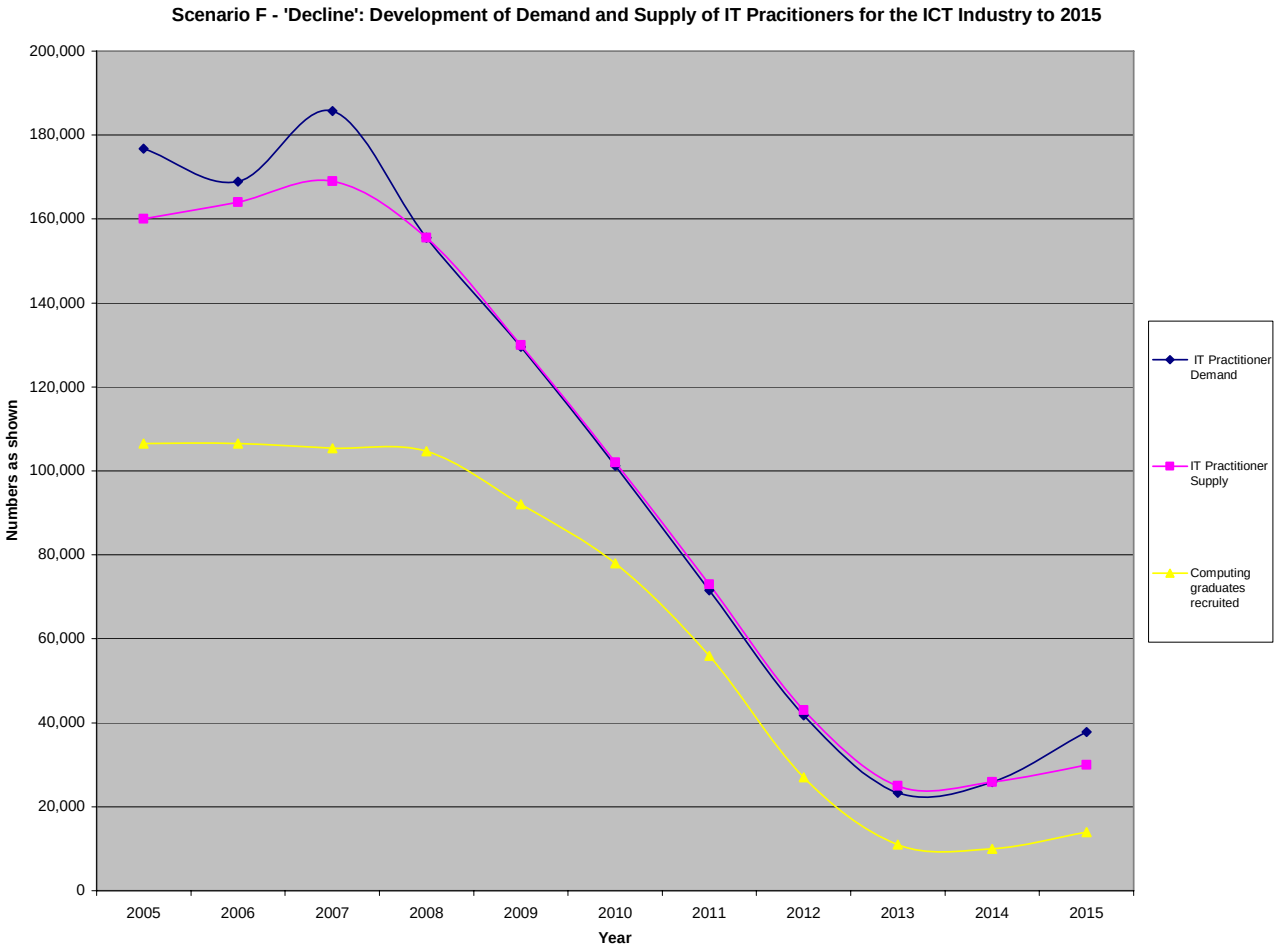

Figure viii: (Net, new) EU Supply and Demand Trajectories for F: *Decline*

All three *core drivers* are now in states that reduce net new demand for IT practitioners. Only 2007 has new demand above the 2005 level, and 2008-2013 sees strong falls, to levels that reduce significantly the fraction of emerging informatics graduates recruited by the ICT Industry. Recruiting ICT enterprises continue to seek experienced IT practitioners as part of their 'new recruits', and the numbers of technical graduates recruited falls to unusually low levels. 2014 and 2015 see a modest pick up in demand, to which supply levels take time to respond.

More detailed *Implications* of the scenario for the Industry and for various areas of policy are presented in Section 10 of the report.

3.4 Possible Net Labour Market Conditions

Based on the net new demand for IT practitioners within the EU ICT Industry (Figure ii), and the illustrative supply trajectories produced, the figures for 2010 and 2015 provide estimates of the *supply-demand imbalances* for those years, as follows:

2010 Labour Market Imbalance Estimates						
	Scenario A: ***Ren-aissance***	Scenario B: ***Steady Climb***	Scenario C: ***Global***	Scenario D: ***Fight back***	Scenario E: ***Dark Days***	Scenario F: ***Decline***
Demand:	250,000	205,000	204,000	178,000	139,000	101,000
Supply:	180,000	175,000	178,000	178,000	139,000	102,000
Surplus/ Shortage	**-70,000**	**-30,000**	**-26,000**	**0**	**0**	**1,000**

Table iv:
IT Practitioner Supply and Demand for the EU ICT Industry: 2010

2015 Labour Market Imbalance Estimates						
	Scenario A: ***Ren-aissance***	Scenario B: ***Steady Climb***	Scenario C: ***Global***	Scenario D: ***Fight back***	Scenario E: ***Dark Days***	Scenario F: ***Decline***
Demand:	243,000	188,500	129,800	150,000	111,000	38,000
Supply:	192,000	186,000	131,300	120,000	90,000	30,000
Surplus/ Shortage	**-51,000**	**-2,500**	**1,500**	**-30,000**	**-21,000**	**-8,000**

Table v:
IT Practitioner Supply and Demand for the EU ICT Industry: 2015

As can be seen, skill shortages are expected in the two years for most scenarios, although the scale of them varies considerably in the light of the projection variations.

3.5 Additional Findings

The report also summarises the main sources of supply and demand for *ICT User skills* and *e-Business skills*, and outlines the latest thinking in trends from the ICT Industry, in particular on the more detailed technical skills within ICT practitioner work. While there are different perspectives from different major players, the strongest common message coming through is that the *combination* of technical understanding of the capabilities of current and emerging ICTs, and expertise in certain market sectors or underlying sciences & other technologies that will be crucial in triggering the technological innovations on which future survival and success of European ICT Industry will depend. In this context the current decline in applications for European university courses in the broader *Science, Technology, Engineering and Mathematics* domain is also cause for concern.

5 Conclusions

The study has shown that:

1. a very large number of drivers are likely to influence the supply and demand of the different types of e-skills in Europe in the coming years, the study identifies ninety such drivers;

2. these ninety drivers impact on one or more of the of three *core-drivers identified* which are likely to have the greatest influence on future demand for ICT practitioner skills for the ICT Industry:
   - the *rate of ICT innovation*,
   - *economic climate*, and
   - *pace of off-shoring*,

3. it is possible to explore, and gain new insights on, developments of ICT activity and e-skills demand and supply in the coming years through consideration of qualitative scenarios built on different combinations and value of the *core drivers*, six such scenarios were identified;

4. broad implications of each scenario on the expected future supply and demand of three *levels* of ICT practitioner skills can be analysed;

5. a simple but effective mathematical model can be developed and calibrated to show expected ICT Industry employment levels corresponding in broad terms to different qualitative scenarios for the domain where certain meaningful quantitative evidence is available: the core and technical IT practitioner occupations;

6. estimates of annual net new demand for IT practitioners for this sector can be produced from these employment levels, making assumptions about the fraction of employment represented by IT practitioners and about levels of replacement demand, and grossing-up to the ICT Industry for the EU-25, based on the relevant ratios of IT practitioner employment[*];

7. drawing on these quantitative foundations for demand, illustrative projections can be produced for future supply of IT practitioner skills in the EU in the light of different market-, ICT Industry- and policy- responses, given a possible serious decline in numbers of good graduates from informatics courses;

8. based on these assumptions, estimates for supply and demand levels in 2010 and 2015 show a range of possible IT practitioner labour market conditions, including a number of scenario combinations for which non-trivial supply shortfalls exist;

9. under the scenarios explored, skill shortages of up to 70,000 could occur, where future high demand conditions coincide with supply limitations, while for scenarios where ICT activity within the EU falls off significantly, surplus conditions are also possible.

[*] Such demand estimates provide useful quantitative indications of the scale of possible future developments based on the best relevant data available. However, given the considerable limitations of (even this) data availability, such projections must always be *continuously* reviewed by, and tested against, the views and assessments of industry experts and evidence from specific market surveys.

5 Recommendations

The proposals in the study include initiatives that could improve the validity and value of quantitative data on e-skills within the EU, in addition to a range of suggestions, most resonating with ideas that emerged from the work of the 2006 EU ICT Task Force. Key recommendations include:

a) Further elaboration of the scenarios developed in this study in workshops and dissemination of the understanding generated, for both ICT Industry and ICT User organisations. This must include:
   - continuing review of developments to clarify actual employment levels going forward, in relation to how the model input variables develop, and
   - indicators, measures and criteria that can be agreed, which can then facilitate comparability of future studies of this kind.

b) Creation of a greater awareness, understanding, and acceptance, of the threats and opportunities arising from the growth of globalisation of ICT activity;

c) Promotion of improved understanding for both the Industry and public policy of the real, quantitative position of e-skills in Europe;

d) More serious collaboration between the ICT Industry and policy-makers on the impacts of the cyclical effects of the ICT market on e-skills supply and demand;

e) Work to improve existing EU-level data collection in relation to e-skills and meaningful benchmarking against the e-skills position in competitor economies;

f) Examining more closely the *quality* aspects of skill shortages, and recognising the need to track *skills excellence*, in addition to overall skills volumes, in relation to ICT innovation;

g) Exploration of innovative mechanisms for addressing possible university-industry mismatches, including:
   - collaborative work recognising the need for better links between informatics departments and *application* communities,
   - more serious exploration of the use of *competence frameworks* as targets for HE provision and mapping of informatics *bodies of knowledge* against them, and
   - creative ways of integrating elements of industry certification knowledge into HE informatics courses.

h) Joint action to counteract negative signals about ICT practitioner work, in particular:
   - ensure that *news of industry recruitment drives* gets through to the key audiences as well as news of redundancies, and
   - encourage choice of informatics courses to senior students in secondary education, (through better briefing material about opportunities at graduation time, to counteract any reports of *current job losses.* Informatics needs to be seen as an attractive career option for all students, especially the most talented.