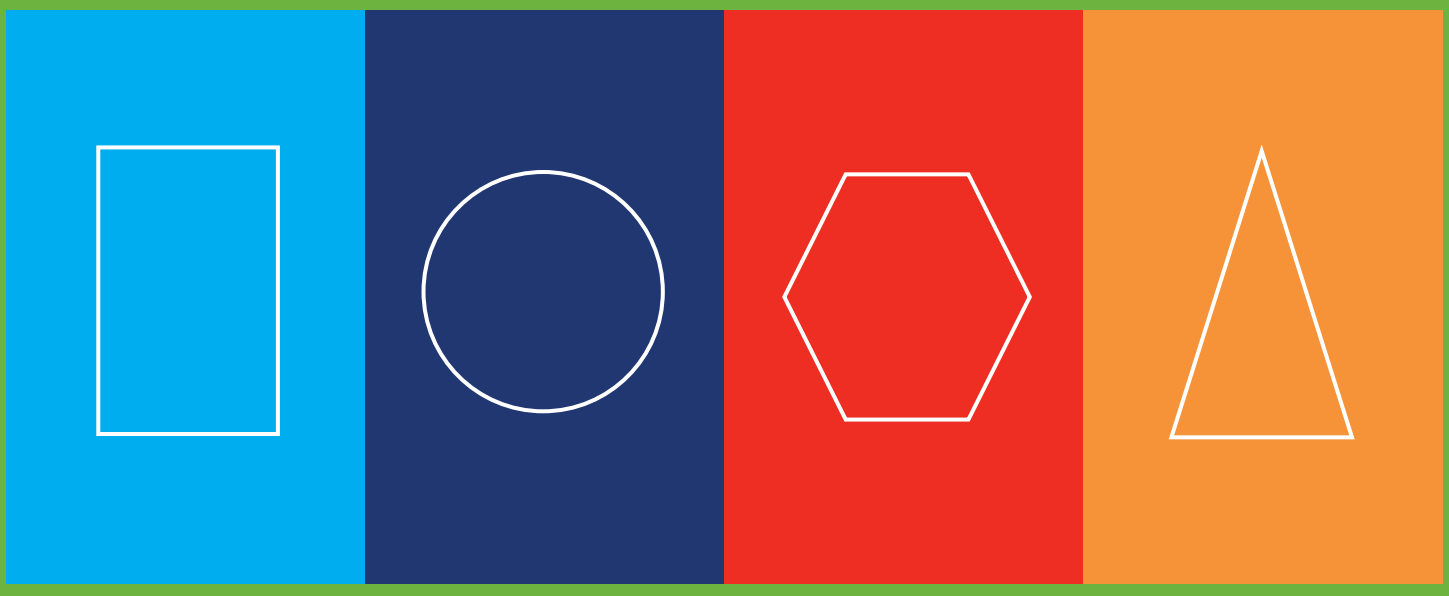

Addressing Future Demand for High-Level ICT Skills

November 2013

Forfás

Expert Group on
Future Skills Needs

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Acknowledgements

Forfás would like to record its appreciation to the members of the Steering Group who oversaw the progress and the development of the report for their significant commitment and contribution – the membership is set out in Appendix 1.

Forfás would like to thank the many industry executives, academics and staff at expert organisations and State Agencies who gave their valuable time and insights though interviews and at workshops.

Forfás would like to acknowledge the high quality and expertise of IDC whose work included the global trends analysis, the undertaking of the consultations with companies and stakeholders and the modelling and analysis of the high-level ICT skills demand forecasts contained in the report.

Introduction to the Expert Group on Future Skills Needs

The Expert Group on Future Skills Needs (EGFSN) advises the Irish Government on current and future skills needs of the economy and on other labour market issues that impact on Ireland's enterprise and employment growth. It has a central role in ensuring that labour market needs for skilled workers are anticipated and met.

Established in 1997, the EGFSN reports to the Minister for Education and Skills and the Minister for Jobs, Enterprise and Innovation.

Forfás, Ireland's policy advisory board for enterprise, trade, science, technology and innovation in conjunction with the Skills and Labour Market Unit, FÁS, provides the EGFSN with research, analysis and secretariat support.

Foreword

This study which is a key action included within the Government's *Action Plan for Jobs 2013* under the objective of building Ireland's ICT skills capability, forecasts the demand for high-level ICT skills over the next five years, across all sectors of the economy. The aim is to ensure our ICT skills are a unique selling point in attracting mobile ICT investment and for entrepreneurs to set up, grow and locate their ICT businesses in Ireland. This can be set against the background of a strong demand for high-level ICT skills in other countries and regions.

The ICT sector is of strategic importance to Ireland, both in terms of the numbers of high skilled professionals employed and its significant contribution to Ireland's export performance – accounting for €70 billion in exports per annum. The report indicates a continuing strong demand for high-level ICT skills with 44,500 job openings forecast to arise over the period to 2018 from both expansion and replacement demand. It highlights the quality and range of skillsets needed to meet rapidly changing technological and market trends. A solid base of ICT skills capability will enable individuals to adapt to changing specialisms trends.

There is no 'silver bullet' solution to ensuring the necessary supply of skills but rather a sustained effort to support the implementation of measures underway in the Government's *ICT Action Plan* and several new initiatives identified in this report. All potential policy levers will need to be utilised to build up the ICT skills supply pipeline including through mainstream education and training, conversion and reskilling programmes, continuing professional development and attracting experienced international and expatriate talent.

The level and quality of domestic ICT graduates is a critical component in the supply of skills both in meeting the demand for graduate hires and over time adding to the stock of experienced professionals. Improved ICT talent development and retention practices within companies are essential for both experienced employees and the career path development of new graduates.

Significant progress has been made in recent years in increasing enrolment on high-level ICT programmes. This is encouraging and must be sustained to meet the forecast increase in the demand. A particular challenge will be to attract more females into rewarding ICT career opportunities.

I would like to thank all those who contributed to the report. Particular thanks are due to the many enterprises and stakeholders who contributed their time and expertise to the study. I wish to express my thanks to Tony Donohoe who chaired the Steering Group and to all members of the Steering Group for their full commitment and support. I would like to record my appreciation to the IDA Ireland and Enterprise Ireland for their support and sharing of expertise. Finally I would like to thank the team at Forfás for managing and leading this project to a successful conclusion.

Una Halligan
Chairperson, Expert Group on Future Skills Needs

Executive Summary

E.1 Introduction

The aim of this study, undertaken by Forfás / EGFSN, is to forecast the demand over the period 2013–2018, for high-level ICT skills at NFQ Levels 8/9/10[1], and at progression levels NFQ 6/7, arising both within the broad ICT sector and across other sectors of the economy.

The study is included as an action within the Government's Action Plan for Jobs 2013. The Plan highlights the ambition that Ireland will build up its ICT skills capability to drive the further expansion and development of the ICT sector and to support innovation and growth across other sectors of the economy. The specific ICT skills examined in this study are:

- Computing skills (including computing software and computer programming and multi-media gaming with a substantial computing content); and
- Electronic & electrical engineering skills (including communications and mechatronics and electronic/computing engineering).

The analysis encompasses roles within the above requiring a comparable combination of technical and business/analytic/foreign language skills. The report has adopted an occupational definition of ICT professionals which includes people requiring a high level of ICT knowledge and capability whose tasks involves activities such as consulting, designing, developing, installing, programming, maintaining, managing and supporting of computer systems and/or data processing facilities, software applications and/or hardware, security, ICT networks and telecommunication networks. The study does not include people with primarily ICT user skills needs (the capabilities required for the effective application of ICT systems and devices as tools in support of their own work and the use of common software tools and of specialised tools supporting business functions within industry[2]).

Forfás commissioned IDC to undertake the research and analysis work with selected enterprises and key stakeholders and the development of the high-level ICT skills demand forecasts contained in the report. This work was supplemented by Forfás research on international country examples of measures to attract and retain international high-level ICT talent. The Higher Education Authority (HEA) also updated their high-level ICT supply forecasts for the period 2013-2018.

The ICT sector is of strategic importance to the Irish economy both in terms of the numbers of high-skilled professionals employed and its significant contribution to Irish exports performance. In 2011, the total exports from ICT related sectors in Ireland accounted for €70 billion. This was down from its peak in 2008 of €74 billion – this trend reflecting a 50% fall in computer, electronics and optical products exports (-€9.7 billion) partially offset by a 17% increase in computer programming and consultancy services exports (+€5.4 billion). Improving on this export performance requires that the right conditions exist for Ireland to remain an attractive location in which to base ICT activities, whether via FDI or Irish owned business.

[1] Hereafter referred to as NFQ Level 8+.
[2] Eurostat Glossary: E-skills.

In 2012, there were an estimated 68,280 ICT professionals working both within the ICT sector and across other sectors of the economy. The results from this study indicate that Ireland is likely to face an average increase in demand for high-level ICT skills of around 5% a year out to 2018 with the employment of ICT professionals anticipated to rise to just over 91,000. There are challenges to be faced in realising this potential in terms of gaining ground in new technology markets and sustaining improved competitiveness with other countries. A key factor in Ireland's unique proposition will be to ensure an adequate supply of ICT talent and skills from the domestic supply pool and global talent, to meet the needs of foreign-owned and indigenous enterprises. This is against the background of a strong global demand for high-level ICT skills and talent in other countries actively competing for these skills.

In Europe (EU 27), under a cautious growth scenario, the excess demand or shortage of ICT professionals is forecast to reach 372,000 in 2015. Under a more optimistic "Return to Confidence" scenario, this potential shortage is forecast to be as high as 864,000 in 2015[3]. It is concluded that if the skills cannot be found or attracted to Europe, then other countries where skills supply is more abundant will step up.

E.2 Global Technology and Service Trends Influencing Irish ICT Skills Demand

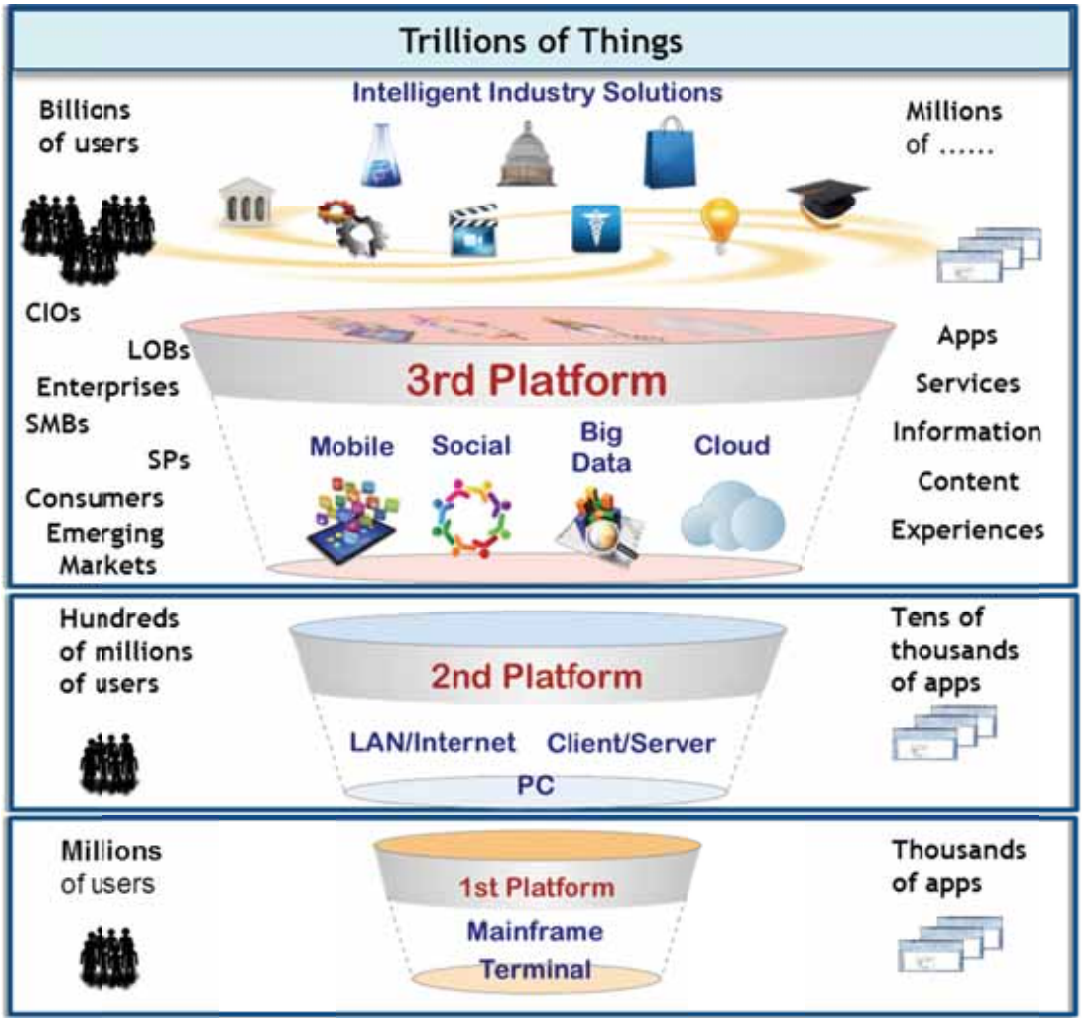
The ICT industry is in the midst of a "once every 20–25 years" shift to a new technology platform for growth and innovation (the Third Platform) that is expected to dominate the market by 2020. This "Third Platform" is characterised by the disruptive combination of the following technologies:

- Adoption of cloud computing, a disruptive delivery model for IT software and services, based on flexible and on-demand business models;
- Rapid penetration of mobile devices and technologies, including mobile apps and M2M, (machine to machine) connectivity through billions of sensors (the Internet of things);
- Emergence of Big Data analytics, driven by the huge increase of data generated by mobile devices and the Internet;
- Adoption of social technologies, migrating from the personal to the business environment, with a profound effect on business and social interactions within enterprises and in supply chains.

As these Third Platform technologies are rolled out and adopted, they enable further adoption of more intelligent industry-specific solutions, an exponential growth in the number of devices or "things" that are connected via the Internet and a proliferation of ICT for personal and business use, the so-called "Internet of Things". This creates a strong need for design and development of microelectronic products and devices that enable the above development and the intelligence needed for developing green IT technologies, smart (or e-) health, and smart grids to name but a few. Across all these trends is the need for IT security. This means that there are several strong changes and new demands for technologies and solutions in the ICT market.

[3] "e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios", a study undertaken by IDC, INSEAD and empirica , prepared for the European Commission , DG Enterprise & Industry.

Figure E 1: The ICT Industry's Evolution to the Third Platform for Growth



Source: IDC 2013
Note: CIOs are Chief Information Officers, LOBs are Line of Business Managers; and SPs are Service Providers.

In this study, the focus is on the following main trends which are impacting upon the demand for high-level ICT skills.

- Mobility and Consumerisation
- Cloud Computing
- Big Data
- Social Media Technologies
- IT Security
- Internet of Things
- Micro-and Nanoelectronics as Key Enabling Technologies

The on-going ICT wave of innovation is driving strong demand for new ICT skills and competences, particularly to design, develop and deploy new applications and services. Some of these are core

technology skills but others, for example Big Data and social media require skillsets with a combination of skills, such as technology, statistics and business skillsets for Big Data; or technology and marketing skillsets for Social Media. Consequently, ICT skills requirements will become increasingly complex and will demand more of the education and training systems and from company training.

E.3 Research Approach

The overall management of the research work was undertaken by Forfás. The approach used to develop the demand forecasts and the recommendations has several strands:

- Use of IDC's existing body of research in the ICT markets, including global and regional demand trends and forecasts on ICT spending and end user surveys, developed by their expert analysts.
- Interviews with a selected range of 38 foreign-owned and indigenous companies that employ ICT professionals, and with 22 key stakeholders in Ireland, identified in consultation with Forfás, IDA Ireland and Enterprise Ireland.
- Workshops held in Dublin and Cork with 50 participants from a broad range of stakeholders including companies, public organisations, employer bodies, sectoral representative bodies, educational and training bodies, research bodies, Enterprise Ireland and IDA Ireland.
- Input and guidance from an EGFSN Steering Group comprising a range of stakeholders, including foreign owned and indigenous companies, IDA Ireland and Enterprise Ireland, established to oversee the progress of the study and the framing of recommendations. (Appendix 1).
- Desk research by Forfás to assess the current policies and actions taken to address ICT skills demand and supply issues in Ireland and other countries.

This research process was combined with IDC's proprietary ICT skills demand model to create the demand forecasts presented in this study. This model has been used recently on behalf of the European Commission to forecast the demand for ICT practitioner skills in Europe. For this study, the demand model has been adapted to reflect the specific domestic conditions.

In relation to supply side, the Higher Education Authority have updated their forecasts on ICT graduate output by NFQ level for mainstream undergraduate and postgraduate programmes for the period 2013 to 2018 as well as the forecast output from the conversion and reskilling programmes that have been rolled out since 2011. These forecasts have been integrated into the study.

E.4 Views from the Stakeholders

The results from the interviews with both enterprises and key informants indicate an expectation that demand for ICT skills will continue to increase. Most believe that the key challenges are in finding people with the right level of skills and experience. When obstacles to filling vacancies arise, enterprises are looking abroad, both inside Europe and further afield.

Two main factors will influence the future demand for ICT skills: technology changes and internal changes in the companies. Internal changes cover a wide variety of issues such as new product launches and reorganisations but also for foreign-owned companies the need to ensure that they can sustain and expand their current operations here, i.e. that conditions are right to attract additional

value added activities from other parts of the world. The availability of high-level ICT skills for both foreign-owned and indigenous companies is a key part of the picture.

A key question is where the responsibility lies for ensuring that ICT skills are developed to meet the needs of employers. When this question was put to enterprises, a balanced view was given. Companies believe that they carry a lot of the responsibility but so do other stakeholders in the market: government, industry bodies, and the education system. While the education system is seen as the main contributor to developing the ICT skills, many enterprises believe that they must also take an active role in working with education institutions to develop the right curricula, provide internships and raise awareness of ICT as a profession.

A key point, and one that enterprise interviews show that some understand, is that enterprises cannot be only “skills consumers” but also have to be “skills producers”. Enterprises will benefit from implementing more advanced talent management systems and the development of the skillsets of both experienced employees and new hires including new graduate entrants. The majority of enterprises interviewed expect their training budgets to increase over the next five years, indicating that the continuing professional development of staff will play a key role, particularly for new technologies. Key informants voiced strong opinions about the need to take a longer-term view and increase STEM education, from early on in the education system.

Both key informants and the enterprises raised the issue of how to attract and retain ICT talent in Ireland. The demand for ICT skills will need to be met by both building up the domestic supply, continuing professional development and the attraction of international talent – including expatriate talent. Factors that influence Ireland's attractiveness for this mobile talent versus other countries include personal taxation, cost of living, housing, infrastructure, and the availability of visas/employment permits.

It is clear from the interviews that there are many existing activities and initiatives aimed at addressing ICT skills demand which involve collaboration between stakeholders. However, there was a viewpoint that more coordination was needed in order to avoid duplication of efforts and for all to work together.

E.5 Assessing the Demand for High-Level ICT Skills

Assessing the demand for high-level ICT skills in a country is complex, even more so in a small open economy like Ireland with a strong export focus, where a large proportion of the skills needed are dependent on demand patterns in the global ICT market, as well as the relative competitive proposition for FDI, and not just upon demand created in the domestic market. In order to assess the demand for high-level ICT skills in Ireland, IDC applied its proprietary skills demand model, which it has developed over the past decade. The model has been used for skills demand projects for the ICT industry and for the European Commission and is at the heart of the current skills demand forecasts used by the EU in the recent eSkills Vision project. The standard model:

- Takes into account IDC's forecast and predictions for ICT technology and services spending in the country examined. These forecasts are developed by IDC's domain expert analysts.
- Forms part of a holistic view of the ICT technology and workforce markets to ensure that there is no "sub-optimisation” (so that the skills demand in any specific sub-sector is not over estimated).

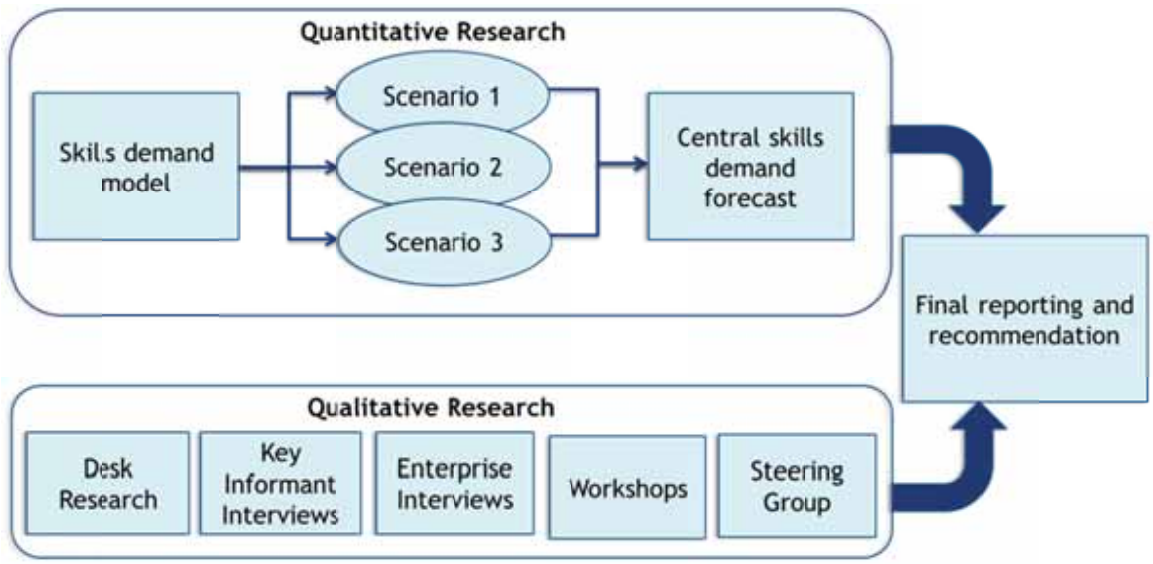
- Uses, as input, statistical information from reputed sources (typically country statistical offices or Eurostat).
- Takes into account economic developments in the country examined, based on historical and – where available – official forecast.

However, for Ireland the following adaptations, amongst others, have been made to capture the complexity of both the broad Irish ICT sector and domestic demand:

- Expanding the view to include R&D and other "ICT production" that's outside IDC's traditional view of ICT spending.
- Looking at ICT export as well as local "consumption" to ensure that the impact of global ICT market demand is captured.
- Establishing the baseline data utilising existing available data, including from CSO Census 2011, the Forfás Annual Business Survey of Economic Impact (ABSEI) and Forfás Employment Surveys.
- Taking into account input and information gathered through the research process from the key informants and enterprise interviews, workshops and relevant stakeholders in general.
- Taking into account discussions and inputs during several meetings from members of the Steering Group set up to oversee the progress of the study and framing of recommendations.

Figure E 2 provides an overview of the model in terms of the data inputs for the baseline and how the forecasting process feeds the development of different skills demand scenarios. As illustrated in the figure, throughout the project, there has been a continuous loop of adjustments of the key variables as data gathering, key informants, enterprises and stakeholders at workshops feedback is evaluated and used to inform the process.

Figure E-2: Schematic View of Scenario Building and ICT Skills Demand Forecast



Source: IDC 2013

The baseline employment figure for ICT professionals is derived from a special tabulation produced by the CSO from the CSO Census 2011 for the following SOC 2010 occupations.

Computing skills are:

- Information technology and telecommunications directors
- IT specialist managers
- IT project and programme managers
- IT business analysts, architects and systems designers
- Programmers and software development professionals
- Web design and development professionals
- Information technology and telecommunications professionals not elsewhere included
- IT operations technicians
- IT user support technicians
- IT engineers

Electronic & Electrical Engineering skills are:

- Electrical and electronic engineers
- Design and development engineers
- Electrical and electronics technicians
- Telecommunications engineers

E.6 High-Level ICT Skills Demand Scenarios 2013-2018

Based on the above input from companies and stakeholders in interviews, workshops and Steering Group meetings, combined with IDC's proprietary skills demand model adapted to reflect specific Irish conditions, three scenarios for ICT skills demand were developed for this study. These are:

- The Central Growth Scenario – "Fighting to Stay on Course". This scenario is anticipated the most likely to occur and is presented in detail. Under this scenario the demand for high-level ICT skills would grow at a compound annual growth rate of nearly 5% over the forecast period.
- The Higher Growth Scenario - under which the demand for high-level ICT skills would grow at a compound annual growth rate of over 7.2% over the forecast period.
- The Lower Growth Scenario - under which the demand for high-level ICT skills would grow at a compound annual growth rate of 2.7 % over the forecast period.

A scenario methodology is a useful approach to explore the different ways in which future events might unfold and is widely used in foresight work. Scenarios are not predictions but rather they tell a "story" illustrating a possible future and are based on a combination of known or possible facts concerning events that might take place in the future, with possible alternative trends.

The first step for the development of the scenarios in this study was a SWOT analysis of the broad ICT sector (see Figure E-3). The SWOT analysis points out the strengths upon which Ireland can build and the weaknesses it has to solve, and helps to identify the most relevant focal issues that differentiate the three ICT skills demand scenarios.

Figure E-3: SWOT Analysis of the ICT Sector

Strengths	Weaknesses
Key sector for the successful Irish development model: open and globally competitive.	Economic crisis undermined attractiveness and competitiveness of the Irish socio-economic system.
High export propensity: Computer services represent 39% of total service exports.	Insufficient domestic supply of high-level ICT skills (the decline in graduates in the period following dot-com bubble in 2002 but steady increase since 2009).
Presence of nine of the world's top ten software companies.	Dependency on inward migration (significant level of high-level ICT skills supplied from abroad).
Strong presence of major multinationals as well as many indigenous companies in the microelectronics sector.	Ireland lags behind OECD countries in terms of fibre connections as a percentage of broadband access network.
Strong attractiveness of Business Shared Services provided by Ireland to the global finance and manufacturing industries.	Domestic market demand for ICT products and services insufficiently advanced and sophisticated.
Large number of Irish-owned firms with leading position in niche markets providing tailored software services (finance, health, education, entertainment).	
Leadership position in mixed signal Integrated Circuit design and a recognised centre of excellence for manufacturing of microprocessors.	
Persistence of hardware manufacturing industry even if declining.	
Strong Government commitment in the 2012 ICT Action Plan and Action Plan for Jobs 2013 for Ireland to build up its high-level ICT skills and become internationally renowned as a location with the appropriate supply of skills/ talent.	
Opportunities	**Threats**
Access to major European markets and fast-growing emerging markets.	Rising personal tax and relatively high cost of living, cost of business and cost of labour reduces the competitiveness of the products / services – although recent price falls and reduction in property costs have helped Ireland to regain some of its competitiveness.
Promotion of Ireland as a competitive place to develop and manage ICT businesses.	The unclear image of career opportunities in ICT and a lack of a clearly defined career path as such remain a problem, especially among high-achieving females, who comprise around 20% of ICT professionals.
The presence of large global players creates opportunities for start-ups and clusters.	The technology infrastructures are a relevant barrier to the development of the ICT sector.
The main market opportunities for Ireland are: mobility, software development, e-Health and Green IT, Big Data, Cloud, and design of integrated circuits and other enabling technologies.	Potential lack of adequate and sufficient skills supply output to meet growing demand.

Source: IDC 2013

The Central Growth Scenario – "Fighting to Stay on Course"

This scenario is anticipated as the most realistic one that will occur in the medium-term up to 2018. It is based on conservative assumptions and is considered highly likely. In this scenario, the Irish economy will continue on its path of moderate but steady recovery from the economic crisis. Domestic demand will gradually improve, and the attractiveness of the country for FDI and inward migration will hold steady. The ICT sector will keep pace with global demand, gaining ground in the new technology markets (e.g. mobility, cloud, Big Data, microelectronics - particularly design of integrated circuits and niche markets, such as e-health and green IT). The demand for ICT output will be driven by global export market demand. International competitiveness will remain a strong challenge, and the IT industry will struggle for every step forward.

Foreign-owned companies and indigenous companies will invest and develop export market opportunities in areas where competitive advantages have already been developed. Companies focussed on the domestic market will struggle to keep up, suffering from the moderate pace of recovery of domestic demand. The demand for high-level ICT skills will increase at an annual growth rate of around 5%, with stronger demand from the ICT sector rather than the ICT user sectors. The demand for high-level ICT skills will be partially met by the domestic supply and the need to attract international talent to satisfy skills demand will continue.

In this central growth scenario, the skillsets needed are varied in terms of the technologies and levels of experience. Most will be around the "Third Platform" technologies of cloud computing, the penetration of mobile devices and technologies, and Big Data / analytics (with social media still being more nascent within the timeframe) as well as the development of industry specific solutions relating to the "Internet of Things" (the 100+ billion sensors and tags and 11.5 billion communicating 'things' on the network) and the underlying enabling technologies. This means that the range of technology skills required will be broad and employers will seek to meet this demand through hiring new graduates as well as experienced people from home and abroad. Around 90% of the enterprises interviewed are planning to hire new graduates, preferably NFQ level 8+, and almost 70% of enterprises see sourcing and hiring from abroad as a continuing option. (A special sample survey of 2012 ICT related Employment Permit data, produced by the Department of Jobs, Enterprise and Innovation, indicated that the majority of these had NFQ level 8 + education and several years' experience).

Technologies are changing fast, and therefore so is the demand for specific technology skills. Consequently, a strong core technology education will form a good basis upon which future specific technology skills can be built. The development of 'soft' skills and competences are also important including business acumen, communications, team working and entrepreneurship. These T-shaped skillsets are needed for innovation and the application of technology to changing business models.

The demand forecasts in Table E-1 depict annual employment levels for high-level ICT skills, arising both from within the broad ICT sector and across other sectors of the economy. It is forecast that the total employment of ICT professionals will rise from 68,280 in 2012 to 91,180 in 2018.

Table E-1: Central Growth Scenario "Fighting to Stay on Course" - Demand for High-level ICT Skills by Sector, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Broad ICT Sector	40,502	43,280	46,190	49,270	52,500	55,780	59,050	62,250	6.2%
Other Sectors	24,848	25,000	25,300	25,600	26,290	27,130	28,010	28,930	2.5%
Total	65,350	68,280	71,490	74,870	78,790	82,910	87,060	91,180	4.9%

Source: IDC, 2013

However, when looking at the number of potential job openings arising in a specific year, this includes both net new jobs due to expansion demand and existing jobs that have to be filled due to replacement demand, including due to retirements, job switching to non-ICT professional occupations, emigration or other reasons. Table E-2 below provides the underlying numbers for potential job openings by skills type and by NFQ level. Overall, in the Central Growth Scenario, it is estimated that there will be more than 44,500 potential job openings for ICT professionals over the period 2013 to 2018[4]. Of these, the level of job openings for computing skills will remain well above electronic and electrical engineering. As can be seen from Table E-2 it is estimated that around 90% of the potential job openings for high-level computing skills will be for NFQ Level 8+, while for electronic and electrical engineering skills, this proportion is 82%.

Table E-2: Central Growth Scenario "Fighting to Stay on Course" - Potential Job Openings for High-Level ICT Professionals by Skills Type and NFQ Level, 2012-2018

	2012	2013	2014	2015	2016	2017	2018	Total Potential Job Openings 2012-18
Computing								
Level 6/7	499	505	509	533	528	522	506	3,602
Level 8+	3,963	4,275	4,501	5,017	5,302	5,468	5,564	34,090
Total	4,462	4,780	5,010	5,550	5,830	5,990	6,070	37,692
Electronic & Electrical Engineering								
Level 6/7	288	297	312	335	351	354	350	2,287
Level 8+	1,189	1,273	1,348	1,495	1,589	1,646	1,720	10,260
Total	1,477	1,570	1,660	1,830	1,940	2,000	2,070	12,547
Total Potential Job Openings	5,939	6,350	6,670	7,380	7,770	7,990	8,140	50,239

Source: IDC 2013

4 These figures do not include job churn job openings arising from the movement of workers between firms in the economy.

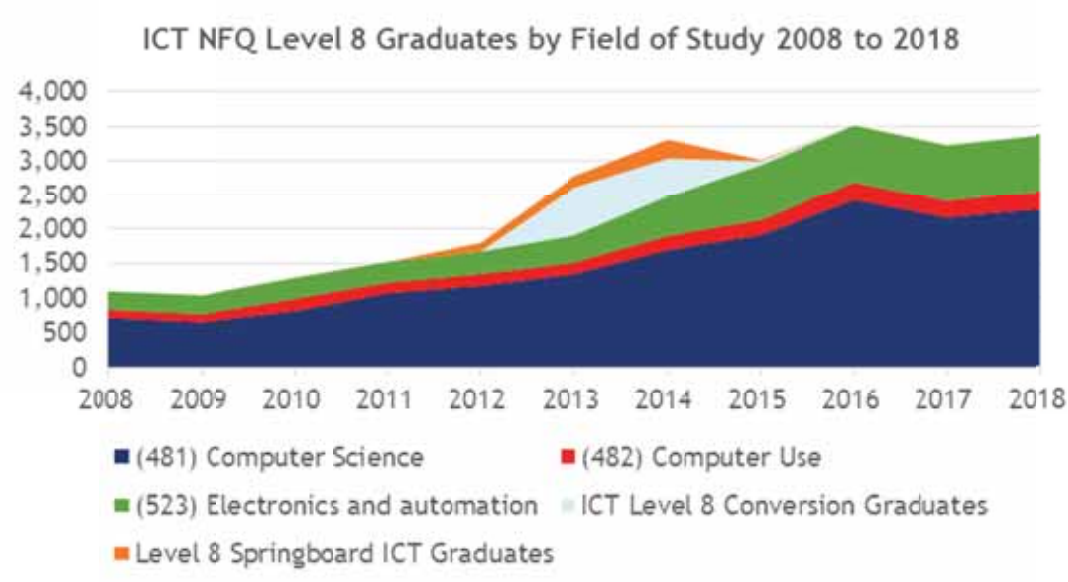
E.7 Forecast of Domestic Supply of High-Level ICT Skills

The key policy levers in building up the ICT skills supply pipeline are the level and quality of graduates from the domestic education and training system, important both in meeting the short term increase in demand for graduate hires and over time adding to the stock of experienced professionals; actions by companies to improve the talent development and retention of their ICT professional workforce, including the career path development of new graduates and the continuing attraction of experienced international and expatriate ICT talent.

This section includes forecasts by the Higher Education Authority on graduate output by NFQ level for mainstream undergraduate and postgraduate programmes for the period 2013 to 2018 as well as the forecast output from the conversion and reskilling programmes that have been rolled out since 2011. The coverage of ICT skills supply is by three discreet ISCED[5] fields of study within the broader category of Science and Engineering: ISCED 481 - Computer Science; ISCED 482 - Computer Use; and ISCED 523 - Electronics and Automation

The supply of mainstream graduates available to the labour market in any given year does not equate to the output of graduates for that year, as each year a proportion elect to proceed directly to further studies, or will otherwise be unavailable for employment in Ireland. The Study provides a forecast of the potential number of graduates available based on the trends reported in the HEA Survey of First Destination of 2011 graduates. Figures E-4 and Figure E-5 show the significant increases expected in the output of ICT graduates in the coming years as well as the impact of the ICT Level 8 Conversion programmes and Springboard Level 8 ICT programmes on the supply of graduates at the key NFQ Levels 8 and 9 by ISCED field of study.

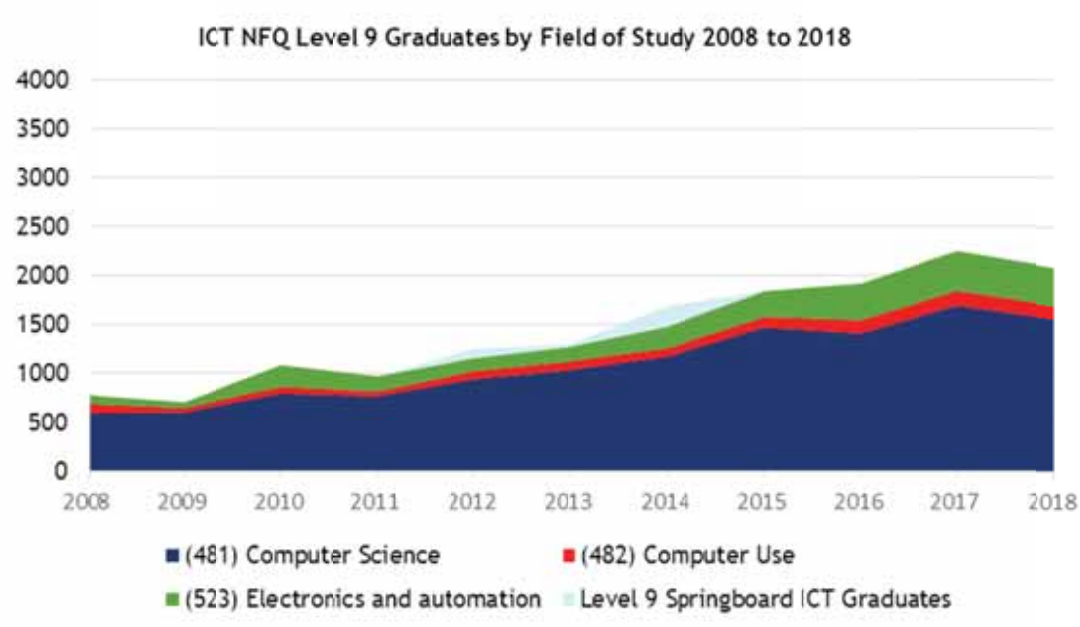
Figure E-4: Forecast of ICT NFQ Level 8 Graduates by Field of Study, 2008 to 2018



Source: Higher Education Authority 2013

[5] International Standard Classification of Education

Figure E-5: ICT NFQ Level 9 Graduates by Field of Study, 2008 to 2018



Source: Higher Education Authority 2013

The projected supply of mainstream ICT Level 8+ graduates contributes close to 50% of the forecast potential job openings at NFQ level 8+, with the projected supply of computing graduates being significantly higher than for electronic and electrical engineering graduates. Projected output from the ICT level 8 Conversion programmes and Springboard level 8 ICT programmes in 2013 and 2014 could bring the potential graduate supply to 57% and 63% of the projected level of job openings for these two years. The right quality and relevance of the skillsets of graduates is essential.

Given the projected supply of ICT NFQ level 6/7 mainstream graduates, and taking account of the output from the Springboard programmes ICT NFQ level 6/7 graduates, the total output would meet around 100% of the forecasted number of job openings at this level in 2013 and 2014 - and thereafter would meet two-thirds of the demand. It should be noted that a quantum of the ICT NFQ level 6/7 graduate supply would take up ICT user positions (people with the capabilities required for the effective application of ICT systems and devices as tools in support of their own work and the use of common software tools and of specialised tools supporting business functions within industry[6]) and this also needs to be factored into the total supply requirements at this level.

[6] Eurostat Glossary: E-skills

E.8 Conclusions and Recommendations

The findings of this study are that the current strong demand for high-level ICT skills will continue over the next six years. In total, 44,500 potential job openings for ICT professionals are forecast over the period 2013 to 2018 arising from both expansion and replacement demand. To ensure that this increase in demand for high-level ICT skills is met, all potential policy levers must be fully utilised, including:

- Continuing to boost the domestic mainstream ICT talent supply pipeline, both in terms of quantity and quality, through actions in education;
- Investing further in targeted skills conversion and reskilling programmes for job seekers with relevant experience and the right aptitude.
- Companies enhancing the talent development and retention of their ICT professionals, including measures which create a talent flow to support the skills development of experienced employees and support the career path and training of new graduates;
- Attracting additional talent towards ICT professional careers, especially high-achieving females;
- Continuing to attract experienced international ICT talent, including actions to attract back expatriate ICT talent. The Employment Permit system has recently been streamlined and improved to help achieve this.

A gap analysis was undertaken between the actions needed to satisfy forecast demand and the key policy initiatives currently being pursued in the Governments ICT Action Plan 2012 and the Action Plan for Jobs 2012/2013 (see Table 14 in the main report). This analysis indicates that there is further potential for action in the areas of attracting more females to careers in ICT (as they are relatively underrepresented in the ICT profession); innovative learning including e-learning; and fostering e-Leadership skills (a portfolio of skills representing deep ICT expertise in a specific area with competence in leadership and management[7]).

Enterprises have an important role to play in actively developing and managing their ICT skills and talent to support their business growth and employment. Enterprise-level training activities and the improved management of ICT professional career paths increase the attractiveness of ICT careers. A supporting policy built around maximising the level of enterprise-led training activities could accelerate the effects of the training initiatives companies are planning.

Comparing the high-level ICT skills demand and supply forecasts, the projected mainstream supply of ICT Level 8+ graduates is close to 50% of the forecast potential job openings at this level over the period 2013-2018 (the proportion being higher for computing graduates than for electronic and electrical engineering). Projected output from the ICT level 8 Conversion programmes and Springboard level 8+ ICT programmes in 2013 and 2014 would add further to this substantial supply bringing it to 57% and 63% of the potential job openings for these two years - the balance of demand to be met through, the conversion of job seekers from related non – ICT disciplines, the continuing professional development of ICT staff, and through continuing inward migration (including the attraction of expatriate talent). The global flow of ICT talent is valuable for exporting companies based here to drive their business performance. Several measures are in place aimed at boosting the domestic high-level ICT education supply, including the building up of the STEM skills supply pipeline. There is a strong consensus of the need for investment in this build up at primary and

[7] E – Leadership Skills, Fonstad (INSEAD) 2013.

secondary education levels. The findings of this study will inform the review of the ICT Action Plan which is planned before the end of 2013. The study suggests additional scope for new actions and the reinforcement of several existing actions in the following set of recommendations. These are denoted by time-period for implementation, Short-term (1-2 years), Medium-term (3-4 years).

1. Review the Scope and Governance of the ICT Action Plan
▪ As part of the planned review of the ICT Action Plan, review its scope to encompass all sources of ICT skills supply and ensure clarity of responsibilities for the overall coordination and implementation of actions. Report on the progress of the updated ICT Action Plan on a half-year basis to the Minister for Education & Skills and Minister for Jobs, Enterprise and Innovation. (new action) **Time frame:** Short-term. **Lead:** Department of Education and Skills, Department of Jobs, Enterprise and Innovation.
2. Boost the Quantity and Quality of ICT Skills Output
▪ Ensure third level Computing and Electronic/Electrical Engineering programmes remain focused on the development of the core technology skills that enterprises need in line with internationally accepted curricula, allowing for sub-specialisation in years 3 and 4. Support the development of softer skills including teamworking, collaboration, problem solving and communications. Establish a timetable for implementation. (reinforcing action) **Time frame:** Short-term. **Lead:** Universities/IoTs, Higher Education Authority (HEA), Companies.
▪ Review and streamline where required existing internship programmes each with differing requirements. Expand the volume of structured ICT undergraduate internships opportunities in line with the planned increase in domestic supply and explore ways to increase the absorptive capacity of enterprises, particularly indigenous companies. (new action) **Time frame:** Short-term to Medium-term. **Lead:** HEA, Employer Bodies, Companies, IDA Ireland, Enterprise Ireland.
▪ Run additional iterations of the NFQ Level 8 Conversion programme starting in 2014 as a strategic response to meeting ICT skills demand. Change eligibility criteria for the retention of social welfare payments while on the programme back from 9 months in a 12 month period to 3 months. Jobseeker register data should be "mined" to identify and inform suitable candidates of conversion opportunities. Draw upon international best practice e.g. the "IT 50 plus initiative" in Denmark and the "Nokia Bridge Programme" in Finland. (reinforcing action) **Time frame:** Short-term to Medium-term. **Lead:** Department of Education and Skills, HEA, Department of Social Protection.
3. Inspire Future Talent
▪ Attract more talent with the right aptitude to careers in ICT, especially women. Strengthen advocacy and career advice provided to young people, especially girls, at second level – and to their parents on the range of rewarding ICT career opportunities available. Establish and report on initiatives to raise female acceptances on ICT programmes from 15% to 25% by

2018. Draw upon the best practice to attract more females i.e. Austria's "Women in Technology" programme, Denmark's "National Pact for Women in ICT"; annual events such as EU initiative "Cyberellas are IT" and other programmes including Dell (WITEM) Accenture, Intel, Microsoft and Coder Dojo. (reinforcing action)

Time frame: Short-term to Medium-term.

Lead: Science Foundation Ireland (Discover Science & Engineering), HEA, ICT Ireland, Engineers Ireland, Companies.

- Organise one-day ICT skills events and practical workshops, with ICT skills competitions for different ages, to raise overall awareness and to attract undiscovered talent of all ages to ICT careers, including those pursuing non-formal entry to ICT careers. (new action)

Time frame: Short-term.

Lead: Employer Bodies, Companies, Science Foundation Ireland (Discover Science and Engineering).

4. Promote Ireland Internationally as the Centre for Global ICT Talent

- Establish a single website with public and corporate involvement to attract international ICT talent - building on the best of existing websites and balancing the needs of both indigenous and FDI companies. It should draw upon the example of the "Make it in Germany" and "Contact Singapore" portals. Utilise the EURES system more fully for the sourcing of experienced ICT professionals from within the EU/EEA area. (new action)

Time frame: Short-term to Medium-term.

Lead: IDA Ireland, Enterprise Ireland, Companies, Dept of Social Protection (EURES).

- Organise career fairs abroad to attract back expatriate ICT talent and high-level ICT talent in locations with a surplus of ICT skills. Such career fairs should be focused around a group of companies with actual jobs to fill. The potential use of Irish embassies abroad could be considered for such events.(new action)

Time frame: Short-term to Medium-term.

Lead: Enterprise Ireland, IDA Ireland, Dept of Social Protection (EURES), Companies.

5. Addressing the Skills Challenge
▪ Enterprises to move further towards being "skills producers" of talent including the development of experienced employees and the career pathways of new graduate entrants. ICT talent management and retention systems should be advanced for attracting and retaining the best ICT talent, from both within Ireland and from other countries (Engineers Ireland Continuing Professional Development Programme is a best practice example). An annual advanced ICT talent management and retention seminar should be run to share best practice among companies in upskilling and HR talent management. (new action) **Time frame:** Short-term to Medium-term. **Lead:** ICT Ireland, Engineers Ireland, Companies.
▪ Build up ICT skills learning platforms by public and private bodies which provide for on-line training at various levels for ICT professions, students and unemployed persons - including for industry-based training and certification aimed at upskilling ICT practitioners and retraining career changers. This should provide modules and programmes at various levels, up to Master's Degree. This will help to foster ICT as a profession. (new action) **Time frame:** Short-term to Medium-term. **Lead:** Universities/IoTs, Skillnets, SOLAS/ Education & Training Boards, Companies.
▪ Establish initiatives to develop e-leadership professional skills (persons with deep expertise in ICT with competence in leadership and management) to drive increased business value and innovation from the creative application of ICT within enterprises – in collaboration between third level institutions and enterprise. Draw upon learning at a European level (e.g. The Software Campus in Germany, IT-Vest in Denmark and the UK Cranfield IT Leadership programme). (new action) **Time frame:** Medium-term. **Lead:** Universities/IoTs, Irish Computer Society, Companies.
6. Maintain the ICT skills development capacity of Higher Education Institutions
▪ Invest in maintaining the ICT skills development capacity of HEIs. This should include up-grading and maintaining the laboratory infrastructure to an up-to-date industrial standard. Create opportunities for existing ICT teaching staff to continually develop their knowledge of the latest technology trends through collaboration between institutions and enterprise; including for short in-service courses. (new action) **Time frame:** Medium-term. **Lead:** Universities/IoTs, HEA, Companies.

Chapter 1: The Demand for High-Level ICT Skills in Ireland

1.1 Introduction

The focus of this study is on assessing the future demand over the period 2013–2018, for high-level ICT skills arising both within (a) the ICT sector and (b) across other sectors of the economy in terms of the following specific ICT skills at NFQ Levels 6/7 and NFQ Level 8/9/10:

1. Computing skills (including computing software engineering and computer programming and multi-media gaming with a substantial computing content); and
2. Electronic & electrical engineering skills (including communications and mechatronics and electronic/computing engineering).

The analysis encompasses those in the above roles with a combination of technical and business/analytic/foreign language skills. A related main objective is to advise on any additional initiatives to retain and attract high-level ICT skills to Ireland. The study presents three plausible demand scenarios for high-level ICT skills over the period 2013-2018. The development of the demand scenarios are based on a mapping of the main international and domestic trends and key drivers impacting on the level and nature of skill demand. This includes for the central demand scenario proposed, an outline of the current and emerging skillsets and competences required.

The study also integrates updated domestic high-level ICT supply projections produced by the Higher Education Authority.

The study has adopted an occupational definition of ICT professionals (computing and electronic/ electrical engineering), which includes individuals requiring a higher level of ICT knowledge and capability whose tasks involve consulting activities, design, researching, developing, installing, programming, maintaining, managing, supporting and servicing of ICT systems and/or data processing facilities, software applications and/or hardware, security, ICT networks and telecommunication networks. The study does not include people with primarily ICT user skills needs (the capabilities required for the effective application of ICT systems and devices as tools in support of their own work and the use of common software tools and of specialised tools supporting business functions within industry[8]).

The Terms of Reference for the study is given in Appendix 4.

Despite the economic downturn in Ireland and many other countries, the Irish ICT sector has fared relatively well with the demand for high-level ICT skills continuing throughout. The main reason for this is the significant ICT cluster in Ireland, due both to strong foreign direct investments from global companies, and to the many indigenous Irish technology companies.

The broad ICT sector is of strategic importance to the Irish economy both in terms of the numbers of high-skilled professionals employed and its significant contribution to Irish exports performance. In 2011, the total exports from ICT related sectors in Ireland accounted for €69.6 billion. This was down from its peak in 2008 of €73.9 billion – this trend reflecting a 50% fall in computer, electronics and optical products exports (-€9.7 billion) partially offset by a 17% increase in computer programming and consultancy services exports (+€5.4 billion). Improving on this export performance requires that the right conditions exist for Ireland to remain an attractive location in which to base

[8] Eurostat Glossary: E-skills.

ICT activities, whether via FDI or Irish owned business (EI software exporting companies had exports of approx. €1 billion in 2012 – a 19% increase over the previous year). A crucial factor to ensure Ireland's attractiveness is the availability of high-level ICT skills at the right quality, quantity and knowledge so that employers can be assured that the supply of ICT skills will be there for them to grow their business.

Key components are to ensure that the education system produces a large proportion of the skills needed, and that experienced people with related skills in sectors that have experienced a decline, are re-skilled to help fill demand, and that Ireland can attract the right skills from abroad to balance supply and demand.

However, the latter part of the equation has its challenges. There is strong global demand for high-level ICT talent. In the EU, according to the "e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios" undertaken by IDC, INSEAD and empirica on behalf of DG Enterprise and Industry under the European Commission, in a “Cautious Growth” scenario the excess demand or shortage of ICT skills in the EU will amount to 372,000 in 2015 compared to 255,000 in 2012. In the more optimistic ”Return to Confidence” scenario, the shortage, i.e. the theoretical number of ICT vacancies would amount to 864,000 in 2015. The global competition for talent is strong and growing.

In addition, as ICT permeates all aspects of business operations and innovation is either centred around or underpinned by technology, there is an increasing demand for people that have acute insight and skills in both ICT and business. These e-leadership skilled professionals are harder to define than traditional ICT skills. Their skill sets are "T-shaped" e.g. they have broad technology skills and deep business skills or vice versa depending on the role they are filling. Consequently, the development of transversal skills such as business acumen, communications, team working and entrepreneurship are becoming increasingly important in conjunction with ICT skills. This is also confirmed in a recent report by FIT[9] in which employers in the ICT sector indicated a preference for new recruits who are innovative, entrepreneurial and have project management skills. This is further reflected in the findings of an IBEC survey[10] in which employers flagged written communication, business awareness, entrepreneurial skills and the ‘right attitude’ as important.

Several initiatives are already in place to address the need for high-level ICT skills. These are set out in the ICT Action Plan 2012 (including doubling the number of honours level ICT graduates by 2018) and the Action Plan for Jobs 2013 (an additional 2,000 honours level ICT graduate professionals for industry in 2013 from reskilling opportunities for jobseekers and migration), and improving the process around employment permits for talent from outside the EEA.

Current Employment of ICT Professionals

According to the Central Statistics Office, from the 2011 census there were 65,350 ICT professionals employed in Ireland across all sectors of the economy (it is estimated that this increased to 68,280 in 2012 - an increase of 4.5%). Of these, it is estimated that around two thirds are employed in what can be described as the broad ICT sector and a third in other sectors, mostly in IT departments.

[9] FIT ICT Skills Audit, 2012.
[10] National Survey of Employers’ Views of Irish Higher Education Outcomes – IBEC, December 2012 at the request of, and in collaboration with the HEA.

However, since some of the employment in the broad ICT sector also supports the needs of the Irish user organisations, IDC estimates that about 44% of ICT employment in 2011 was for serving demand in the local economy and 56% for serving the demand of ICT export markets (see the Assessing the Demand for High-Level ICT Skills section for more details).

This breakdown of employment of ICT professionals underlines the importance of the ICT sector for Ireland. However, the employment of ICT professionals in other sectors should not be overlooked. It is important to get both the domestically focused and the export part (foreign owned and internationalised SMEs) of ICT employment working well. By increasing the adoption of new technologies in the domestic economy, Ireland will be better placed in terms of being able to develop centres of excellence for ICT for specific industries, as is much of the focus in Ireland's Research Prioritisation exercise. If indigenous and global companies, and domestic business industries all focus on developing expertise around certain technologies and solutions, it will create a virtuous circle that will further attract talent and investments from abroad as well as improving the attractiveness of the ICT profession amongst young people.

Purpose of this Study

The main purpose of this study is to estimate the demand for high-level ICT skills in Ireland out to 2018. For this work, IDC utilised its in-depth knowledge of ICT markets through its many expert analysts and its proprietary skills demand forecast model. The research also took into account findings from the extensive consultations and workshops held with companies and stakeholders and the input of members of the Steering Group as follows:

- Five meetings with an input from the Steering Group set up to oversee the work of the study consisting of a broad selection of stakeholders;
- Two workshops with participation from around 50 stakeholders from MNCs, indigenous technology companies, academia, ICT users in the local market, government bodies and industry associations;
- In-depth interviews with 22 key informants/stakeholders;
- In-depth interviews with 38 enterprises in their role as employers of those with ICT skills.

This report presents the results from this extensive research process.

1.2 Global Technology and Service Trends influencing Irish ICT Skills Demand

After years of global economic downturn that has heavily affected large parts of Europe, enterprises are still cautious about IT spending. They remain more heavily focused on the "cost agenda" (buying decisions motivated chiefly by a desire to reduce the organisation's running costs, and/or to reduce the cost of its IT assets/investments) than on the "growth agenda" (buying decisions motivated chiefly by the desire to grow the organisation's top-line revenues, or at least to drive up customer or citizen loyalty and satisfaction).

Yet, while cost cutting and cost control are critical to enterprises and shape much of their views of IT technology and services buying, these measures cannot in themselves form a long-term strategy. After four years of recession and cost control, enterprises simply cannot continue to cut their way

to value creation. At some point – and for some enterprises, that means right now – they have to return to top-line growth. Returning to growth in a flat macroeconomic climate means keeping and taking market share from competitors and that in turn means creating and marketing compelling offerings, and (critically) having a focus on existing and potential new customers. In other words, the focus for enterprises – at least the leading ones – will turn once again outside the organisation, towards understanding and engaging with end customers (and to an extent with business partners and suppliers).

Demographic Changes

Demographic changes in the workplace and in the "real world" are creating new demand patterns, and putting new strains on employers looking to attract and keep the best talent. While on the one hand, populations and workforces are ageing (itself creating interesting new demand patterns), on the other hand new waves of digital-native employees and consumers want to use new technology (e.g. mobile, cloud) and new services sitting on that technology (e.g. social), in different ways. Moreover, in many parts of Europe, immigration and internal migration patterns are creating unprecedented ethnic and lifestyle diversity in both populations and workforces. For example, in Ireland, the 2011 census showed that the number of non-Irish nationals was up by 143% in nine years to more than 544,000 people, with the largest proportion of these from Poland (23%) and the UK (21%). Enterprises and government bodies need to understand and continue to adapt to these major demographic shifts if they are to continue to remain relevant to customers and citizens.

Enterprises and organisations are reacting to these shifts by simplifying, standardising and automating their IT infrastructures. They are doing this to drive cost and agility improvements to make the IT assets/investments not just less costly, but better adapted to the ever-changing needs of the business. Secondly, changing demographics impacts on how companies and public bodies interact with customers, citizens, employees and partners, and brings a new focus on "front-end" technology and interfaces. These trends are not just relevant for the domestic market but are global in nature and affecting businesses and public sector organisations across, in particular, advanced economies.

Towards the "Third Platform"

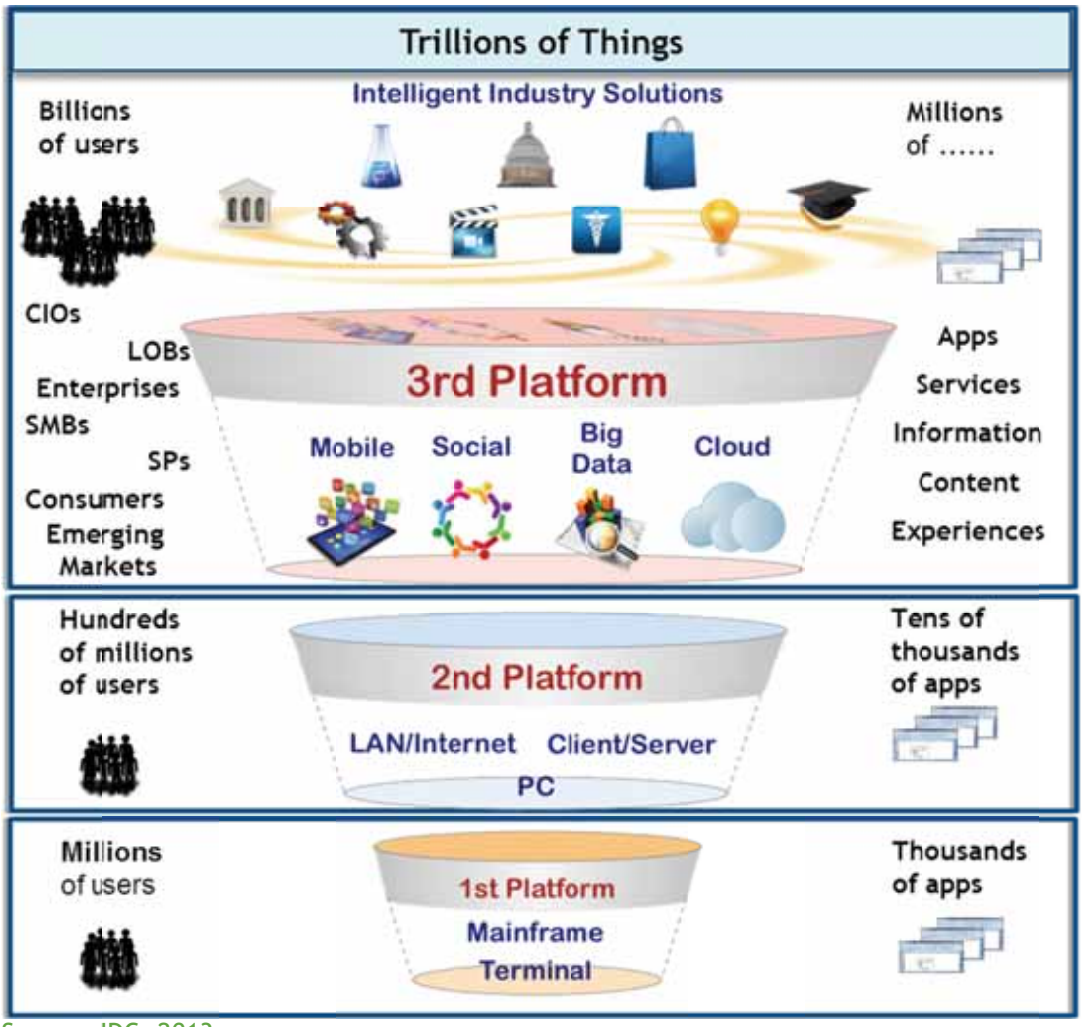
The ICT industry is in the midst of a "once every 20–25 years" shift to a new technology platform for growth and innovation, expected to dominate the market by 2020 (Figure 1). This is characterised by the disruptive combination of the following technologies:

- Adoption of cloud computing, a disruptive delivery model for IT software and services, based on flexible and on-demand business models;
- Rapid penetration of mobile devices and technologies, including mobile apps and M2M, (machine to machine) connectivity through billions of sensors (the Internet of things);
- Emergence of Big Data analytics, driven by the huge increase of data generated by mobile devices and the Internet;

- Adoption of social technologies, migrating from the personal to the business environment, with a profound effect on business and social interactions within enterprises and in supply chains.

It is estimated that by 2020, the ICT industry will generate $5 trillion in spending worldwide (which is over $1.3 trillion more than it does today). About 40% of the industry's revenue and almost all of its growth will be driven by Third Platform technologies that today represent just 22% of ICT spending. The "Third Platform" will engage billions of users and generate millions of apps, sustaining a new intelligent economy. The Third Platform also represents a change of scale in the size and depth of the ICT market, both in terms of the number of users, the number of connected devices, and the number of applications and services. This change of scale also represents a paradigm shift.

Figure 1: The ICT Industry's Evolution to the Third Platform for Growth



Source: IDC, 2013
Note: CIOs are Chief Information Officers, LOBs are Line of Business Manager; and SPs are Service Providers.

According to the Information Society Technologies Advisory Group (ISTAG), an advisory body to the European Commission in the field of information and communication technology, ICT is entering into a society or infra-centric phase, in which social innovation is becoming a main driver for ICT development. Social innovations are new ideas (products, services and models) that simultaneously

meet social needs and create new social relationships or collaborations. In other words, ICT itself has become a social technology, completely interwoven with and driven by social and economic dynamics. The combination of technology and social innovation is a powerful force for change whose impact will be strongly felt in the next 5-10 years. This evolution will also create demand for new skills in ICT professionals, who will need to be able to deal with social innovation dynamics.

The emergence of these trends is leading to the development of a real digital market, where the millions of applications enabled by these new technologies are traded and enterprises use them to solve specific business issues with new business models.

This underlines how the development and deployment of these technologies and services relies as well on a profound change of the underlying hardware innovation. Research in sub-micron technologies is moving towards new materials and radically different designs. At the same time, multicore processors and intelligent systems (SoC, System on a chip) are becoming mainstream across all computing user sectors. This will improve hardware speed and power, but also enable a new level of process integration and innovation, accompanied by sophisticated applications and services, with advanced control and management capabilities, across all of the computing value chain. A clear example is the expected integration of car telematics and car electronics, and the forthcoming introduction of automated car driving systems. This evolution is profoundly affecting the embedded electronics industry, where the EU industry is traditionally strong and is struggling to maintain its competitive positioning. While the embedded electronics market was traditionally separated from the traditional IT services market, the emergence of new services based on the new electronics will require new understanding and skills from ICT professionals.

There is also a potential "bottleneck" in software development, since software innovation is not keeping pace with hardware innovation. Although multi-core processors have been mainstream for several years, current software development still lags behind, with sequential applications still the dominant program design. Parallel programming is far more difficult than sequential programming, and migrating applications and services is costly. There is a need for new, cost-effective software tools and systems enabling the development of new software or reengineering of the existing software. Again, this is going to impact the skills needed from ICT professionals.

A further strong trend is the exponential growth in the number of devices or "things" that are connected via the Internet and a proliferation of ICT for personal and business use, the so-called Internet of Things. This creates a strong need for design and development of microelectronic products and devices that enable the above development and the intelligence needed for developing green IT technologies, smart (or e-) health, and smart grids to name but a few.

Across all these trends and exacerbated by the proliferation of ICT across business processes as well as personal interactions of consumers is the need for IT security.

Based on these considerations, and for the purpose of this study, the following main trends have been identified in ICT markets that will affect the demand for high-level ICT skills. In each of these main categories, there are sub-trends and niche markets that could also provide opportunities for Ireland, such as mobile apps, gaming, medical devices, social marketing, ecommerce, and green energy. Across the board there will be a strong need for software development, engineering, integration, and support skills.

These main trends are:

- Mobility and Consumerisation;
- Cloud Computing;
- Big Data;
- Social Media Technologies;
- IT Security;
- Internet of Things;
- Micro- and Nanoelectronics as Key Enabling Technologies.

Mobility and Consumerisation

Enterprise and consumer mobility is one of the most important current trends globally and an important driver for ICT and consumer spending driven by the proliferation of mobile smart devices. Consumerisation describes the broad phenomenon of leveraging mobile solutions in the business environment. From a technology perspective, mobility entails mobile devices (tablets, smartphones, etc.), mobile software (including mobile device management, mobile application platform and mobile applications), the related IT professional services and mobile telecom services.

It is estimated that the sale of smart devices globally, including smartphones and tablets, will grow by an average of around 25% a year globally over the next three years compared with a flat PC market. Further, mobile working is also growing at 5%-7% year on year. This translates into increasing ICT diversity with strong growth in mobile applications and a trend towards consumerisation. However, it is important to understand that while the smartphone is gaining ground universally even in emerging markets, on the consumer side tablets remain largely an US, Chinese and UK phenomenon.

Consumerisation is defined as the set of changes engendered by employees bringing personal devices (hence often termed Bring-Your-Own-Device or BYOD) and using Web 2.0 social applications in the workplace and is as a trend gaining momentum. Consumerisation is a multi-faceted issue brought about by the explosion of new consumer devices (iPads, smartphones, etc.) but also Web 2.0 social applications (Facebook, Twitter, LinkedIn, DropBox, EverNotes, etc.) within the enterprise. Viewed in this light, the consumerisation battle is taking place on two fronts: the device side, as well as the [personal] productivity application side. The consumerisation trend is the result of three major shifts within the market.

- Explosion in Device adoption.
- The rise of social networking at home filters through to the workplace. Facebook, created in 2004, reached 1 billion users in 2011. The company is the poster child of Web 2.0 consumerisation.
- The blurring of boundaries between business and personal time. Powerful technology is cheap enough to be available to all; new collaborative applications pervasive enough to be relevant everywhere. The combination of empowered end-users and powerful, user-friendly devices brings a plethora of potential issues. Workers will no longer wait for their corporate world to catch up with progress; they will find a work-around solution to apply their personal productivity tools into a work context.

The growing mobility of people and goods has challenged organisations to meet the requirements of employees and customers while on the move. In this context, the explosion of mobile consumer applications has driven increasing visibility and demand of business applications in the mobile environment. The reliance on mobile devices for business purposes is very strong, particularly in Europe, with up to 64% of companies currently adopting more than one mobile device type. Reliance on mobility solutions has also grown substantially in the recent past. At the end of 2011, IDC's research showed more than 43% of European companies had already adopted more than one mobile solution in the organisation.

Beyond the obvious benefit of anytime and anywhere availability, there are several drivers pushing companies to adopt mobility strategies either to enhance customer services and/or to increase employees' efficiency. On the customer side, they include:

- Meeting expectations of increasingly technology-savvy customers;
- Reducing lead time and improving service level;
- Higher degree of personalisation.

On the employee efficiency side, they include:

- Enhancing employee productivity;
- Improving information and data accuracy; instant and visible information management;
- Providing mobile workforce with faster access to time-critical information for enhanced customer responsiveness;
- Better and faster decisions thanks to quicker reaction to unexpected changed situation in the field;
- Automated inventory stock take/supply tracking;
- Automated sales orders, allowing the sales force to access current product and shipment information from any location;
- Enhancing communication links between office and warehouse.

Impact on ICT Skills Demand

With both employees and customers using mobile consumer applications heavily, many companies realise that the adoption of mobile solutions in the enterprise environment could help face these challenges in a different way to gain advantage against competition.

An effective mobility strategy calls for the development of a new set of ICT and managerial skills. On the IT side, there are strong opportunities for mobile applications' developers, as the market is moving from emerging in-house development to sophisticated solutions that underpin business processes. Even so, customisation to companies' processes will remain key, fuelling demand for skills both from third-party services players and end-users' IT departments. Moreover, a successful mobility strategy requires the integration of mobile applications with traditional ones, calling for IT integration skills either from third-party vendors and/or from companies' IT departments.

With security being one of the key challenges of mobility, enhanced security skills will be also high in demand. On the managerial side, mobile solutions may require a rethinking of business processes, governance and policies to support the new strategy. Moreover, it could also generate a cultural

change in the organisation: mobility can enhance business processes, but it can also help the creation/launch of new services and/or a focus on new markets.

While Europe has had a pioneer status in mobility, European firms have been more sceptical than their US counterparts around consumerisation and BYOD largely due to business case challenges (unclear support models, roaming costs etc.), uncertain tax regulation, and user privacy and data security challenges in particular. Perhaps the most significant reason, however, is cultural. Many European firms don't yet have in place the appropriate trust and communication models that need to exist between IT and users within the organisation to allow BYOD to flourish.

According to IDC's 2012 EMEA Enterprise Mobility CIO Survey, attitudes are quickly changing, however. In this survey, 58% of respondents claimed they either had BYOD policies in place today or were currently evaluating them over the next 3-6 months, up from 39% in an April 2012 survey on this topic. Operationally, consumerisation introduces skills and management issues. With different hardware, operating systems and configurations, the complexity of support grows exponentially. This will put increasing pressure on organisations to have a much broader set of technology skills to support users in their day-to-day work and ensure that a myriad of device and software combinations work optimally. The only way to limit this support complexity is to formulate and enforce policies on which devices and software are approved and supported. Nevertheless, the implication is still that IT departments generally must have broader technical skill sets than is the case without consumerisation. For instance, Windows 7 support might require qualified Microsoft engineers in house. Adding Mac OS as well as multiple mobile operating systems will bring up the number of engineers needed.

The pace of change will also trigger an asset management challenge for IT departments. End users change devices as they wish, influenced by necessity for upgrades or simply fashion. As such, building and maintaining an accurate asset registry will take up time and effort. Some might even give up on the idea. In other words, asset management and change management skills will become valuable within a consumerised environment.

A third key area where consumerisation increases skills demand is security. With the borders between corporate and consumer IT heavily blurred, having strong security processes and policies in place will be crucial to protect the organisation's data. Hence, an organisation that has embraced consumerisation strongly will most likely need to have a dedicated IT security team, if it doesn't already, and an expanded team if one currently exists.

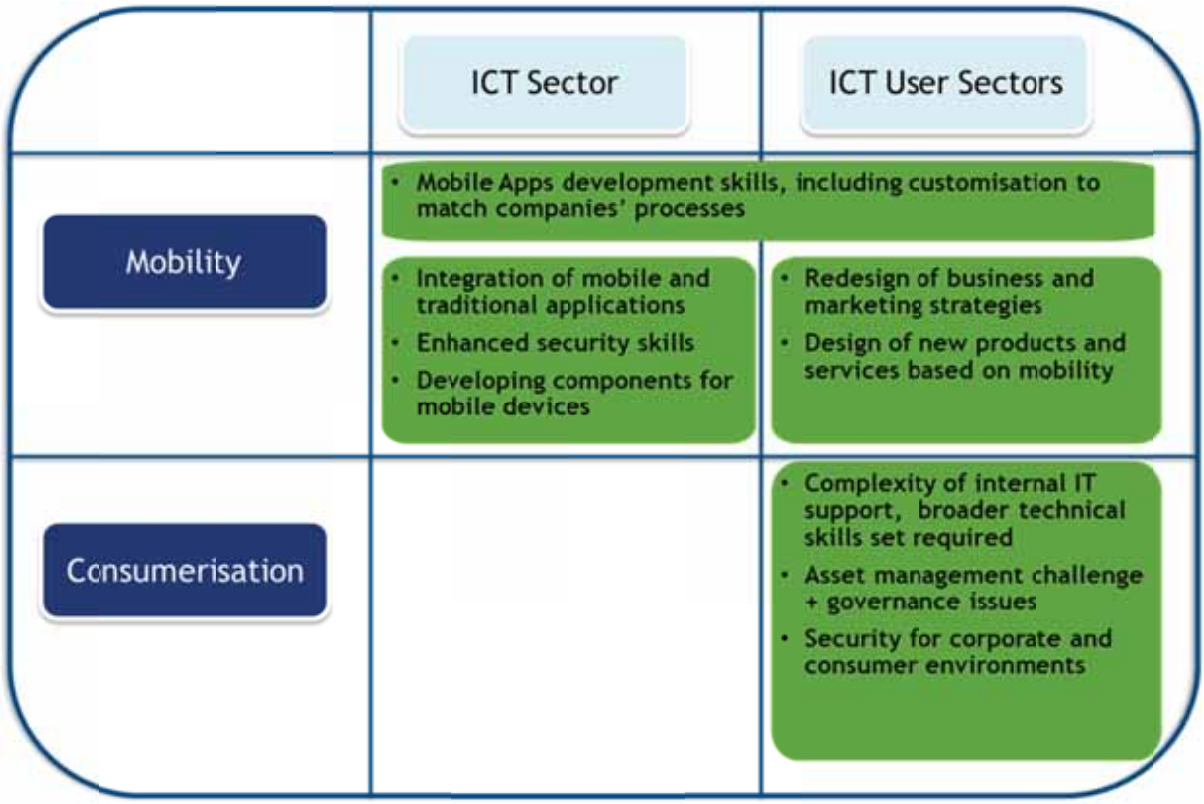
The proliferation of mobile devices creates a need to manage them. Mobile device management is currently the most adopted mobile solution and strong demand is also anticipated for mobile application platforms. By the end of 2013, the number of companies investing in this area will have doubled. In the application area, most organisations will focus their attention on mobile applications to enhance employees' productivity.

It is estimated that just around a quarter of mobile solutions are developed in house: increasingly companies are looking for external vendors for their mobility strategies. This doesn't mean that companies in different sectors won't be affected by the need for new mobility skills. Integrating mobile solutions into companies' existing processes and workflows will remain a key challenge. Moreover, mobility doesn't only require new ICT skills. New business skills will be increasingly in demand, particularly in sectors where mobility is leveraged as a new channel to reach customers (e.g. telecom/media, finance, government and healthcare). These include redesigning business

processes and marketing strategies to integrate and take full advantage of the mobility strategy. Here, people with T-shaped skills or e-leadership skills will be increasingly valuable.

Last but not least, the almost insatiable appetite for continuous innovation in mobile devices creates an increasing demand for engineering skills for design and development of microelectronic components for these devices. Figure 2 summarises the changing demand for ICT skills.

Figure 2: ICT Skills for Mobility and Consumerisation



Source: IDC for GUIDE, 2013

Many of the developments needed for this technology area match well with initiatives under the Ireland's research prioritisation area of "Future Networks and Communications"[11]. With more than 400 enterprises in Ireland within the telecommunications sector alone, there is a strong basis for developing mobility technology, not to mention Ireland's significant expertise in chip design and software programming.

Cloud Computing

Cloud is a new delivery and consumption model for IT that has gained substantial traction, in particular in the US and Europe; although adoption is growing strongly in emerging markets. It is estimated that spending on public IT cloud services (applications, platforms and infrastructure, including virtual private cloud) will grow by an average of 22% a year in developed markets (US,

[11] Report of the Research Prioritisation Steering Group, November 2011.

Canada, Western Europe, and Japan) to 2016 and twice that (44%) in emerging markets (APAC (excl. Japan), Latin America, Central and Eastern Europe, and Middle East and Africa).

In a cloud model, IT is delivered to the user as a service from a central, shared site and delivered via the Internet instead of the company's IT department buying hardware, software and perhaps services to create the IT package that the user uses. The “cloud” can be used to deliver infrastructure, platforms, applications and business processes as a service. Cloud is based on a sharing of resources, automated provisioning, configuration and management of the resources via self-service interfaces. The original cloud model has substantial advantages in the form of improved IT usage, leading to lower cost. It enables high flexibility and fast provisioning and de-provisioning of resources by allowing the user to tap into existing resources and pay only for what is used and spend long time in the provisioning phase while the IT department purchases the necessary resources. However, while the "pros" are strong, there are some "cons": users fear for their data when the applications, servers and/or storage are shared, they struggle with compliance because they don't know where data is, and the model means, that providers of cloud service only provide service level agreements (SLA’s) for the total cloud, not for the specific users. In addition, the total standardisation of the cloud means that users will not have the level of customisation to which they are used. This can in some cases be a challenge for adoption.

The latter has given rise to new variations of cloud: using the same model for sharing, but restricting the resource sharing to units within a specific company. Most of the characteristics of cloud can be preserved, but the environment is now dedicated, and therefore called private cloud. These private clouds can be either built on a customer's premises or hosted in a vendor's data centre, in which case the model is called hosted private cloud. Finally, the original shared public cloud can have added security and service level agreement features, which turns it into a virtual private cloud. The need to distinguish between all these models is because they lead to different skills requirements for vendors and IT departments.

The economic downturn has a somewhat limiting impact on migration to private cloud, which means that a cautious investment policy could lower the private cloud spending somewhat, although not by much as savings are substantial. According to IDC's annual European Enterprise Services survey in 2012, 43% saved 10% or more by migrating to cloud, 20% saved at least 20%, and all expect to save substantially more in the future. The impact on the broader organisation in terms of increased agility, flexibility and increase in productivity are seen to be more important than the direct IT cost savings for most of Europe's organisations. Consequently, if the economic downturn lift faster, then private cloud is likely to lead to faster growth. Public cloud seems to be less negatively impacted by the economy, although some organisations are less willing to take risks in making changes to their IT environments. Overall, for companies under strong financial pressure cloud represents an opportunity to get access to IT resources without upfront investments, and consequently there is particularly strong interest in Spain and Italy in public cloud services, especially for applications for which the buyers would not have been able to afford a license.

Migration to cloud to take a number of steps: critical applications are migrated to private cloud first, and will later be migrated to shared clouds. It is anticipated that business IT environments will over time converge on virtual private clouds, while private clouds will gradually, but never fully, disappear, and fully open public cloud adoption will become mainly consumer-oriented and keep growing in that space. The key conclusion is that cloud is a force that is transforming the ICT landscape.

Impact on ICT Skills Demand

The cloud model has a dramatic influence on the tasks that IT departments perform as well as those ICT vendors and service companies perform when they use human resources to produce and deliver ICT. When companies buy IT as a service, whether from public cloud or hosted cloud, they no longer need the technical skills and resources to build and maintain their own infrastructures and applications. Instead, they need to understand the available cloud services and technologies in the market, make sure users have access to the right services and applications, manage the usage and cost, manage data security and help users. In short, the internal roles turn from IT builders and managers to brokers, strategists and business supporters.

When companies decide to build a private cloud, they need technical skills to do so or they will buy them externally. Building and optimising clouds require high-level complex ICT skills, which is why most companies prefer to buy them, although some IT departments prefer to have the skills in-house. Managing and maintaining private clouds is easier, because cloud in contrast to traditional IT is automated. Again, the skills required are at the higher level, focusing on design, supervision of automated solutions, cost management, etc. Although there is a large amount of reuse of templates and models, standardisation of services, etc. there is still a substantial degree of customisation of the private clouds and therefore demand for skills to create these environments. Generally, the amount of resources needed for private clouds far exceeds the skills needed for public clouds. It is estimated that 85% of the professional services spending on cloud is used on private clouds. User companies also need skills to migrate their existing applications to cloud, unless they want to source this competence externally as well, which many do to minimise the risk in the migration process.

As cloud adoption penetrates deeply into organisations, fewer people with traditional technical infrastructure technology skills will be needed due to the economies of scale possible. More people with higher-level ICT skills – both from a technology perspective and from the perspective of understanding how to best utilise cloud for business purposes – will be needed. Nevertheless, the penetration of cloud is still in so early a stage that it is difficult to predict if this will lead to an overall neutral result or net-loss/net-gain of skilled people.

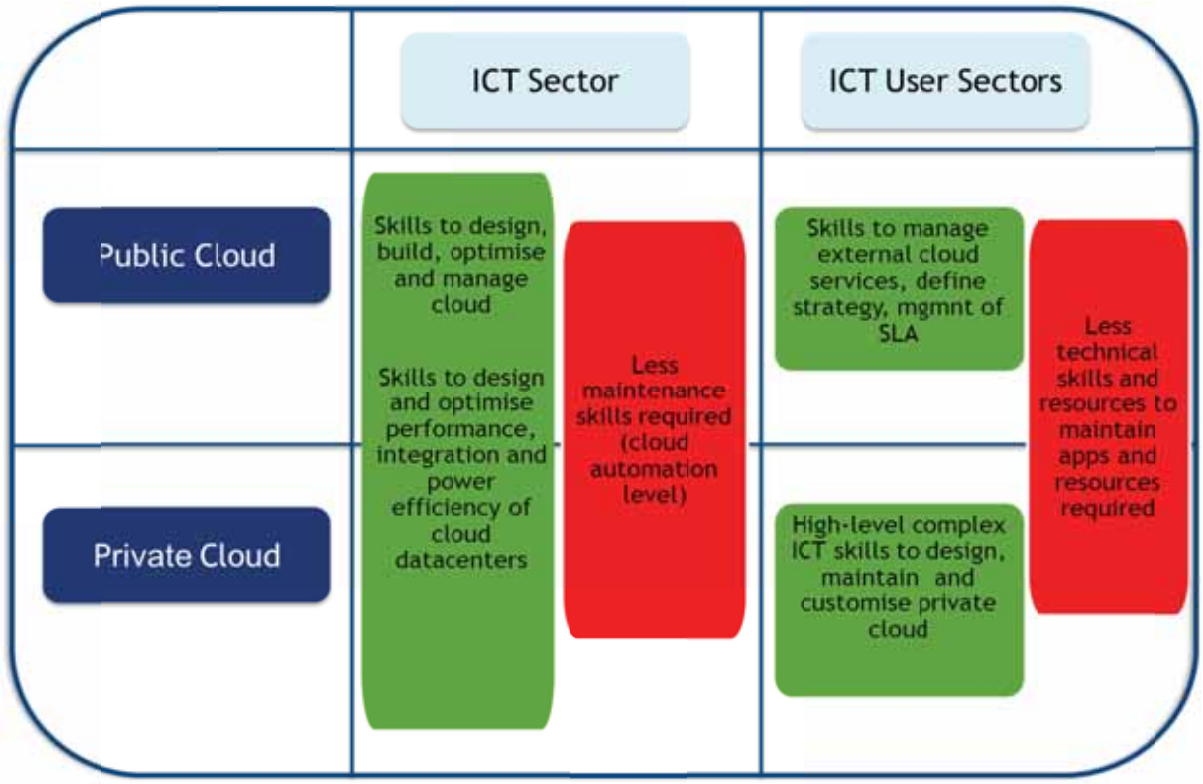
On the ICT vendor side, skills requirements are increasing. Vendors need to design, build, optimise, and manage their clouds and all the users of these clouds. Public clouds are in some ways easier to design and implement than private clouds: they are fully standardised and either used (optimised) for one application (suite) or a fully standardised infrastructure, where the end-user customer or an ISV will take care of the application implementation. Security is a very complex task in public clouds, which will add to the continued growth in demand for security skills (see the section on IT Security for more detail).Consequently, use of cloud means a reduction in need for resources to build and manage IT because it is standardised and automated. It also means that the need for resources are moving from user sites to vendor sites and the need for user-site skills change to become more business and strategy-oriented. For a while, migration will sustain the need for traditional resources skilled in cloud and/or virtualisation in either the end-user organisations or in the vendor community, but over a ten-year perspective, as all relevant applications will have been migrated, this demand will tail off.

The gradual migration to cloud means that enterprise ICT landscapes become even more complex for a while, as public cloud resources, private cloud resources and traditional ICT will exist in a

mixture that needs interconnection. This will require technical skills onsite to manage what is left of the existing IT environment and the integration (data management) unless organisations opt to outsource this task. Surveys undertaken by IDC in the US, which is ahead of Europe in cloud adoption, show that US companies find this task increasingly complex and need to outsource because they can't acquire and maintain these skills in-house. This indicates a shift of technical resources from management of IT to creation of IT, and a shift towards project-oriented competences, not maintenance/management competences, which is a different skill set.

As discussed above, over time a decline in demand for more traditional technology and operational support resources is expected. Cloud will give rise to a wealth of new applications that needs skills to be designed and implemented. These new applications will be developed on cloud platforms and with reuse of code and therefore require fewer resources than development of traditional applications. Each developer will therefore become much more productive - and the skills requirement will balance between a reduction in skills needed per application and the explosion of the number of applications. As the cloud market develops, larger data centres will be established for delivering public cloud services as well as virtual private or event private clouds for large corporate in order to create the best economy of scale. A key concern around data centres is energy consumption, in particular as energy prices continue to rise and there are growing concerns about the environmental impact of large data centres. Consequently, microelectronic engineering skills are needed for continuous innovation of chip designs to improve power efficiencies and optimise the performance of computer systems. Figure 3 summarises the changing demand for ICT skills.

Figure 3: ICT Skills for Cloud Computing



Source: IDC for GUIDE, 2013

There is a wide range of multinational companies in Ireland active in cloud and a number of large-scale data centre facilities focused on cloud. This could provide a good basis from which to grow capabilities and expertise in cloud. There are already many indigenous companies with cloud offerings a focus from Enterprise Ireland on further growing this area (amongst others) with Competitive Start Fund earmarked for supporting start-ups.

Many of the skills developments needed for this technology area and that of the following area on the “Internet of Things” match well with initiatives under the Research Prioritisation area of Digital Platforms, Content and Applications".

Big Data

IDC defines Big Data broadly as follows: "Big Data technologies describe a new generation of technologies and architectures, designed to economically extract value from large volumes of a wide variety of data, by enabling high velocity capture, discovery, and/or analysis."

Many Big Data market analysts, vendors, and users agree on another often quoted part of the definition of Big Data — data sets that grow so large or so fast that they are difficult to handle using traditional technology. The difficulty with this definition is the difficulty in defining "large", "fast", or "traditional”. Big Data is not only about specific attributes of customers' data sets, but it is also about using new technologies and techniques to manage rapid growth, increased variability, and accelerating velocity in those data sets to drive business growth. Every organisation can face a Big Data challenge if its current IT infrastructure is not fit to handle the increasing requirements for availability and performance of their growing volumes of data. Therefore, a further alternative definition for Big Data is "what you have at the point in time when your existing architecture can no longer deal with the volume, variety, and/or velocity of your organisational data."

The market hype around Big Data is substantial and continues to grow. In one sense, Big Data is an evolution of what business analytics has been doing under various names for over two decades. However, from a technology perspective, Big Data comprises a set of genuinely new technologies (e.g. Hadoop, highly scalable databases, advanced data visualisation tools, and high-performance search engines) and a convergence of more mature technologies (e.g. event-driven processing, business intelligence or BI, and data mining). One thing is certain, to embrace fully Big Data, organisations need to be dedicated and determined to embrace a more information-led culture.

The combination of market hype and the fact that many of the component technologies are already mature has pushed people, particularly in Europe, toward cynicism around Big Data. This is important as it affects the effectiveness of vendor marketing strategies. If the market gained a broad understanding of the complex blend of old and new that Big Data represents, this would make it much easier for vendors to market using this umbrella term. However, this has not been the case so far. Many vendors have jumped on the Big Data bandwagon, presenting offerings branded as Big Data or "Big Data ready," but the understanding and interest of the IT end-user community are lagging somewhat behind. With Big Data, the compelling use cases really need to come from the business users that want to overcome the current limitations of their IT setup in order to create more agile business processes, to segment and target their customers more accurately, or to design wholly new business models based on the new opportunities created by technology advances.

Big Data is still not embraced by organisations at large. On a global level, Big Data penetration of software, hardware and services markets is between 0.4% and 4.4% of total spending, highest for storage technologies. Overall, IDC estimates that spending on Big Data will reach around €7.6 billion globally in 2013 but will grow by around 30% a year to 2016. According to IDC's European Enterprise Software Survey in 2012, only 29% of European organisations said they are ready for Big Data.

However, 52% of respondents stated they are not ready for Big Data, and 20% were undecided on their readiness. Adoption of Big Data technologies in Europe lags behind North America because North American data sets are generally larger and more homogenous, lacking the language variations present in Europe. The same survey also showed that 27% of respondents use Big Data to extend or accelerate what they are already doing. This shows the pragmatic approach that end users are adopting with Big Data. They are using it to accelerate existing analysis-based use cases rather than completely generating new ones.

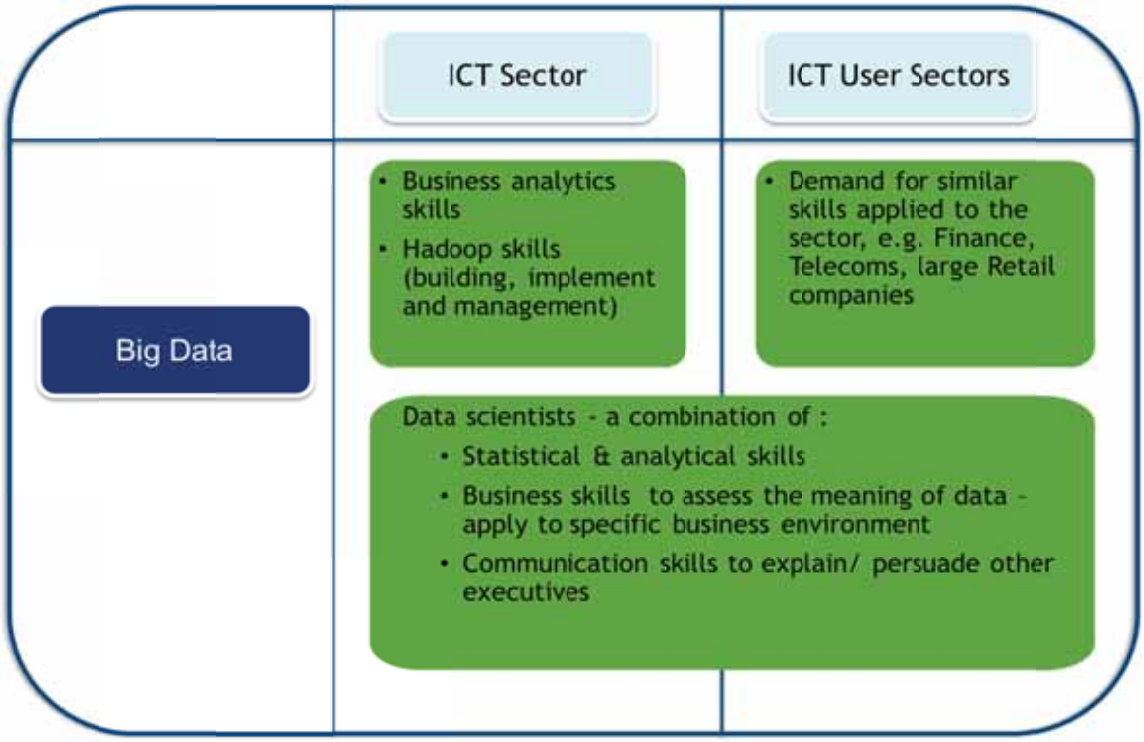
Impact on ICT Skills Demand

A key element of Big Data is the newest technology involved - Hadoop, an open source processing framework that allows large analytical queries to be broken down to many small queries that can be run in parallel, and then reassembles the results into one dataset. Hadoop skills are in short supply and experience of building; implementing and managing Hadoop environments are even rarer. The vast majority of Hadoop projects are pilots and proof of value, and there are very few live production environments. However, the Hadoop ecosystem is expected to grow quickly.

The role of the statistician has been reborn with the rise of Big Data, combining analytical and statistical skills with some level of business understanding to create the "data scientist". The job of the data scientist is to bring the data together from diverse datasets and then explore it to find patterns, trends and insights. By necessity, the data scientist has in-depth knowledge of statistical tools and techniques, but also needs either the business acumen to apply what they have learned to the organisation, or the communication skills to explain the implications of their findings to business executives. In addition, people with skills that span business acumen as well as the technical aspects of data analytics will be in high demand. These T-shaped skillsets will be critical for bringing the value of Big Data to the business. Similarly, for the broad ICT sector, these skills will be needed to develop industry specific solutions around Big Data

Figure 4 summarises the changing demand for ICT skills.

Figure 4: ICT Skills for Big Data



Source: IDC for GUIDE, 2013

There is already a good representation of market leaders in Ireland in the analytics/Big Data technology space. Big Data is one of the key Government research prioritisation areas with plans to invest heavily in new research facilities[12]. This includes establishing a new industry-led Technology Centre, commencing new Government initiatives where big data analytics are used to deliver solutions to public service challenges, putting in place the skills needed to sustain this new opportunity and finally, establishing a joint industry/Government task force to co-ordinate the delivery of these measures. Strong capabilities in Big Data can also support development in other new technology areas by providing applied analytics and insight in areas such as smart health, and smart cities. There is potential for Ireland to establish itself as a test bed for trial and validation of new technologies.

Many of the skills developments needed for this technology area and that of the following area on IT Security match well with initiatives under the Research Prioritisation area of Data Analytics, Management, Security and privacy."

Social Media Technologies

Social media technologies are becoming a core part of ICT's next growth platform. The number of intelligent devices on the network ranging from smartphones and networked entertainment devices to automobiles, building automation systems, smart meters and thermostats, medical electronics,

[12] Action Plan for Jobs, 2013.

industrial controllers, Radio Frequency Identification (RFID) tags and sensors, at the basis of the so called Internet of Things will soon outnumber "traditional computing" devices by almost 2 to 1. This affects the way people think about interacting with each other and with devices on the network.

A distinction may be made between social marketing, the use of social tools and techniques, and reaction to social data as an external process, and enterprise social networks as the internal use of social techniques in order to facilitate collaboration, knowledge sharing, and support business processes in a more open fashion than the point-to-point communication facilitated by email.

European organisations will deploy social marketing as well as enterprise social networks in 2013 – although less aggressively than North American peers. Europe is naturally slower at social because of the cultural and linguistic diversity of the region; much social activity is naturally conducted in people's native language, hence is not accessible to the whole region in the same way as in North America (although translation services are making this easier). Consequently, social marketing and enterprise social networks have been somewhat slower to take hold. Inhibitors for social media adoption include:

- Fears about data privacy. The legislative landscape on data privacy is changing in countries across the world and, in Europe, also at European level and much is still unclear. In the short term, increased legislation may inhibit levels of sharing on the social Web — users will use it more for reading and less for sharing. The use of some social networks such as Twitter and Pinterest will be more for curation (sharing links to existing content) than for creation of unique content. This provides information about what they "like" and what they are interested in or intrigued by rather than specific personal information.
- Multiple languages spoken across the region. Users will continue to conduct private activities in their local languages, despite the broader acceptance of U.S. English as an international standard for business. Vendors need to reflect the need to support both outbound and inbound messages in social Web workflows and tools.
- Proving return on investment (ROI) for social activities. This is not easy. For example, if people are not convinced of the benefits of being "liked" on Facebook, they need further persuading that social Web activities will generate ROI. In summary, gains can be classified into sales revenues, consumer insights, brand protection, lead generation, and call centre operations, while costs can be classified into people and technology.

However, there are changes in attitudes. Organisations are becoming much more aware of the benefits of the social Web; and more and more see it as a valuable marketing tool and a valuable source of feedback. The results for the risks of the social Web showed more variable patterns. From a qualitative perspective, organisations are involved in a broad range of social Web-related initiatives. The bulk of these initiatives are conducted at the national level, but not all — for example, the Italian bank UniCredit's "We Will Fix It" campaign works across all countries, where UniCredit operates.

Impact on ICT Skills Demand

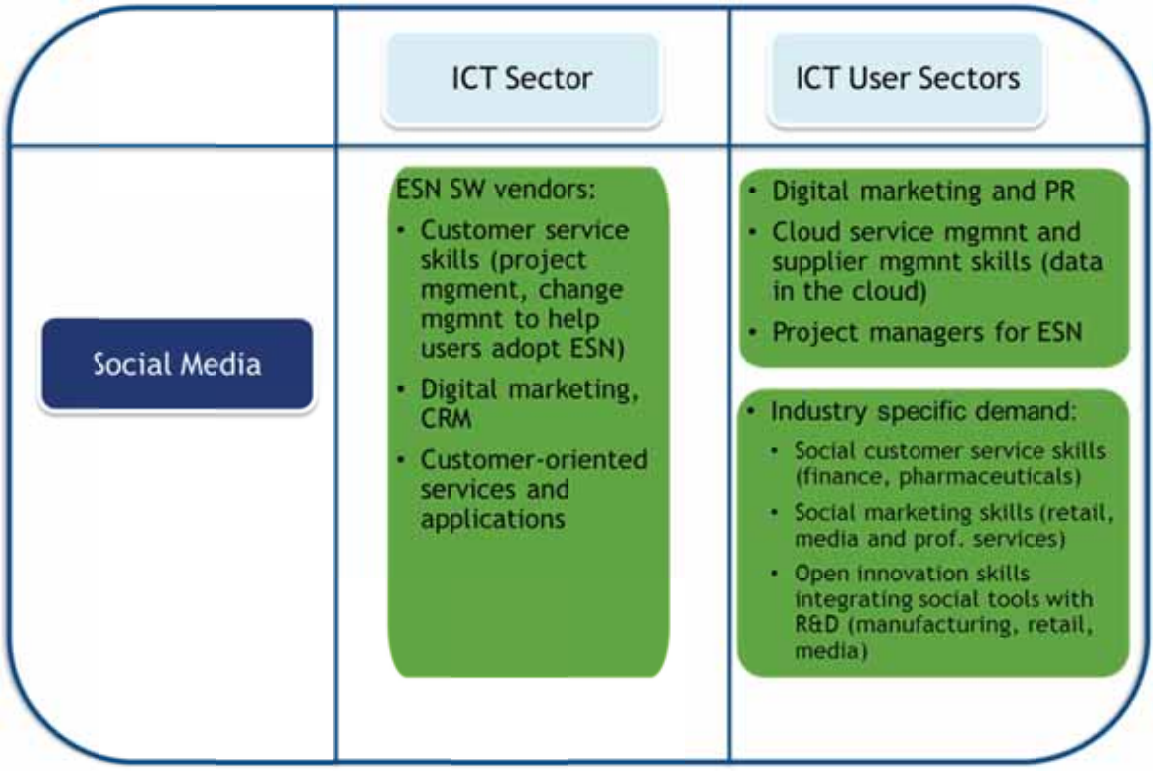
The key area where social is affecting skills demand is in digital marketing and PR, as organisations evaluate how to extend marketing campaigns from traditional media across to social media. Social data by its nature is in the cloud, so experience of cloud service management, orchestration, and supplier relations will be relevant to organisations.

Becoming "social" also requires that organisations put together all the elements of a correct social media strategy, that they understand how social media can be effectively leveraged and in which business processes and to enhance which workflows. Furthermore, to make the most of investments, organisations will need to define governance policies to ensure that there is no backlash from social media usage. Many Enterprise Social Network (ESN) software vendors employ service staff, known as customer success managers or adoption consultants among other terms; their purpose is to ensure the customer is achieving adoption of its ESN, and gaining business value from it as expected.

A key danger of ESNs is that they can fall into disuse. Member of such service staff are typically skilled project managers and consultants with understanding and experience of the internal collaboration and ESN space.

Figure 5 summarises the changing demand for high-level ICT skills.

Figure 5: ICT Skills for Social Media Technologies



Source: IDC for GUIDE, 2013

IT Security

The pervasiveness and increasing dependency of organisations on ICT including for communication outside a "protected" internal-organisation-only environment, make organisations much more vulnerable to deliberate or accidental security breaches. Consequently, ICT security technologies and skills are in increasing demand. It is estimated that spending on IT security products in 2013 will be around €25 billion globally, and growing at more than 7% a year over the next three years.

There are three main areas of ICT security:

- Identity and access management (IAM), which is a comprehensive set of solutions used to identify users in a system and control their access to resources within that system by associating user rights and restrictions with the established identity.
- Secure content and threat management (SCTM) products defend against viruses, spyware, spam, hackers, intrusions, and the unauthorised use or disclosure of confidential information.
- Security and vulnerability management is a comprehensive set of solutions that focus on allowing organisations to determine, interpret, and improve their risk posture.

Trends, such as mobility, consumerisation, cloud, and social networking, only increase organisations' interactions with customers, partners, suppliers, and other parties and hence their vulnerabilities in particular to malicious cyber attacks. As a result, the demand for security technologies and skills is evolving from a reactive antimalware focus into a need for complex context aware protection.

The move toward cloud solutions is strengthening the need to invest in security, as sensitive information may no longer reside on dedicated hardware and the mode of access changes.

With the onset of a much more mobile workforce – and BYOD as discussed – the security concerns of organisations increase. The management of mobile devices presents tremendous challenges as mobility deployments come with a completely new set of potential security and privacy issues.

Mobile device management (MDM) and identity and access management offerings are in greater need as the ability to provision and de-provision applications and data on personal devices in an efficient and compliant manner is increasingly relevant. Access control technologies for mobile may also include data loss prevention (DLP), and security information and event management; even biometric solutions are becoming available to address these issues.

Furthermore, the proliferation of downloadable applications for mobile devices opens the door for unique, new threats to the network and malware on mobile devices is expected to provide increasing headaches. The growing use of social media, although still relatively nascent also opens up security questions around privacy, regulations, and the security of data and information that reside in social media platforms. Indeed, social media tools for business purposes are intrinsically dangerous if used without precautions. Network attacks can originate as social messages — viruses, worms, phishing schemes, and other forms of malware can be concealed in text messages that look like social media update messages (e.g. tweets), and advertisements on social sites.

This means that companies will have to define and invest in policies, procedures, and solutions in order to regulate and manage information sharing on social media tools. Many organisations are uncertain as to how to best formulate the policies and procedures, and indeed how to implement

these. In addition, monitoring technologies (e.g. scanning for malware and other suspicious activities) as well as content classification, content filtering, and data loss prevention tools might be appropriate to grant both network and endpoint protection. In addition, identity and access management solutions are vital to protect against authentication hacking.

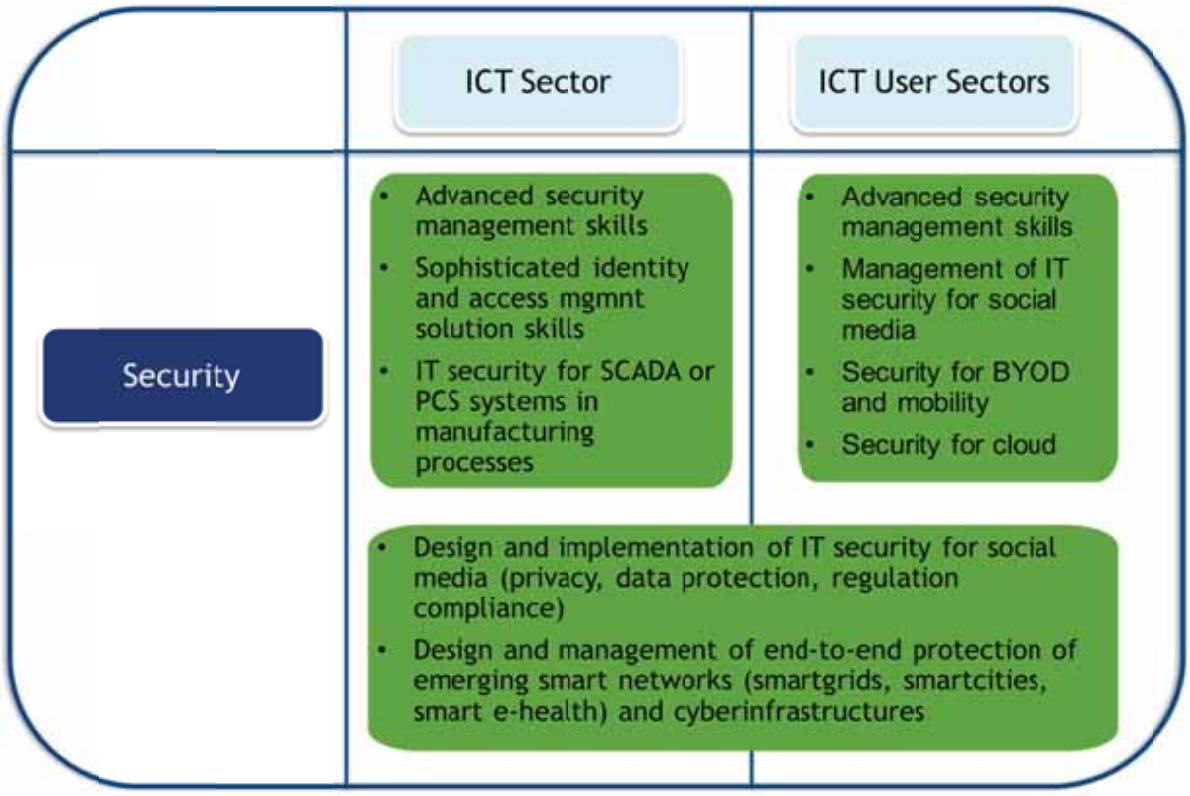
Impact on ICT Skills Demand

In short, the major trends in the ICT markets all somehow increase security risks for organisations and hence drive the need for ICT security-related skills, including designing, implementing and operating security solutions, as well as the knowledge of how to design, formulate and implement security policies and procedures. The majority of the security skills that organisations need are closely related to specific security software technologies.

Many vendors are developing integrated and bundled security solutions, which reduce the skilled resource needs. However, this reduction is more than countered by the overall increase in demand for security knowledge and expertise driven by the above-mentioned trends. This is unlikely to change in the near future. In addition, the relentless development of malicious and innovative cyber-attacks means that there is also a constant need for updating of the skills and knowledge of security professionals to deal with this.

Figure 6 summarises the changing demand for ICT skills.

Figure 6: ICT Skills for IT Security



Source: IDC for GUIDE, 2013

Many of the major global security companies are already present in Ireland. With security technology also a research prioritisation area (including information security, biometrics, and cryptography), there is potential for Ireland to establish itself as a test bed for trial and validation of new technologies.

The Internet of Things

The digital market will include not only mobility, cloud, Big Data, and social but also the 100+ billion sensors and tags and 11.5 billion communicating "things" on the network. These will include embedded systems, connected entertainment devices, appliances, and industrial automotive devices, just to name a few.

This "Internet of Things" (IoT) enables objects sharing information with other objects/members in the network, recognising events and changes so to react autonomously in an appropriate manner. IoT therefore refers to a network that connects any object with the Internet according to agreed protocols via radio frequency identification (RFID), infrared sensors, GPS, laser scanners and other information sensor equipment, for information exchange and communication, with a view toward achieving intelligent identification, positioning, tracking, monitoring, and management.

By the end of 2013, the number of installed intelligent communicating devices on the network will outnumber "traditional computing" devices by almost 2 to 1 globally. This will change the way people think about interacting with each other and with devices on the network.

Within the next two years, it is expected that there will be over 3.5 billion connected industrial products, including cars, planes, and boats, appliances/toys, and entertainment devices connected and communicating over the Internet. These devices will have the ability to share information about their "state" in terms of the need for service, availability for use, time of arrival, and so forth. Microblogging and location/mapping will emerge as ways for consumers to manage their relationship with the devices and objects they deem most relevant to the tasks that they need to undertake on a daily basis. Currently, IoT solutions are mostly deployed to address issues around supply chain and product/asset tracking and location in such industries as utilities, oil and gas, manufacturing, retail, healthcare, and logistics. Going forward, IoT solutions have the potential to create smart environments spanning across different industries (smart cities, smart energy, smart transport, smart buildings, smart health, smart manufacturing, smart retail, etc).

Impact on ICT Skills Demand

Enabling technologies, such as nanoelectronics, communications, sensors, smart phones, mobility, M2M, embedded systems, cloud computing and software will be essential to support IoT product innovation. Technical complexity will create a massive need for new skills. With many solutions still in infancy, demand for R&D skills is expected to be huge. IERC, the European Research Centre on “Internet of Things”, has identified some key areas of focus. These areas require new R&D and ICT management skills and include:

- Architecture, covering issues around object identification, virtualization and decentralisation;
- Security, along the entire information life cycle;

- Software and middleware, supporting data flows from sensing devices and including complexity management;
- Interfaces, with a focus on multi-model interface approach;
- Smart sensors, with a focus on integrating sensing and reasoning capabilities into networked devices as well as other enabling devices;
- Testing, in relation to initial large-scale projects;
- Standardisation, ensuring interoperability across applications;
- Business models, as IoT enables new products, markets and new ways of doing business;
- IoT governance, with particular reference to the governance of "Things" and with the final aim to guarantee trust, identity and liability management.

The “Internet of Things” has the potential to transform every sector of the European economy. In the Government area, IoT will enable the development of smart cities. IDC defines a smart city as a finite unit of a local entity, which declares and makes a conscious effort to have a holistic approach to employ information and communication technologies, for real-time analysis, to transform its essential modus operandi with the ultimate goal of improving the quality of life of the population living in the city, ensuring sustainable economic development. Most smart city programs have started with smart grids, smart buildings and intelligent transportation. In the future, initiatives can entail smart parking (for example already implemented in Los Angeles), structural monitoring of cities' infrastructure and monuments, as well as waste management.

In healthcare, IoT will enhance clinical solutions and consumer health monitoring, the latter bringing significant benefits to elderly care.

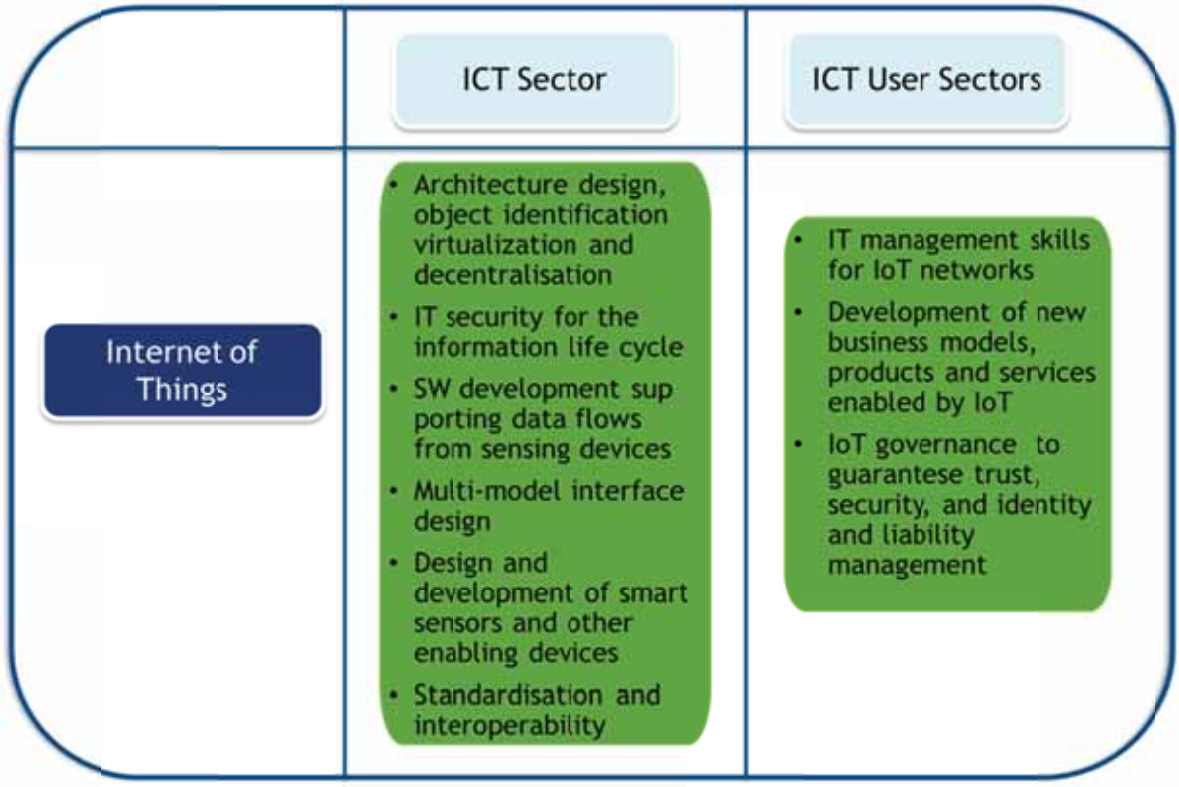
In utilities, smart meter projects are underway (or already completed in such countries as Italy and Sweden). Smart grid investments are also strengthening, fuelling the growth of smart buildings.

In retail, projects around product tracking and traceability are progressing. New initiatives around near-field communication (NFC) payments will emerge. NFC has made great strides in countries, such as Korea, Japan, and Australia as a way to streamline consumer applications like coupon redemption, pay TV, and travel.

In logistics, demand will focus on tracking and location services. IoT will become an integral part of vehicles' control system, and of traffic management and control.

In manufacturing, IoT will enhance industrial control, thanks to M2M applications, or indoor location services. It will also enable vehicle auto-diagnosis or other intelligent products. Manufacturers will be challenged to enhance their traditional products with innovative IoT components. This will make IoT more pervasive in everybody's life. Figure 7 summarises the changing demand for ICT skills.

Figure 7: ICT Skills for the Internet of Things



Source: IDC for GUIDE, 2013

Ireland is well placed to develop a strong position in many of the areas within IoT. Firstly, there is leading expertise in developing the enabling technologies (see Micro- and Nanoelectronics as Key Enabling Technologies section below). For example, in health, nine of the top ten pharmaceutical companies in the world have a base in Ireland, as do eight of the top ten medtech companies. There are plans to establish a National Health Innovation Hub to drive collaboration between the health system and the enterprise sector leading to the development and commercialisation of new healthcare technologies, products and services, to establish Ireland as a leading location for Irish and international start-up and growing medtech and healthcare companies[13].

Micro-and Nanoelectronics as Key Enabling Technologies

Micro- and nanoelectronics including semiconductors, are key enablers of the rapid change in the ICT sector and hence in driving the change to the knowledge economy.

Over the past 40+ years, Moore's Law has described the pace of innovation. In accordance with Moore's Law, every eighteen months the speed of computer processors doubles. Integrated circuit (IC) technology has evolved so quickly that the processors in smartphones are now more powerful than processors in desktop computers were just a few years ago. However, micro- and nanoelectronics enable more than PCs and mobile devices. The technologies are also core for

[13] Action Plan for Jobs 2013.

development of e.g. green energy wind turbines, energy-aware data centres, medical devices, and a myriad of other products and devices across the IT, telecommunications, and indeed other industries. Consequently, microelectronics is core to many of the trends already mentioned above:

- Cloud computing, through application-optimized semiconductor technologies to optimize performance, integration and power efficiency;
- Mobility - not least through the inclusion of IC technology in mobile devices;
- The Internet of Things via enabling devices for e.g. smart health, smart grids and smart cities.

On a global level, the microelectronics market was worth €230 billion in 2012. Despite the weak economic environment over the past five years, the market has grown by 5% per year since 2000 and is forecasted to grow at least at this level out to 2020.[14] This represents a massive opportunity and one in which Ireland is well placed to take a strong share. In particular, integrated circuit design and product development represents around €200 million a year in spending in Ireland. Integrated circuits are the key technology components in electronic systems today and the point at which most innovation takes place. As the underlying semiconductor technology evolves and achieves increased performance, new and exciting applications for the integrated circuit come along, so innovation through new products is an ongoing cycle that must be supported on an ongoing basis.

To cope with the demand for microelectronic products, much innovation has moved into the "More Moore" and the “More than Moore” realm. "More Moore" aims at higher performance, lower costs and less energy consumption through building more capability on a given space of silicon, rather than increasing the clock speed of the computer. “More than Moore” is fundamentally about integrating more functionality onto the same piece of silicon. This is essentially, where the “Digital World” meets the “Analog World”.Today all this “mixed signal” functionality can be integrated onto a single chip. Ireland also has a strong presence in mixed signal IC design, so this also represents a strong opportunity going forward. Microelectronics is also a key strategic area for growth and jobs within the European Union. Europe has about 50% of the global production of electronics for the automotive sector, around 40% of the global production in energy applications and is also strong in design of electronics for the mobile telecommunications sector, for health implants and for sensing technologies.[15] Consequently, over the coming years, there will be a strong emphasis on driving coordinated investments in R&D in the sector with a roadmap established by the end of 2013 on how to reinforce Europe's clusters of excellence in manufacturing and design of which Ireland is considered such a cluster.

Impact on ICT Skills Demand

The rapid developments in micro- and nanoelectronics increase the demand for a range of engineers with strong core engineering skills. At the same time, software development skills, which ensure that applications and solutions can take full advantage of the new core enabling technologies will be needed. These developments drive demand for more of the following ICT skills:

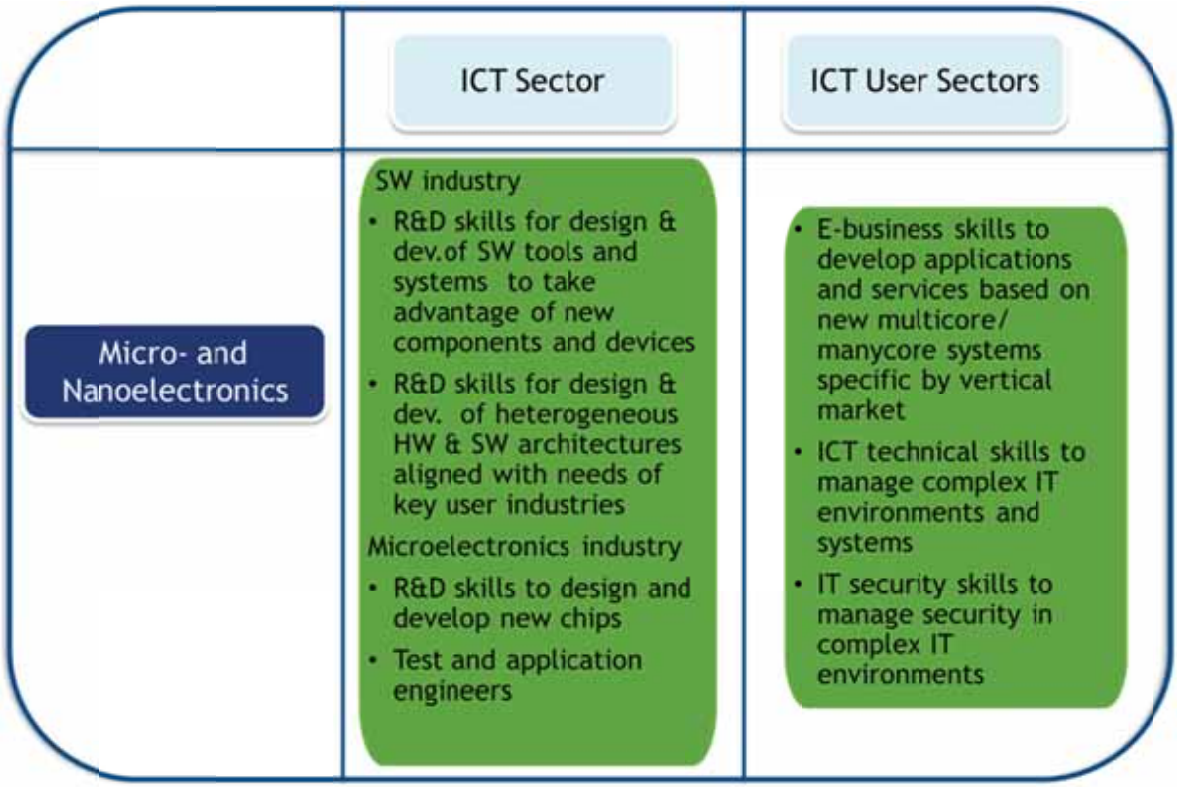
- Electronics engineers with strong core engineering skills to work as chip designers, test engineers, and application engineers;

[14] World Semiconductor Trade Statistics (WSTS), 2012.
[15] A European Strategy for Micro- and Nanoelectronic Components and Systems, COM (2013) 298 Final.

- R&D skills for development of heterogeneous hardware and software architectures, harnessing existing competencies in both hardware and software to develop architectures that are aligned with requirements in key industries such as automotive, healthcare, and energy;
- R&D skills for developing software that takes full advantage of new enabling technologies and components.

Figure 8 summarises the changing demand for ICT skills.

Figure 8: ICT Skills for Micro Electronics and Parallel Systems



Source: IDC for GUIDE, 2013

Ireland has long-standing and strong expertise in microelectronics dating back some 35 years. The presence of the major multinationals and numerous indigenous companies combined with strong R&D facilities means that there is a good basis for ensuring that new technology capabilities and advanced skillsets are developed on a continual basis and aligned with industry needs. Strong capabilities in microelectronics (including semiconductors) enable development and innovation in many of the other technology areas previously discussed.

Global Sourcing and International Competition for ICT Work and Skills

Over the past two decades, technological developments and improvement in the stability of telecommunications and the associated costs have made it possible to move more activities outside the customer's domestic location to a country where it is possible to gain access to skills and

resources cheaper than in the customer's country. This has increased the competition for ICT work, in the sense that specific activities can more easily be undertaken in other countries or regions either by divisions of companies or by being outsourced or out-tasked to external service providers, specialising in R&D, software development, ICT services or business processes underpinned by ICT. The outsourcing of activities to locations outside the customer's country of residence is often termed offshoring (when in geographically distant locations), nearshoring (when in countries closer by) or increasingly used as an umbrella term: global sourcing.

IDC estimates that the worldwide offshore IT services market was €29.5 billion in 2011 and will increase to nearly €60 billion in 2016, with a five-year CAGR of 15.2%. The bulk of these services in 2011 — nearly 68% — were captured in the US, while the EU contributed to less than 28%. This geographical split will not change dramatically in the short term: by 2016, the US will still account for the largest share of spending and the EU will remain the second largest geography.

While India is the leading country for global sourcing due to the large number of skilled resources in the ICT sector in the country and the continuous supply of ICT graduates, in the past decades other countries have also entered into the competition for ICT work, including China, Russia, Philippines, and Brazil. However, organisations that consider placing ICT work in another country do not make these decisions without careful considerations on issues such as data location, cultural affinity of the people undertaking the work, languages, technical skills, economic and political stability - and of course cost. These considerations have meant that other countries have also emerged as potential locations, including Ireland, Poland, Czech Republic, and Spain to mention a few.

For ICT user industries, one of the premises of getting a specialist vendor to take over an IT activity, whether this is running the main IT environment, developing a specialist application, or supporting and maintaining a core enterprise application, is to take advantage of the economy of scale and therefore lower cost that the vendor can bring. However, not everything can be off-shored (or indeed outsourced). There are specific tasks where customers have a strong preference for working with skilled people that understand fully the business culture, the language and the environment.

Looking at the ICT industry in itself, there is a major push to move both R&D, software development and service delivery to the most optimal location, when considering factors such as cost, availability and quality of skills, financial environment, economic stability, infrastructure, and overall security (physical and cyber). A major driver for this is to protect margins and industrialise service delivery as much as possible but also to gain access to highly educated ICT skills. Vendors are also establishing centres of expertise, particularly around specific industry sectors, close to the customers. European customers for example still prefer to see references that are close to their own environments, and the ICT industry is responding to this.

The global sourcing trend is relevant for most of the considerations in Ireland around demand and supply of high-level ICT skills since the ICT sector and the export of ICT technologies and services are crucial to the country's economy. Consequently, how Ireland stacks up in a SWOT on many different factors, including the availability of high-level ICT skills, against other countries vying for the business of the global ICT sector is of utmost importance.

Chapter 2: Views from the Stakeholders

2.1 Introduction

A central part of the research process was to ensure that in-depth views and input from key stakeholders in Ireland were collected, including MNCs, the indigenous ICT companies, end-user organisations that employ high-level ICT skills, government bodies, academia, trade associations or other parties with deep interest in the issue of ICT skills.

To this end, two different interview processes were undertaken:

- Interviews with 38 enterprises that employ ICT personnel in Ireland, to understand the drivers and barriers they see for the employment demand for high-level ICT skills. The research also covered topics, such as expectations of future demand, challenges in finding, attracting and retaining high-level ICT skills and actions that could be taken to alleviate or improve skills quality and availability, and improve Ireland's ICT skills competitiveness.
- Interviews with 22 key informants, who represent a broad selection of trade organisations, government bodies, academia and the broad ICT sector on similar topics to the enterprise interviews.

2.2 Enterprise Interviews - Results and Analysis

The 38 enterprises interviewed represent around 13.3% of the total high-level ICT employment in Ireland across a range of sectors (MNCs, the indigenous industry and end-user organisations in the commercial and public sector). The following section provides the key results from these interviews.

Table 1: Numbers of ICT Professionals in the Enterprises Interviewed

Total employees within the 38 enterprises surveyed	**30,830**
Number of Computing Professionals	7,400
Number of Electronic & Electrical Engineering Professionals	1,750
Total ICT Professionals	9,150

Source: IDC, 2013

The enterprises represent a broad spectrum of ICT employers, drawn from the following four groups:

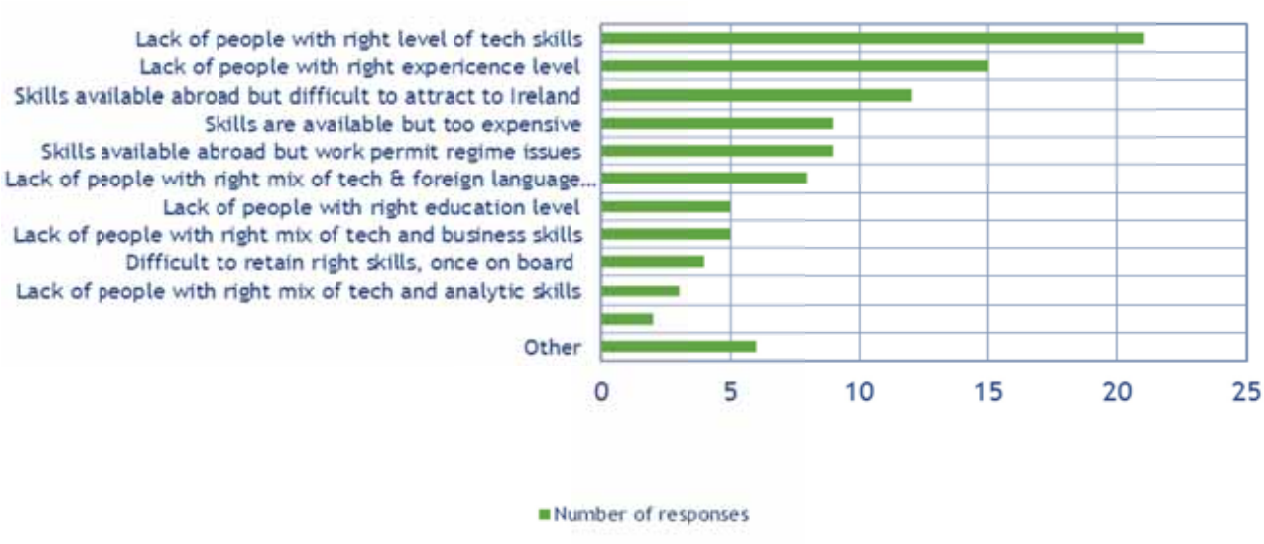
- Irish operations of global technology companies, primarily exporting from Ireland;
- Indigenous exporting technology companies;
- Indigenous and International firms serving predominantly the local Irish ICT market;
- ICT user organisations, i.e. industry, financial services institutions, health organisations, public bodies.

Although it is widely recognised that there is strong demand for ICT skills and that it can sometimes take a while to fill certain positions, there are a limited number of vacancies that could be classified as hard to fill. The research indicates that overall vacancies are in the region of 6.5% with

more vacancies in computing (7%) than in electronic and electrical engineering (3.3%). Within these vacancies, the survey showed an unclear picture of hard-to-fill vacancies both in terms of the proportion of vacancies (many stated that none were hard to fill from domestic and inward migration supply) and of the types of skills that enterprises find difficult to fill. The skills vary from software programmers and developers with specific programming languages or a mix of these (such as Android, .Net, and Java), through experienced project managers to analytics and silicon design skills[16]. However, more than two thirds of enterprises interviewed stated that the difficulty in finding some skills has not yet stopped them from filling positions altogether.

In relation to the main challenges that enterprises are facing in terms of satisfying their ICT skills demand, the results presented in Figure 9 paint a fairly clear picture. (the number of responses indicated in this and following tables are the number of times companies responded in relation to a particular issue).

Figure 9: Challenges in Acquiring ICT Skills



Source: IDC, 2013

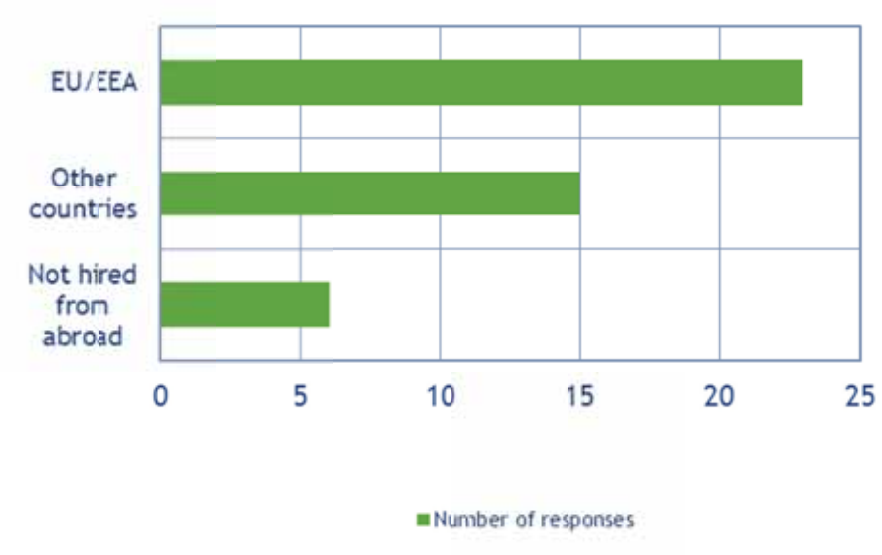
Technical skills and the right experience level are the two key stumbling blocks that enterprises are experiencing when they look for new ICT employees. More than half of respondents said that the right level of technical skills was the issue they most came across while 40% were concerned about the level of experience. About a third of respondents found that the skills that they needed were available abroad but that they found it difficult to attract them to Ireland. About a quarter of respondents said that even if they had sourced the ICT people they needed abroad they found that the work permit regime could be challenging for bringing them in.

This raises the question of the degree to which enterprises hire ICT skills abroad and from where. As Figure 10 illustrates, the majority of enterprises have hired from abroad at some point for a wide range of positions but predominantly software engineers, people with analytics skills and ICT people hired because of the combination of language skills. For around half of enterprises the source was

[16] The National Skills Bulletin 2013 highlights several difficult to source ICT skills- as outlined in Appendix 6.

other European Union or European Economic Area nationals, with many mentioning Spain, Portugal and Eastern Europe as key countries. However, enterprises are also hiring from other countries, such as US, India, China and South Africa but many state that if they do hire nationals from outside the EU/EEA region, they would always try to hire those that are already resident in Ireland in order to avoid additional work permit and visa paperwork.

Figure 10: Hiring of ICT Talent from Abroad

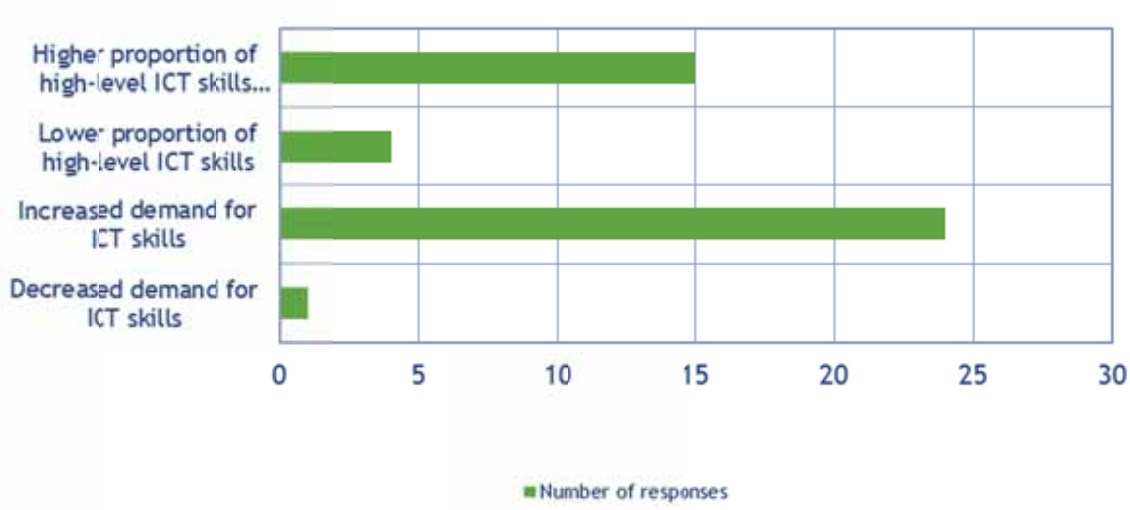


Source: IDC, 2013

Future Skills Demand

So what of the future? Clearly, the expectations are for a positive trend with 63% of enterprises stating that they expect to see increased demand for ICT skills as shown in Figure 11 and only one respondent expecting demand to decrease, due to efficiency improvements and outsourcing of some functions. In addition, 40% of respondents are also expecting that high-level ICT skills will grow as a proportion not only of the total number of ICT staff but as a proportion of the total employment in the organisation overall. This is an indication of the pervasiveness of ICT in the enterprise, which brings with it the need for ICT skills to reside in divisions and functions outside the traditional IT department or R&D function. Around a third of enterprises stated that ICT skills would increasingly be integrated across the organisation, while only 10% said that they would remain centralised.

Figure 11: Expected Changes in ICT Skills Demand



Source: IDC, 2013

Figure 12 provides a picture of the drivers and barriers that enterprises believe will lead to this picture of ICT skills demand in the coming years.

Figure 12: Drivers and Barriers for Skills Demand in 2-5 Years

Source: IDC, 2013

Two issues dominate the picture: internal changes that affect the demand for ICT skills and technology shifts happening in the market. Internal changes covers a host of different issues but most are seen as drivers for increased skills demand, rather than barriers, such as projected company growth based on entering new markets or an increase in the activities that are based in Ireland. However, a number are also sounding a warning that some activities may relocate from Ireland due to relatively lower cost resources in other parts of the world.

Technology changes in the market are overwhelmingly seen as a driver for new ICT skills demand in the next five years. The types of technology shifts clearly include "the big four": mobility, cloud, social business, and big data - in particular the latter. But there are other key technology developments that enterprises believe will drive new ICT skills demand, such as the technical development of industrial equipment relating to the “Internet of Things”, automation and machine learning. The interviews indicate little, if any, variation between the views of multi-national and Irish-owned companies on technology drivers.

The expectation of the enterprises surveyed is that the various drivers will lead to almost a doubling of their combined number of ICT professional employees by 2018 or the equivalent of an average annual growth rate of 11.8%.

This is quite a strong growth rate considering that growth in ICT skills demand in 2013 over 2012 is estimated at around 4.5% (see the Skills Demand Scenarios section in chapter 4) - and organisations are already finding it difficult to find the right skills, as we have seen. Moreover, they certainly don't expect it to be easy in the future either: 58% of respondents believe that it will remain difficult in the future to find the right skills, while one in four believe that it will be easy enough.

Enterprises plan to use four key approaches to acquiring the new ICT skills they will need in the future, as shown in Figure 13:

- Hire new high-level ICT graduates (90% of respondents);
- Hire experienced people from other organisations (80% of respondents);
- Hire from abroad (70% of respondents);
- Retrain and up-skill existing staff (40% of respondents).

Three of these approaches would serve to add to the stock of high-level ICT skills in Ireland, while hiring from other organisations would only churn the vacancies. However, although it is positive that the majority of enterprises will take in new graduates to fill the ICT skills demand, some are more reluctant than others about this approach, as these comments by enterprises illustrate:

"We do take graduates but.... when we have hired people straight from college it takes a year to get them up to scratch and then they disappear in the second year." (Industrial Equipment Manufacturer)

"Our best success has been with hiring graduates and training them up. Of the 100 people to come in up to 2018, the majority of those coming in on the roll-out side will be ICT graduates." (Indigenous ICT Company)

Figure 13: Approach to Acquiring ICT Skills

Source: IDC, 2013

Measures and Actions to Improve Skills Levels and Availability

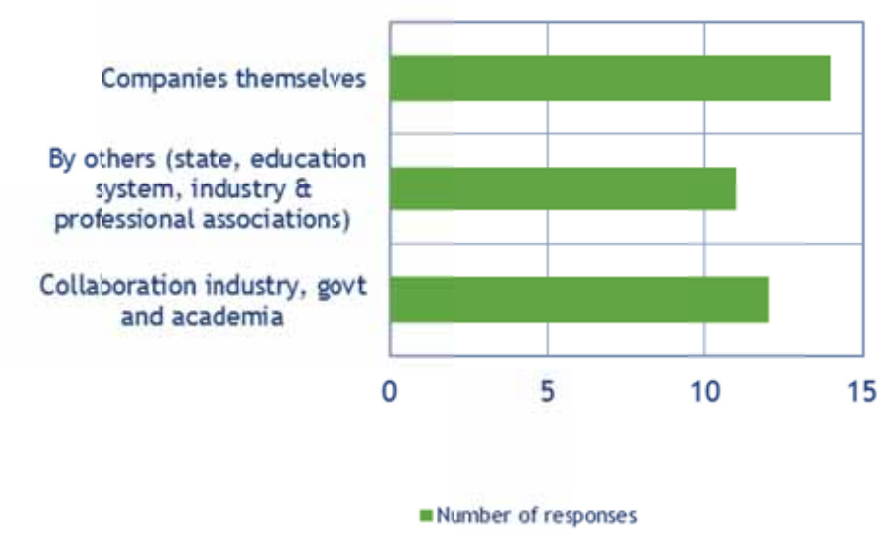
As can be seen from the above table, the results from the interviews with enterprises shows that there is an expectation of increasing demand for high-level ICT skills but also concern that it will not be easy to find, attract and develop the skills needed. But whose responsibility is it?

When this question was put to the enterprises a balanced view was given as shown in Figure 14: the companies themselves carry a lot of the responsibility but so do the other stakeholders in the market: government, industry bodies, and the education system. The following comments from some of the enterprises illustrate clearly how there needs to be joint efforts to succeed in overcoming the ICT skills mismatch:

"It is the company's problem rather than the state's problem. What we need to do is get involved more with Universities (and have done) on internships, mentoring students and just plugging into the top Universities so we get early visibility of the top candidates." (Indigenous IT company)

"As a responsible company deeply invested in the communities where we operate, we have an obligation to work with our industry peers, academia and with students to help ensure that there is a strong pipeline of qualified individuals who can have a rewarding career in technology." (multinational IT company)

Figure 14: Improving the Skills Balance - Who's Responsible?



Source: IDC, 2013

Apart from collaboration with other stakeholders, about two thirds of enterprises also stated that they have formal training plans for their high-level ICT employees (the rest provide ad-hoc or on the job training). Almost 60% of enterprises also support staff seeking to undertake their own personal development.

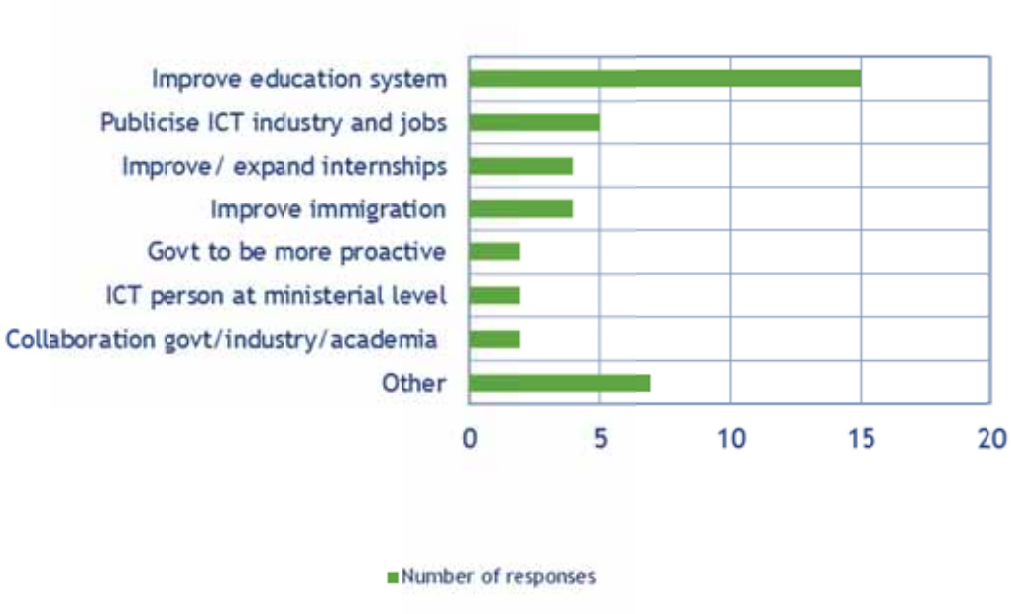
Two-thirds of enterprises expect that their training budgets will increase in the next five years as their number of ICT employees increase. Only 5% expect training budgets to decrease. This is quite a positive finding. In tough economic times, discretionary spending, such as training budgets, often get hit or at least the actual spending postponed until the financial outlook improves.

Training may be one of the facets that keep ICT employees content and therefore less likely to look for new opportunities in other companies. The attrition level for high-level ICT skills does not seem to be a major concern for about 60% of enterprises, while about a quarter sees it as an issue. Attrition rates between companies vary greatly, from only 3% to around 40%; the latter for smaller companies where the loss of only a few employees can make a big difference. Less than a quarter of enterprises said that they have a formal program aimed at lowering the attrition rate. This mixed picture continues with many of those that are concerned about their attrition rate having both formal programs to address this and also formal training programs.

The Enterprise View of Policy Measures and Initiatives

Finally, enterprises were asked to provide their views on the current policies and initiatives in place to address the high-level ICT skills demand in Ireland and any improvements that should be made. There were broad views on what could be done but Figure 15 provides a summary view of the main considerations.

Figure 15: Improvements on Policies and Measures to Address High-Level ICT Skills Demand



Source: IDC, 2013

The education system was the main topic for 40% of respondents but with many different angles as illustrated by the following comments:

"If we want to grow the knowledge economy, we need to overhaul the early years' education to promote the STEM subjects." (Major Public Body)

"IT people tend to have less work experience than in electronics and electrical engineering or indeed other roles. Many Universities find places for electronic and electrical people but IT people tend to be left to their own devices to find internships. So the relevance doesn't tend to be as good as in other disciplines." (Medical Device Manufacturer)

However, enterprises do not tend to think that solving the issue is the responsibility of "others" but rather have a more balanced view of the best way forward. Many enterprises mentioned their involvement with local educational institutions to try to drive internships, revise curricula, raise awareness of ICT as a profession amongst students, etc. However, several also mentioned that they would like to see some changes in the way that the skills agenda is handled amongst public bodies:

"Also there is no recognised body, which looks after people in ICT and it got a bad reputation during the dotcom crash." (Multinational IT Company)

"....much greater co-ordination of government funded bodies to address the skill shortage agenda. A nirvana from this research would be that there would be one body responsible for the next 10 years in developing, growing and attracting in ICT skills for Ireland." (Multinational IT company)

"...Would be good to have an ICT person at Ministerial level. Not a politician, but someone who has the ICT background and the communications skills; and someone with the profile to be significant abroad." (Indigenous IT company)

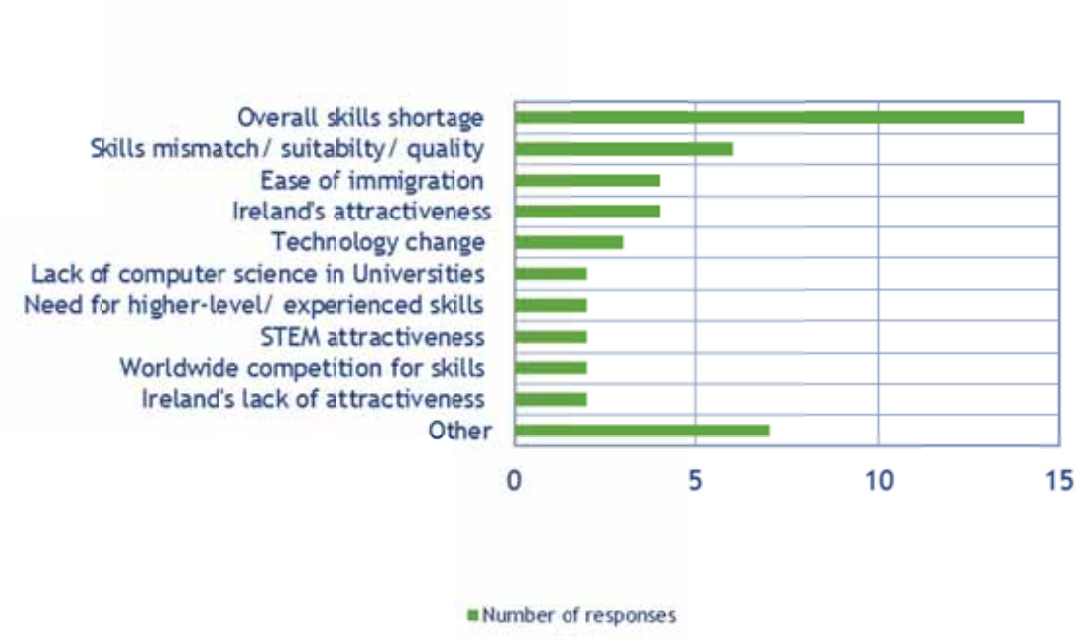
There were several other diverse improvements mentioned (gathered under the "Other" category), such as improving the collaboration between IDA and Enterprise Ireland, improving retraining opportunities, and reducing income tax to increase Ireland's attractiveness.

2.3 Key Informant Interviews - Results and Analysis

The intention of interviewing a broad representation of stakeholders as part of the process was to ensure that opinions reflect as much as possible a holistic view of the high-level ICT skills situation in Ireland. Encouragingly, although the key informants represent a broad spectrum, there is agreement on several issues that affect the market and what can be done to address these. However, the broadness of respondents also means that on some issues there is a great variety of opinions. Key informants largely agreed that the main critical issue is an overall shortage of ICT skills in Ireland (see Figure 16) and this has been an on-going issue throughout the economic crisis. As one stakeholder put it: "Within the ICT sector, we are victims of our own success with lots of firms coming to set up in Ireland and the resulting impact on demand for skills. Nine out of the top 10 IT companies are based in Ireland, [which is] very positive as it results in demand for jobs, even if that leads to shortages." (Recruitment Agency)

However, several other issues were seen as critical in addressing this shortage, not least that the skills that are available - or becoming available - are not necessarily of the type and quality needed and that it is not easy to attract. In terms of the type and quality required. The following comment from one key informant illustrates the issue: "We are victims of our own success - [we] cannot currently deliver a sufficient pipeline of skills to our growing ICT sector for reasons of both quantity and quality. There are lots of developers out there who are not of a standard required by some employers. A lot of these people have done short courses (add-ons) or very specialist ones. Or they don't have the right experience to back up the skills."

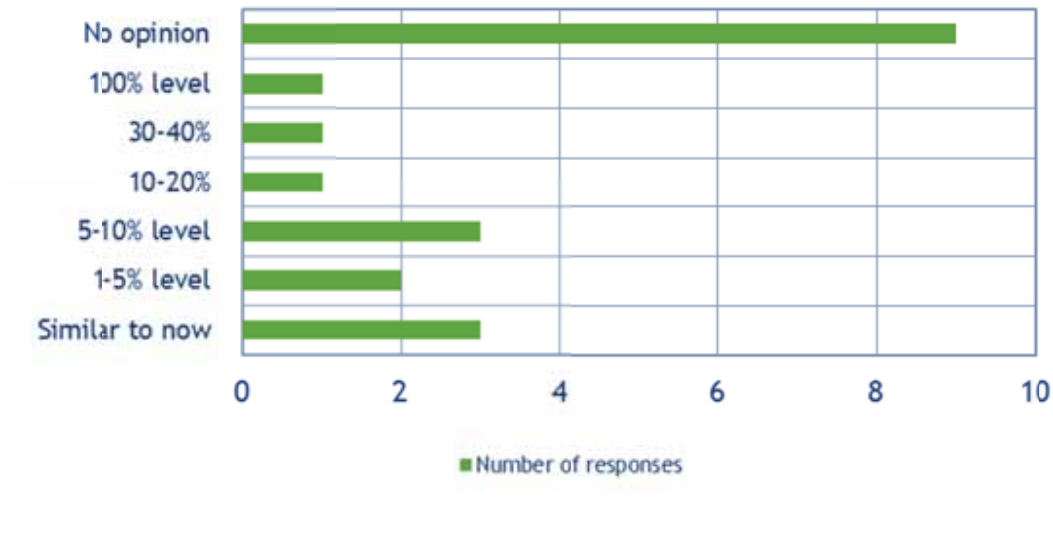
Figure 16: Critical Issues Affecting Demand for High-Level ICT Skills



Source: IDC, 2013

Overall, more than half of the key informants believe that the demand for high-level ICT skills will continue to increase over the next five years. However, there are dispersed views on which skills will be needed with the ones most frequently mentioned being software engineers, foreign languages (in particular French and German was mentioned) and analytics. Thereafter, there was a broad list of skills from gaming to technical support and from social media, mobility and web design, to business skills, softer skills and process improvement skills. The "Other" responses in the Figure cover a diverse collection from the impact of the economic environment to the benefit of certification and the need for joined-up thinking around skills issues. Only around half of the key informants would venture their opinions on the level of increase in skills demand, however. But for those that did, there are also mixed views on the scale of demand increase as shown in Figure 17.

Figure 17: Expected Increase in Demand for High-level ICT Skills in Next 2-5 Years



Source: IDC, 2013

Over half of the key informants thought that demand would be greatest for ICT professionals with 2 - 8 years' experience. Several considered there would always be a demand for quality ICT graduates in order to constantly 'feed' the talent pipeline within companies. The value of structured work - experience opportunities in companies for ICT undergraduates were highlighted, so that they would be more 'up to speed' upon taking up employment. Companies could also help new graduates gain experience by creating a career path for them, by mentoring and through assignment work. While the demand for experienced ICT professionals of 8 years + was thought to be smaller in scale, they were considered critical given their recruitment would enable the building of a team comprising both new graduates and experienced personnel.

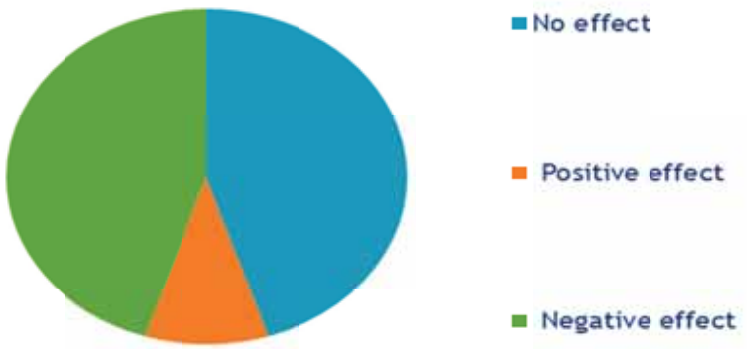
When asked what could be the possible effect of lack of high-level ICT skills or indeed the mismatch of skills and requirements, several critical issues were mentioned, such as loss of innovation in the ICT sector in Ireland, which could lead to a loss of competitiveness and indeed economic drag for Ireland overall.

The key question of course is what to do about it? The responses of key informants cover a range of different approaches and initiatives, related to what companies; the government; and academia can do to help alleviate the situation. While some of these can be seen as short to medium-term solutions (e.g. re-skilling of current employees for example by the employers, improving collaboration between the "triumvirate" of industry, Government, and academia and easing the process for immigration), some have a longer time horizon, such as increasing the attractiveness of STEM subjects already at primary and secondary levels. In the shorter term, the outcome-based focus of some labour market activation with a strong linkage between success (job placement for the person going through the training) and payment of the trainer was mentioned as a positive approach.

Future Trends Affecting ICT Skills Demand

A key component of ensuring that Ireland can meet future skills demand is not only a question of securing the number of people required but also of anticipating, which skills will be in demand and indeed, which other factors may influence the nature of this demand. To this end, the key informants were asked a series of questions relating to the main economic, business and ICT trends that could affect the Irish ICT skills market. There were split opinions on whether this has any impact at all or whether it has a negative effect as shown in Figure 18. Only a few respondents thought that the effect had actually been positive (e.g. easier to hire people from Southern Europe and companies increasing their use of technology, with increased ICT spending as a result).

Figure 18: Opinions on the Impact of the Economic Situation on High-Level ICT Skills Demand

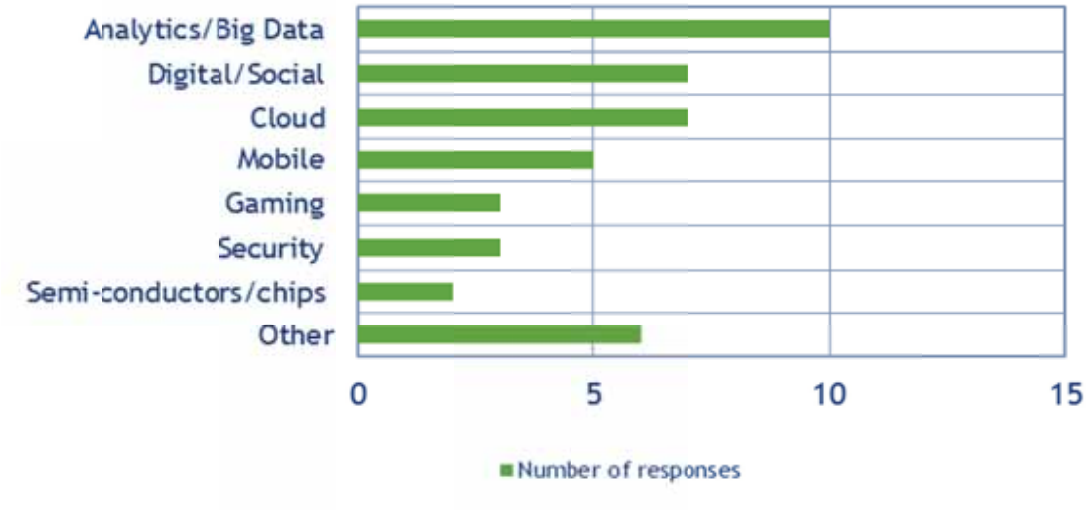


Source: IDC, 2013

However, when asked to list the business and economic trends that will affect ICT demand in the next five years, again responses varied and included concerns that Ireland would not be competitive and attractive compared to other countries mostly due to cost and personal taxation levels.

When it comes to technology and innovation trends that may affect the demand for high-level ICT skills, respondents were more in agreement as shown in Figure 19.

Figure 19: Innovation Trends Affecting High-Level ICT Skills Demand



Source: IDC, 2013

Not unexpectedly, the technologies underpinning the Third Platform (see chapter 1 on global technology and services trends) are seen as the most important in shaping future ICT skills demand in Ireland. Apart from the other technology trends shown above, respondents also mentioned areas such as medical devices, e-learning, design and miniaturisation, and networking technologies, which illustrates the broadness of the ICT skills that are likely to be needed in the future and hence the complexity in making these skills available.

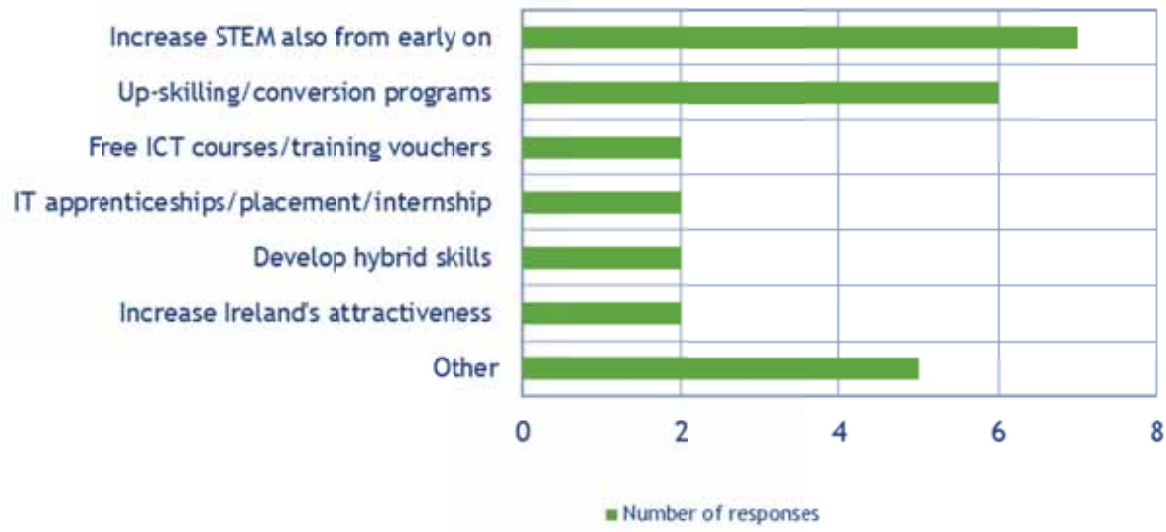
Meeting the Demand for High-Level ICT Skills

On the topic of meeting the demand for high-level ICT skills, two specific measures stand out: one that could likely address short to medium-term requirements and one that has a more long-term perspective, as shown in Figure 20. A third of respondents highlighted the need to increase the focus on STEM subjects in the education system, also from primary and secondary levels.

While this does not answer the immediate demand for ICT skills, it underlines an issue that has permeated throughout this project. As one key informant phrased it - Ireland may need to solve the short term issue but it needs also to plan for the longer term in order to stay competitive and develop into an "ICT powerhouse".

Upskilling and conversion programmes are seen by many as being a good approach to developing the high-level ICT skills needed, but some respondents would like to see the activities from the ICT Action Plan 2012 extended also below NFQ Level 8 education in order to speed up supply.

Figure 20: Opinions on Measures to Meet High-Level ICT Skills Demand



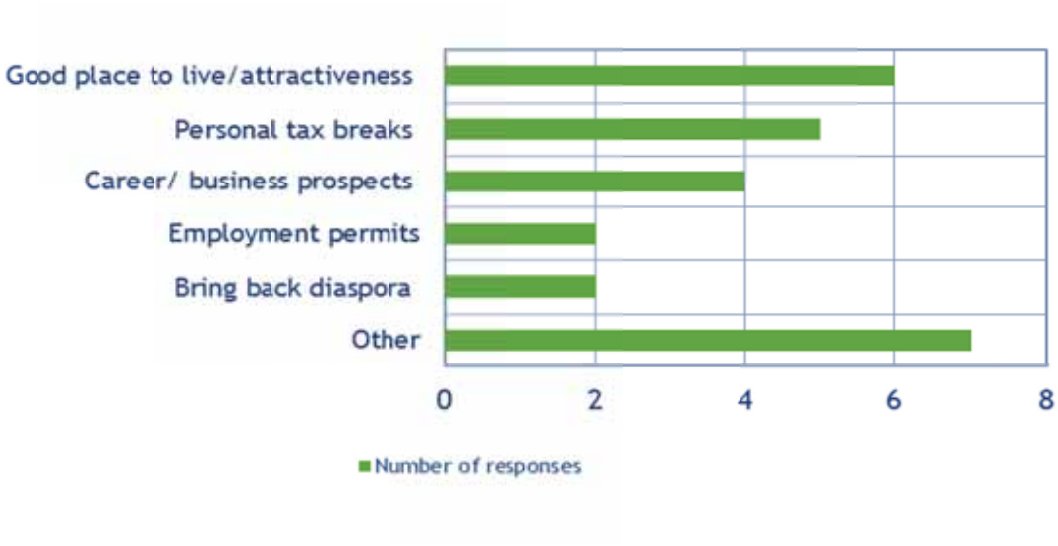
Source: IDC, 2013

In relation to the existing skills base, Key informants believed that it is important that employers step up and take an active role as developers of talent. This is not only a question of providing training but also of providing employees with clear and appropriate career paths (which should also improve retention). Another related point, although much broader in scope, is how to make ICT into a proper profession. However, this is not something to be solved by individual employers but must be dealt with in broader collaboration. In fact, there is a strong feeling that better collaboration and integration of the activities of industry, the government and academia would bring much better synergies and aid the joint purpose of fulfilling demand. In the short- to medium-term, it is clear that the demand for high-level ICT skills in Ireland will need to be filled both by building up the domestic supply and by continuing to attract talent from abroad. Key informants were asked what key components should be explored to attract ICT talent into Ireland. Their responses are presented in Figure 21.

Most of the views of the respondents fell under the broad umbrella of making Ireland an attractive place to live. However, around a third believe that this is already the case but that the attractiveness has to be promoted more clearly against competing countries and regions, such as Singapore, Eastern Europe and the Nordics. Others believe that there are actions that need to be taken to improve the attractiveness first, such as providing personal tax breaks to ICT professionals, creating attractive ex-pat packages, providing affordable housing, and improving the infrastructure (transport and broadband). One of the key informants summed most of this up as follows:

"We have to ensure that the following factors are in place: infrastructure (including destinations in/out of Dublin airport), transportation, cost of living, affordable/available accommodation, an easy place to come and live and work and ease of access." (Multinational business services company)

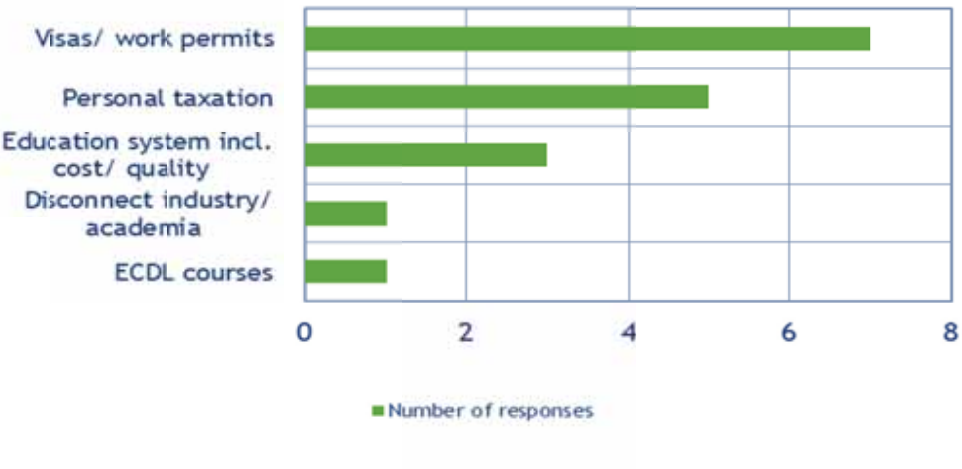
Figure 21: Attracting Talent to the Irish Labour Market



Source: IDC, 2013

Another measure mentioned by some respondents was to bring back the diaspora. Ireland has done this before, so it should be possible again. Apart from improving the general attractiveness mentioned above, this also ties in with other suggestions, such as building Ireland up as a centre of excellence for ICT. Key informants were asked to assess whether there are current policies that have a positive or a negative effect on the demand-supply gap for high-level ICT skills. A small number of policies were mentioned that had a positive effect: the creation of ICT clusters, the low corporation tax, the work of the IDA in attracting FDI, and the general high standard of the education system. Policies that have a negative effect are shown in Figure 22.

Figure 22: Policies and Practices Hampering Balance in the ICT Skills Market



Source: IDC, 2013

Clearly, the two key areas mentioned - visas/work permits and personal taxation - are relevant for attracting and getting ICT talent into Ireland. There are of course several actions proposed to attract the necessary skills from abroad into Ireland as part of the 2013 Action Plan for Jobs, including an additional 700 employment permits, (over and above the 1,200 permits issued in 2012) for the ICT sector in 2013. Also, several improvements were announced in the operation of the Employment Permit system in April 2013. The responses from the key informants underline the importance of these activities.

The key informants were also asked to formulate their vision of what an ideal scenario of ICT innovation and ICT skills balance in Ireland in five years' time would look like, and what it would take to get there. Several respondents would like to see Ireland established as the "Silicon Republic of Europe" or the "Destination of Choice". This would be achieved if Ireland can ensure that there is a "strong indigenous supply", with skills capabilities in "creativity, innovation and design", combined with an attractive lifestyle, tax regime and education system.

This comment from a key informant sums up this picture very well:

"If Ireland is recognised as a location for sourcing key people, quickly, for important projects, if we develop new competitive advantages, such as mature rules relating to data as a resource, along with bolstering our current competitive advantages, the technology sector is poised to grow strongly. On these issues, we have already made great strides."

Apart from the measures mentioned before, some key informants mentioned other initiatives and considerations. First of all, there is a need to promote the industry overall. This should not just be to the third level students but even to parents so that they will direct their children towards ICT careers. This is already a big part of the Steps programme but should be expanded and supported.

However, in order for the education system to support the vision, it is not just a question of updating the curriculum; the teachers and lecturers also need to be kept up to speed with new technology developments.

Finally, as has been mentioned earlier, in order to achieve the best results there needs to be collaboration between industry, government, and academia. There could be a "clearing house" for skills development that could oversee the initiatives. This would enhance integration between third level education and business in areas such as the types of skills graduates need and the research projects launched so that they are better monetised.

Chapter 3: Assessing the Demand for High-Level ICT Skills

3.1 Introduction

Assessing the demand for high-level ICT skills in a country is complex. This becomes even more so in a small open economy with a strong export focus where a large proportion of the skills needed are not just reliant upon demand created in the domestic market. Demand is also strongly dependent on market conditions and demand patterns in the global ICT market, as well as the relative competitive proposition for FDI and availability of skills from other countries and regions across the world.

In order to assess the demand for high-level ICT skills in Ireland, IDC has applied its proprietary skills demand model, which it has developed over the past decade[17]. The model has been used for skills demand projects for the ICT industry and for the European Commission and is at the heart of the current skills demand forecasts used by the EU in the recent e-Skills Vision project.

The standard model:

- Uses, as input, statistical information from reputed sources (typically country statistical offices or Eurostat);
- Takes into account economic developments in the country examined, based on historical and – where available – official forecast[18];
- Takes into account IDC's forecast and predictions for ICT technology and services spending in the country examined. These forecasts are developed by IDC's domain expert analysts;
- Forms part of a holistic view of the ICT technology and workforce markets to ensure that there is no "sub-optimisation"-that the skills demand in any specific sub-sector is not over estimated.

However, for Ireland the following adaptations, amongst others, have been made to capture the complexity of both the broad Irish ICT sector and domestic demand:

- Expand the view to include R&D and other "ICT production" that's outside IDC's traditional view of ICT spending.
- Looking at ICT export as well as local "consumption" to ensure that the impact of global ICT market demand is captured.
- Establish the baseline data utilising existing available data.
- Take into account input and information gathered through the research process from the key informant and enterprise interviews, workshops and relevant stakeholders in general.

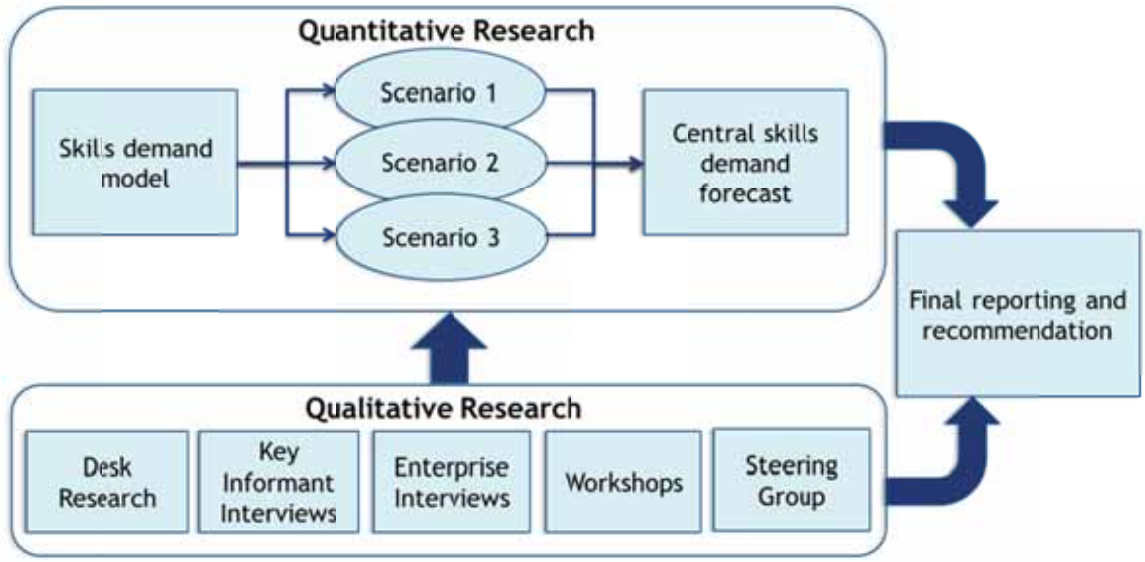
Figure 23 provides an overview of the model in terms of the data inputs for the baseline and how the forecasting process feeds the development of different skills demand scenarios.

[17] IDC Europe, Marianne Kolding, Gabriella Cattaneo, Rosanna Lifonti.

[18] The economic indicators have relatively limited impact on the model for demand forecast. Of stronger influence is IDC's forecast for global and domestic technology spending. IDC experience from tracking technology markets for 40+ years is that there is no direct correlation between ICT spending and GDP/GNP, particularly not when considering market opportunities spanning domestic and global markets as well as business and consumer.

As illustrated in the figure, throughout the project, there has been a continuous loop of adjustments of the key variables as data gathering, key informant feedback etc. is evaluated and used to inform the forecasting and the final scenarios are established.

Figure 23: Schematic View of Scenario Building and ICT Skills Demand Forecast



Source: IDC, 2013

3.2 Key Assumptions

As described earlier, the main objective of the model is to assess the demand over the period 2013 - 2018, for high-level ICT skills (specifically for computing skills and electronic and electrical engineering) across the whole economy. In order to do so and to reflect the holistic market for high-level ICT skills in Ireland, it has been necessary to make some specific assumptions. These are presented in summary format below:

Segmenting the broad ICT sector from other sectors: In order to decide the weighting of the broad ICT sector versus other sectors, the employment statistics from the CSO Census for 2011 (Standard Occupational Code SOC 2010) were used. The following assumptions on the breakdown of ICT professionals employed outside the broadly defined ICT sector were developed with guidance from Forfás:

- 50% of ICT professionals employed in the manufacturing industry are employed in ICT manufacturing and therefore part of the broad ICT sector. The remaining 50% are counted as ICT professionals in Other Sectors;
- It is assumed that 75% of ICT professionals working in the financial services sector can be considered part of the broad ICT sector. The remaining 25% are counted as ICT professionals in Other Sectors;
- In the Professional, Scientific and Technical Activities sector, it is assumed that 75% of ICT professionals working in this sector can be considered part of the broad ICT sector. The remaining 25% are counted as ICT professionals in Other Sectors;

- Of the segment "No industry stated", it is assumed that 75% of ICT professionals working in this sector can be considered part of the broad ICT sector. The remaining 25% are counted as ICT professionals in Other Sectors;
- Of the broad ICT sector, 10% can be assumed to serve the Irish user organisations;
- In 2011, there were 65,350 ICT professionals employed in Ireland. The assumptions above result in a segmentation of 40,502 ICT professionals in the broad ICT sector (62% of total) and 24,848 (38%) in other sectors (their age profile is outlined in Appendix 6);
- Since 10% of the broad ICT sector can be assumed to serve Irish user organisations rather than export market, this means that about 44% of ICT employment in 2011 was for serving Irish domestic demand and 56% for serving the ICT export markets.

Segmenting computing and electronic & electrical engineering. Using the special SOC 2010 tabulation produced by the CSO from Census 2011, the following assumptions are used:

Computing Skills	SOC 2010 Code	Numbers employed
IT and telecommunications directors	Code 1136	625
IT specialist managers	Code 2133	7,830
IT project and programme managers	Code 2134	4,050
IT Business analysts, architects & system designers	Code 2135	3,265
Programmers and software development professionals	Code 2136	13,240
Web design and development professionals	Code 2137	1,930
IT and telecommunication professionals not elsewhere included	Code 2139	5,270
IT engineers	Code 5245	2,980
IT operations technicians	Code 3131	6,520
IT user support technicians	Code 3132	4,300

Electronic and electrical engineering skills	SOC 2010 code	Numbers employed
Electrical and electronic engineers	Code 2123 and 2134	6,070
Design and development engineers	Code 2126	2,020
Electrical and electronic technicians	Code 3112	2,060
Telecommunications engineers	Code 5242	5,190

Note: An age profile of ICT professionals 2011 is given in Appendix 5

Segmenting high-level ICT skills by NFQ Level: This split is based on SOC 2010 data for 2011 with high-level ICT skills being split by NFQ levels.

Estimating potential job openings: The total number of potential job openings arising in a specific year includes both net new jobs that have to be filled due to expansion demand and existing jobs that have to be filled due to replacement demand, including due to retirements, job switching to non-ICT professional occupations, unemployment, move to inactivity emigration or other reasons.

The following assumptions have been made in relation to the calculation of the total number of potential job openings:

- Expansion demand is calculated as the net new number of jobs between two years;
- Replacement demand is calculated using the following assumptions:
- Levels 8+: assume that 4.5% of existing high-level ICT staff would need to be replaced each year. This is in line with 2012 estimates by CEDEFOP and the UK Commission for Employment and Skills.
- Levels 6/7: apply a lower rate (since NFQ levels 8+ would be more portable in a strong global market for such skills - including Europe). A rate of 4% has been used for NFQ Levels 6/7 - for both computing and electronic / electrical engineering.

Contributory reasons for replacements include:

- Retirement
- Job switchers to other non-ICT professional occupations
- Unemployment
- Looking after the family
- Becoming a full time student
- Other inactive reasons
- Emigration

Forecasting the most likely demand growth for the baseline scenario:

- Demand growth in the broad ICT sector is based on two different growth assumptions:
- Recovery in agency-assisted employment to continue but with declining growth rates over the period due to the higher absolute numbers
- Slower recovery in demand for ICT technologies and services delivered to end-user organisations by ICT companies serving the Irish market
- Demand growth in other sectors:
- Slower recovery in demand for ICT skills in Irish companies outside the broad ICT sector

Under the assumptions above, IDC established the baseline demand for ICT skills. The process was guided by official statistics and data from, for example, Forfás, CSO, IDA, Enterprise Ireland as well as relevant input from the interview process. The expected demand growth has been developed under three forecast scenarios, as presented in the following section.

Chapter 4: ICT Skills Demand Scenarios 2013-2018

4.1 Introduction

The demand for ICT skills is the result of complex interactions between economic, technological and market trends affecting overall development of a country's domestic and export markets. The high level of uncertainty resulting from the on-going economic crisis makes it necessary to understand better, how ICT skills demand will evolve in Ireland in the coming years in order to face and manage potential mismatches between demand and supply. It is also crucial to understand and anticipate the possible opportunities and risks that these trends will bring for the broad ICT sector.

Predicting the future is nevertheless quite difficult, especially with a high level of uncertainty. A scenario methodology is a useful approach to explore the different ways in which future events might unfold. The scenario method is one of the most widely used in foresight work: scenarios are not predictions but rather simulations of some possible futures. In fact, a scenario tells a "story" illustrating a possible future; scenarios are usually used to highlight discontinuities from the present situation and to point out the choices/decisions available and their potential consequences.

The scenario method is built on possible futures and is based on the combination of known or possible facts concerning events that might take place in the future with plausible alternative trends, which are defined as the key issues or factors.

The first step for the development of the scenarios in this study was the SWOT analysis of the broad ICT sector (Figure 24) in order to highlight the most relevant strengths and opportunities facing the sector in the near future. The SWOT analysis points out the strengths upon which Ireland can build and the weaknesses it has to solve, and helps to identify the most relevant focal issues that differentiate the ICT skills demand scenarios. The SWOT analysis was based on main public sources and was discussed at the first workshop held with a wide range of stakeholders. The next step was based on the analysis of the possible trajectories of development of the broad ICT sector and the definition of the draft scenarios, which were discussed at the second workshop. Taking into account the results of desk research, feedback from the workshops, input from the stakeholder interviews, input from the Steering group members, combined with IDC's proprietary skill model adapted to reflect specific Irish conditions, the following three scenarios for the period 2013-2018, were finalised as presented below:

1. The Central scenario;
2. The Higher Growth scenario;
3. The Lower Growth scenario.

These scenarios are focused on short-medium term developments, with the level of uncertainties relatively limited. Within this timeframe, there is a low chance that wildcard events or exogenous factors could radically influence and change the situation in Ireland.

4.2 The Irish ICT Industry: a SWOT Analysis

The first set of identified opportunities relates to Ireland and to the economy (see Figure 24). The stakeholders involved in the process above (workshops and interviews) stressed how important it is

that the country promotes itself as a good and convenient place to live, to study, to work and to do business both for Irish people and for non-nationals. The promotion of the country as a good location for business should be addressed to industry in general as well as to the ICT sector. This also includes creating a favourable environment for innovative start-ups, both Irish and foreign, in order to develop a good base on which to operate and innovate for most promising technological trends.

The ICT sector can take advantage of a talent pool of ICT professionals, which is valuable for both foreign owned and for Irish owned companies. Besides, the cluster of international firms and Irish companies may offer attractive career opportunities. While the international economic crisis is threatening the ICT sector, the current technology and market trends are providing a number of valuable opportunities to the country. Capturing these opportunities can help in facing the current economic crisis. These main technology and ICT market opportunities are:

1. Cloud computing: Ireland can play a role both as a provider of software and services and as an early adopter across industries and the public sector;
2. Software engineering: Ireland can develop a centre of excellence to support and stimulate high growth areas (telecommunications including mobile, cloud computing, security and financial services). In this case, to establish a centre of excellence encompasses several or all of the following elements: research, business incubation, customer solution centres, curricula for developing high-level ICT skills in the area, initiatives to attract FDI specifically for the area - for Ireland to be seen as a top location for the area in global technology perspective. An example of this is what MIDAS Ireland is aiming to achieve in the microelectronics industry;
3. Telecommunication and mobility: Ireland can develop competitive enterprises and consumer solutions for the telecom and mobile market;
4. E-health and green IT: Ireland can successfully develop such niches;
5. The Internet: social networks and software-as-a-service solutions;
6. Media and entertainment: Internet Protocol Television, user generated content for cross media platforms, interactive programming, and gaming are all segments where Ireland can play an important role;
7. Microelectronics: take a leading position in developing the integrated circuits that are at the heart of many of the new ICT developments.

There are challenges in taking advantage of the above opportunities. Personal taxation and cost of living affect the relative competitiveness of the ICT industry and the ability to attract international ICT talent. Strengthened communication infrastructures can support the further the development of the ICT sector. Finally, since ICT skills are the main production factor and there is a greater demand than the domestic supply of some skills, this may act as a barrier to further ICT development and growth in the broad ICT sector.

The SWOT analysis of the broad ICT sector made it possible to highlight the most relevant focal issues characterising the sector and, more specifically, influencing and shaping the future demand of high-level ICT skills. The main focal issues identified for ICT skills demand relate to the macroeconomic framework, the broad ICT sector and market, and to education and training policies.

Figure 24: SWOT Analysis of the Broad ICT Sector

Strengths	Weaknesses
Key sector for the successful Irish development model: open and globally competitive.	Economic crisis undermined attractiveness and competitiveness of the Irish socio-economic system.
High export propensity: Computer services represent 39% of total service exports (2011).	Insufficient domestic supply of high-level ICT skills (decline in graduates in the period following dot-com bubble in 2002 but steady increase since 2009).
Presence of nine of the world's top ten software companies.	Dependency on inward migration (significant level of high-level ICT skills supplied from abroad).
Strong presence of major multinationals as well as many indigenous companies in the microelectronics sector.	Ireland lags behind OECD countries in terms of fibre connections as a percentage of broadband access network.
Strong attractiveness of Business Shared Services provided by Ireland to the global finance and manufacturing industries.	Domestic market demand for ICT products and services insufficiently advanced and sophisticated.
Large number of Irish-owned firms with leading position in niche markets providing tailored software services (finance, health, education, entertainment)	
Leadership position in mixed signal Integrated circuit design and a recognised centre of excellence for manufacturing of microprocessors.	
Persistence of hardware manufacturing industry even if declining.	
Strong Government commitment in 2012 ICT Action Plan and the Action Plan for Jobs 2013 for Ireland to build up its supply of ICT skills and become internationally renowned as a location with the appropriate supply of skills/ talent.	
Opportunities	**Threats**
Access to major European markets and fast-growing emerging markets.	Rising personal tax and relatively high cost of living, cost of business and cost of labour reduces the competitiveness of the products / services – although recent price falls and reduction in property costs have helped Ireland to regain some of its competitiveness.
Promotion of Ireland as a competitive place to develop and manage ICT businesses.	The unclear image of career opportunities in ICT and a lack of a clearly defined career path as such remain a problem, especially among high-achieving females, who comprise around 20% of ICT professionals.
The presence of large global players creates opportunities for start-ups and clusters.	The technology infrastructures are a relevant barrier to the development of the ICT sector
The main market opportunities for Ireland are: mobility, software development, e-Health and Green IT, Big Data, cloud, and design of integrated circuits and other enabling technologies.	Potential lack of adequate and sufficient domestic skills supply to meet growing demand.

Source: IDC, 2013

4.3 The Main Focal Issues for High-Level ICT Skills Demand

The selected focal issues are those considered most likely to characterise the ICT skills demand in the next five years and therefore best describe the scenarios that may occur. Nevertheless, there are several uncertainties that can modify to a varied degree, the baseline scenario presented. Based on these uncertainties, a central growth scenario and two other alternative scenarios were identified. The main focal issues and the related uncertainties that will shape ICT skills demands in the medium term are:

- The global and domestic macroeconomic framework: Macroeconomic dynamics are in this study considered as largely exogenous to the ICT skills scenarios. The focus is mainly on their impact on the development of the broad ICT sector and market and, therefore, on the demand for ICT skills. The macroeconomic environment determines the trend for GDP and demand growth, as well as the confidence of stakeholders in the market and their propensity to invest and innovate. The scenarios consider the macroeconomic environment both at a global and domestic level. Overall, macroeconomic growth is a key driver of ICT growth because it supports investments, innovation capacity and the ability to capture the technology and market opportunities.
  - Global macroeconomic uncertainties: The main current uncertainty for the macroeconomic framework is related to the speed of recovery from the economic crisis especially affecting the Western economies, including Ireland. Other relevant uncertainties to consider are the level of foreign direct investment (FDI), ICT investment trends, and the sector and geographic diversification of the industry and trade.
- The ICT sector and market: The ICT innovation and technology trends described in the previous chapters are dramatically changing ICT delivery and business models, as well as the interaction between the producer, vendor and user industries as well as consumers. However, the ability of Irish industry to exploit new technologies and market opportunities depends on its capacity to innovate, on the competitive advantages already developed and also on the strategies that will be adopted. The different types of market opportunities adopted and developed will in turn determine different demand trends for ICT skills, both at a quantitative and a qualitative level.
  - The ICT uncertainties: The main uncertainty is the rate of adoption of the main ICT innovations. In addition, the uncertainty of adoption patterns for these innovations by geography, by industry and by company size is also relevant. It makes a difference whether the technologies are adopted by high-tech industries and by large companies only or whether the technology is pervasive across geographies, industries, companies and indeed consumers.
- The education and training system: where education is undertaken by the education system, while training is also driven by enterprises. In general, the rate of change of formal education systems is generally a slower process - and not just in Ireland. It can take several years before students educated in a new programme/ subject enters the labour market. Therefore changes to the mainline education system are likely to have less influence on the scenarios which are focused on a medium-term perspective. However, the Springboard programme and ICT NFQ Level 8 Conversion programme are examples of education programmes, run in collaboration with enterprise which provided a fast responsive over a shorter time frame. The training system can

potentially be more flexible over a shorter time frame and shaped by enterprises and employees' choices, as well as by the general economic climate.

- The education and training system uncertainties: The general economic climate and the availability of funding may significantly change the industry training budgets and policies so that future developments present a higher level of uncertainty. From this point of view, Irish enterprises' apparent willingness to invest more in training in the coming years, which emerged from many interviews, has been taken into account.

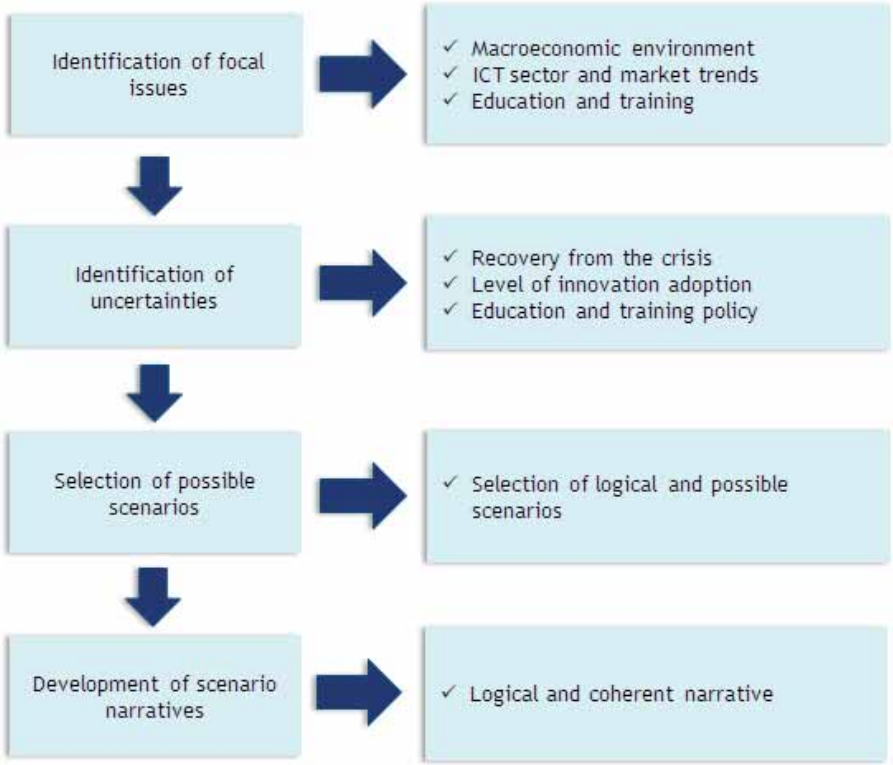
4.4 Demand Scenario Development

Figure 25 outlines the main steps of scenario development. It is important to note that scenarios are not forecasts, even if they provide a narrative explanation for the projections of ICT skills demand growth. In the approach for this study, the first scenario, Central Growth Scenario "Fighting to Stay on Course", is considered as the baseline, or most likely scenario, while the others highlight the potential better opportunities (Higher Growth Scenario) or risks of downfall (Slower Growth Scenario) for the Irish ICT sector, for ICT in other industries and therefore the related demand for high-level ICT skills.

The scenarios will be presented in the following structure:

- Scenario overview (narrative presentation);
- Potential Impacts (impacts on ICT skills demand);
- Likeliness (based on the current assumptions).

Figure 25: Scenario Development Process and Factors



Source: IDC, 2013

4.5 Scenario 1: Central Growth Scenario – "Fighting to Stay on Course"

Scenario Overview

In this scenario, the Irish economy continues on its path of moderate but steady recovery from the crisis. Domestic demand will also gradually improve, and the attractiveness of the country for FDI and inward migration will hold steady. The Irish ICT sector will keep pace with global demand, gaining ground in the new technology markets (Mobility, Cloud, Big Data, and niche vertical markets, such as finance and e-health).

However, international competitiveness will remain a strong challenge, and the IT sector will struggle for every step forward. The strategic initiatives on Big Data and cloud will start to gain ground. Foreign-owned companies and indigenous companies will invest and develop export market opportunities in areas, where some competitive advantages have already been developed in the past. This will help realise the opportunities of a slow but continuous recovery from the economic recession without running too many risks.

Since domestic demand will slowly improve, companies focused on the domestic economy will also gradually improve their performance. Irish indigenous, exporting companies will take advantage of a steady although moderate recovery in the international market and hence improve their performance as export grows. The demand for high-level ICT skills will increase at an average growth rate of approximately 5%, with stronger demand from the broad ICT sector rather than the user industries, only partially satisfied by domestic supply. The continuing need for inward migration to satisfy skills demand will remain high. This scenario is based on conservative assumptions, and the extrapolation of present trends, and is considered highly likely.

Main Assumptions

This scenario is specifically based on the assumption that the Irish economy is going to recover moderately but steadily. The GDP growth rate is expected to be almost 2% in 2014 and to grow steadily and moderately in the following years. These trends are based on the forecasts for the Irish economy implemented and provided by the European Commission (European Economic Forecast, 2013) and by Moody's. Both these sources show that investments have bottomed out in 2012. Further, in the short term multinationals and indigenous internationalised SMEs are expected to count for the bulk of investments as domestic economic issues continue to constrain the investment ability for domestic firms.

On the one hand, household consumption improves gradually with domestic demand remaining steady for at least 2013 and probably for 2014 as well. On the other hand, export of goods and services increase. International demand increases because of a more confident economic climate. In the ICT market, domestic demand is expected to increase slowly.

Within this scenario, enterprises in the mobility market will grow and become more competitive. The indigenous Telecoms, Internet, Media & Entertainment sector has grown over the last six years and Ireland can count on a pool of companies, including global players, to provide technology solutions and support services. Ireland is also well placed to service this market because of the

continued adoption of high-speed Internet, although further investments in this area will be necessary.

The move towards mobility is just one of the key trends describing the "consumerisation" of IT, which is a much broader and complex phenomenon that affects many business processes and solutions. Consumerisation of traditional Enterprise Resource Planning (ERP) or Customer Relationship Management (CRM) software for example, implies consumer-like, intuitive user experiences and mobile interfaces and software-as-a-service (SaaS) delivery, all elements appealing to small and medium companies. Another key aspect of the mobility trend is the continuous innovation in mobile devices - an area where Ireland's microelectronics sector already has a good foothold in the global market.

Most European and US companies are currently focused on the cost agenda and productivity gains will be a key driver for the development of the cloud market. The cloud model has substantial advantages in the form of improved IT usage, leading to lower cost. The scenario assumes that Ireland will be an early adopter of cloud and will also develop cloud software and services for consumption outside Ireland.

Both the mobility and cloud segments will strongly support the further development of the software engineering market segment. International firms as well as a large number of Irish owned firms gaining leading positions in niche markets will invest and support software engineering services.

Overall, in this scenario foreign-owned companies and indigenous companies will invest and develop market opportunities in areas, where some competitive advantages have already been developed in the past. This will help realise the opportunities of a slow but continuous recovery from the economic recession without running too many risks.

There is effective implementation of the disruptive reform within the Action Plan for Jobs 2013 aimed at building up Ireland's ICT skills capability, including actions progressed within the education and training system to increase the output of skilled ICT graduates and to improve the throughput and quality of employment permit applications.

The ICT sector will show continuous although moderate growth that will lead the education system to continue to adopt a policy to support the attractiveness of ICT careers. Funding of the educational system will stay at the same level as before the crisis, and initiatives launched will continue to attract young people to ICT careers. There will be additional efforts to match demand and supply, with some further new initiatives supported by the Government (as, for example, in internship with structured programmes enhancing students' skills and experience in the workplace).

To address the needs for some specific new skills, enterprises training budgets will improve. Ireland will adopt additional policies addressed at attracting talents from abroad. This will be mostly focused at high-level ICT skills since demand. Ireland's attractiveness as a place to live, work and do business will gradually improve due to the policy actions addressed to overcome the threats of the crisis and adopted with the Action Plan for Jobs 2013.

Finally, one of the possible threats Ireland will have to face is the competitiveness position of other non-European countries with high-tech capabilities, able to attract FDI or to compete with products and services in the international market.

Skill Sets Needed

In this central growth scenario, the skillsets needed are varied in terms of the technologies and levels of experience. However, most of these will be around the third platform technologies of cloud, mobility, and Big Data / analytics (with social media still being more nascent within the timeframe) as well as the development of industry specific solutions relating to Internet of Things and the underlying enabling technologies. This means that the range of technology skills needed are broad and employers will seek to meet this demand through hiring new graduates as well as experienced people, also from abroad. The interviews with the stakeholders indicate that this is the case for computing as well as electronic and electrical engineering skills. Almost 90% of enterprises surveyed are planning to hire new graduates, preferably NFQ level 8+ - and 80% of enterprises will hire experienced people from other organisations. Sourcing skills from abroad was seen as a possible option for 70% of enterprises surveyed. Interestingly, from Employment Permit data from the Department of Jobs, Enterprise & Innovation, out of a random sample of 50 Employment Permits issued in 2012, 95% of these had NFQ level 8+ education, 90% had more than two years' experience and 62% had greater than five years of experience. The technical skill sets covered a broad range from electronic systems development, to web design, quality assurance testing and development of banking solutions. There is a realisation that the demand for skills can only be filled through a combination of means. It is a positive that enterprises are not only looking for experienced staff but also new graduates that they can train and bring onto a career path. Technologies are changing fast, and as a result so is the demand for specific technology skills. Consequently, a strong core technology education will form a good basis for future technology skills to be added.

Impact

The demand for high-level ICT skills will show a continuous increase with a compound annual growth rate (CAGR) of 4.9%, as shown in Table 2. This growth will be driven especially by both the broad ICT sector and the other sectors, which will adopt the above mentioned innovation technologies.

Table 2: Central Growth Scenario "Fighting to Stay on Course"- Demand for High-level ICT Skills by Sector, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Broad ICT Sector	40,502	43,280	46,190	49,270	52,500	55,780	59,050	62,250	6.2%
Other Sectors	24,848	25,000	25,300	25,600	26,290	27,130	28,010	28,930	2.2%
Total	65,350	68,280	71,490	74,870	78,790	82,910	87,060	91,180	4.9%

Source: IDC, 2013

The demand for Electronic and Electrical Engineering skills will grow at a faster rate than for Computing skills but from a much lower base, as shown in Table 3.

Table 3: Central Growth Scenario "Fighting to Stay on Course" - Demand for High-level ICT Skills by Type, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Computing	50,010	52,170	54,550	57,050	59,960	63,010	66,080	69,100	4.8%
Electronic & Electrical Engineering	15,340	16,110	16,940	17,820	18,830	19,900	20,980	22,080	5.4%
Total	65,350	68,280	71,490	74,870	78,790	82,910	87,060	91,180	4.9%

Source: IDC, 2013

For both high-level computing and high-level electronic and electrical engineering skills, the broad ICT sector is the main "consumer" of skills, as shown in Figures 26 and 27.

Figure 26: Central Growth Scenario "Fighting to Stay on Course" - Demand for High-level Computing Skills by Sector, 2011-2018

Source: IDC, 2013

Figure 27: Central Growth Scenario "Fighting to Stay on Course" - Demand for High-level Electronic and Electrical Engineering Skills by Sector, 2011-2018

Source: IDC, 2013

Demand by NFQ Level Skills

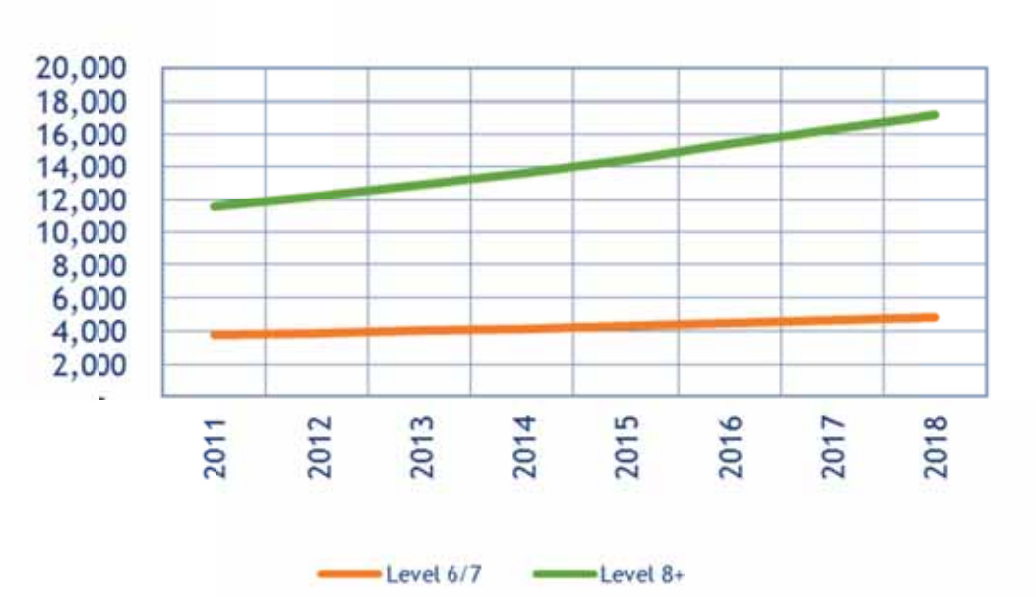
The increasingly complex nature of technological developments means that both computing and electronic and electrical engineering skills most in demand are at NFQ Level 8+. Indeed, as shown in Figure 28, the increase in demand for computing skills will be at these higher levels, while demand for NFQ level 6/7 remains stable.

Figure 28: Central Growth Scenario "Fighting to Stay on Course" - Demand for Computing Skills by NFQ Level, 2011-2018

Source: IDC, 2013

This was also the expectation of stakeholders interviewed and indeed from the discussions at the workshops. The increase in the demand for electronic and electrical engineering skills is also highest for NFQ Level 8+, as shown in Figure 29. Over the forecast period, there is a slight increase the demand for Level 6/7 skills but from a low base of total demand for employees.

Figure 29: Central Growth Scenario "Fighting to Stay on Course" - Demand for Electrical and Electronic Engineering Skills by NFQ Level, 2011-2018



Source: IDC, 2013

New Job Openings for High-Level ICT skills

The demand forecasts above depict total annual employment demand for high-level ICT skills in a specific year. However, when the numbers of potential job openings arising in a specific year are looked at, this includes both net new jobs that may have to be filled due to expansion demand and existing jobs that have to be filled due to replacement demand, including those due to retirements, job switching to non-ICT professional occupations, emigration, inactivity, or other reasons. Figures 30 and 31 provide a view of these potential job openings by skills type. Expansion demand is based on the difference in demand for skills between two years, e.g. the higher number of skills needed in 2014 over 2013. The calculation of replacement demand is based on input from several sources, conversations with key stakeholders and IDC's assessment of how this results in average replacement proportions for different NFQ levels. For example, the EGFSN Future Requirement for High-level ICT Skills in the ICT Sector 2008 report used a 5% per annum replacement rate for NFQ level 8+. However, a 2012 CEDEFOP analysis of annual replacement for 'physical, mathematical and engineering science professionals arrived at 4.4%.per annum. Also in 2012, a report from the UK Commission for Employment and Skills estimated net replacement rates for 'science, research, engineering and technical professionals' at over 3.3% per annum (excluding occupational mobility and migration). Consequently, IDC has estimated that a gross 4.5% per annum replacement rate is a

reasonable assumption for NFQ Level 8+. We have assumed a slightly lower rate at 4% per annum for Levels 6/7, since skills at these levels are less portable (also abroad) so that the replacement level of people at this level is lower.

Figure 30: Central Growth Scenario "Fighting to Stay on Course" - Potential New Openings for Computing Skills by Replacement and Expansion Demand, 2012-2018 – NFQ Levels 6/7/8/9/10

Source: IDC, 2013

Figure 31: Central Growth Scenario "Fighting to Stay on Course" - Potential New Openings for Electronic and Electrical Engineering Skills by Replacement and Expansion Demand, 2012-2018 – NFQ Levels 6/7/8/9/10

Source: IDC, 2013

Table 4 provides the underlying numbers for potential job openings by skills type and by NFQ level. Overall, in the Central Growth Scenario "Fighting to Stay on Course", over the period 2012 to 2018, it is estimated that there will be more than 50,000 new job openings. Of these, demand for computing skills will still be well above electronic and electrical engineering. As can be seen from Table 4, it is estimated that around 90% of the potential job openings for high-level computing skills will be for Level 8+, while for electronic and electrical engineering skills, this proportion is 82%.

Table 4: Central Growth Scenario "Fighting to Stay on Course" - Potential Job Openings for High-Level ICT Professionals by Skills Type and NFQ Level, 2012-2018

	2012	2013	2014	2015	2016	2017	2018	Total Job Openings 2012-2018
Computing								
Level 6/7	499	505	509	533	528	522	506	3,602
Level 8+	3,963	4,275	4,501	5,017	5,302	5,468	5,564	34,090
Total	4,462	4,780	5,010	5,550	5,830	5,990	6,070	37,692
Electronic & Electrical Engineering								
Level 6/7	288	297	312	335	351	354	350	2,287
Level 8+	1,189	1,273	1,348	1,495	1,589	1,646	1,720	10,260
Total	1,477	1,570	1,660	1,830	1,940	2,000	2,070	12,547
Total Job Openings	5,939	6,350	6,670	7,380	7,770	7,990	8,140	50,239

Source: IDC, 2013

Likelihood

This scenario is anticipated the most likely and realistic one. It is based on conservative assumptions of the general economic trends and on slow recovery from the economic crisis. It is therefore realistic that this scenario will occur in the medium term and without dramatic and exogenous changes.

4.6 Scenario 2: The Higher Growth Scenario

Scenario Overview

This scenario is driven by more favourable economic conditions and an aggressive strategy by the Irish ICT industry to develop new technologies and conquer innovative markets. In this scenario, the global economy improves more rapidly than expected, thanks to structural reforms and coherent macroeconomic policies, leading to a positive effect on the Irish economy and its level of confidence. Thanks to the acceleration of international demand, Ireland enters a positive

development cycle driving domestic demand and investments growth. The positive climate drives a faster increase of FDI, compared to the Central Growth Scenario, and improves attractiveness for foreign talent. The Irish ICT sector performs well in the emerging and existing markets (mobility, cloud, Big Data, Internet of Things, social and niche vertical markets) with some breakthroughs in a few areas (one could be multimedia gaming). The strategic initiatives on Big Data and Cloud reinforce Irish competitiveness. Irish firms increase investments and competitiveness, and are able to gain ground in the national and international markets. More start-ups are created, competing in Ireland and abroad.

The demand for high-level ICT skills would increase at an average growth rate of approximately 8% in the period 2012-2018, mainly driven by the ICT industry. This scenario is relatively unlikely in the short term, but may become more likely in 7-8 years if the economy recovers and companies make the necessary investments in technologies and skills.

Main Assumptions

Within this Higher Growth Scenario, a more optimistic view is taken of the economic situation over the next few years. The risks to the survival and cohesion of the European Economic and Monetary Union soften thanks to Member States structural reforms and a more rapid international recovery from the crisis occurs than currently expected. This improved trend will have immediate impacts on the European and the Irish open economy with a more positive recovery trend from the end of 2013. The acceleration of the international demand would have a positive effect on the GDP trend; this acceleration would positively influence the level of domestic confidence, which in turn will increase the national demand for goods and services as well as the investment trends of both multinationals and indigenous enterprises. GDP would reach growth rates over 2% from 2014 and then continue on this positive trend.

The domestic recovery and the decrease of the debt-to-GDP ratio would make Ireland more attractive to FDI than it was during the crisis. Unemployment would progressively decrease and quality of life will improve. A step change reform of the education system would take place in order to make it competitive with the most advanced education systems in Europe.

From 2014, the ICT sector's propensity to innovate (for both vendors and users) would increase.

As in the Central Growth Scenario, the adoption of new technologies would be driven by mobile and cloud technologies. In addition, there will be other market opportunities where Ireland could play a strong role. Areas, such as e-health and green IT, where Ireland has developed some technology advantages are niches where Irish companies will be able to make investments and consolidate their technology advantages. This, in turn, drives FDI in these areas as Ireland is now seen to be developing a strong skills base in these technologies.

Big Data would be relevant for many companies operating in segments, where Ireland has a strong track record, such as finance, supply chain management, and a broad range of headquarter activities.

The positive economic and innovation trends would lead some companies to invest in the development of contents and applications for social media technologies. Since English is the international standard here, Ireland can play a strategic role. Social media for business purposes is already adopted by many multinationals but in the coming years, the gazelles and growth-oriented

SMEs will start adopting social media technologies, both in Ireland and abroad. This will create increased demand both domestically and for exports.

The level of confidence in the economic system would be favourable to investments in some new and competitive markets, such as the games industry, where Ireland has good potential thanks to both technology and creativity. However, Ireland would have to face the strong competitive advantage of Asian countries and implement sophisticated marketing processes suitable to a growing global consumer market.

One of the main aspects differentiating this scenario from the previous one (Central Growth Scenario) is that indigenous ICT SMEs would be more competitive and stronger and would export more than they do today. Companies would also supply a more demanding domestic market.

The industry's dynamism would put pressure on the education system to keep up and "upgrade". There would be a strong demand for better education at both secondary and university level, especially for foreign languages and for general capabilities (collaboration, problem solving, and flexibility). There would be an increasing mismatch between demand and supply of high-level ICT skills in both the ICT and user industry. To face this mismatch, enterprises would rapidly increase training budget levels. The government will support this trend with some tax breaks and extended policies addressed to life-long-learning and skills conversion.

As well as the effective implementation of actions within the Action Plan for Jobs 2013 aimed at building up Ireland's ICT skills capability, other actions to improve access to funding measures for small and medium sized enterprises, would start to bear fruit including a new Seed and Venture Capital Scheme, a Development Capital scheme and an Innovation Fund Ireland Scheme. These efforts along with increased capacity building lead to an increasing number of indigenous high-potential start-up companies (HPSUs).

Finally, the policy to attract talent from abroad become even more relevant and would not only be focused at high-level skills: there would be a need to match the demand for both high-and medium-levels. The initiatives for retaining international ICT talent would also be very relevant. These initiatives will be addressed at both EEA and non-EEA nationals.

Impact

The Higher Growth scenario is more challenging from the point of view of high-level ICT skills than the Central Growth Scenario "Fighting to Stay on Course". In this scenario, Ireland would show strong demand for specific high-level ICT skills on one side, and for dual business-technology skills on the other side, merging e.g. marketing/sales and technology capabilities. There will be strong demand for staff able to work in multidisciplinary teams overcoming barriers between technology and business. The demand for high-level ICT skills would grow at a rate of over 7% per year, as shown in Table 5.

In this scenario, there will be the need for skills to develop sophisticated ICT technologies, tools and solutions. In some areas, such as Internet and social networking, companies based in Ireland are mainly specialised in services and customer support, less so in the development and deployment of software. To consolidate and strengthen the Irish competitive advantage the Higher Growth Scenario will require an increased level of software development within the country, focused on the upstream phases of the value chain. In some niches, such as medical devices and e-health, there is a

competitive capability that needs to be consolidated with stronger downstream positioning (marketing and distribution) in order to develop an export capability on the global market.

Table 5: The Higher Growth Scenario – Demand for High-level ICT Skills by Sector, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Broad ICT Sector	40,502	44,510	48,860	53,600	58,750	64,220	69,940	75,860	9.3%
Other Sectors	24,848	25,110	25,520	25,930	26,750	27,720	28,740	29,810	2.5%
Total	65,350	69,620	74,380	79,530	85,500	91,940	98,680	105,670	7.2%

Source: IDC, 2013

Table 6: The Higher Growth Scenario – Demand Growth for High-Level ICT Skills by Type, 2011-18

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Computing	50,008	53,190	56,750	60,600	65,070	69,870	74,900	80,080	7.0%
Electronic & Electrical Engineering	15,342	16,430	17,630	18,930	20,430	22,070	23,780	25,590	7.7%
Total	65,350	69,620	74,380	79,530	85,500	91,940	98,680	105,670	7.2%

Source: IDC, 2013

Likelihood

This scenario is a very positive one and consequently it is not currently considered as the most likely. During the second workshop held with the stakeholders, this scenario was assessed as less likely than the previous one. On the other hand, this scenario highlights that there are opportunities to grow faster than currently projected, if market opportunities are to be exploited fully.

This scenario is less likely mainly because of the limited period being considered. IDC believes that within a period of 7-8 years this scenario could indeed occur, if Ireland creates the virtuous circle latent in research priorities, FDI, and existing capabilities and technologies in the ICT sector.

4.7 Scenario 3: The Slower Growth Scenario

Scenario Overview

This scenario highlights the potential risks of a negative downturn on the economy, due to a slower recovery than expected, which is still possible and should not be overlooked, In this more fragile climate, the Irish ICT industry would not be willing or able to increase investments, leading to a relative inability to exploit the emerging innovative market opportunities. The government in turn may be unable to continue strong proactive policies for FDI attraction relative to other competitor countries, because of higher budget deficits, which would lead to a slowdown of FDI growth. The weakness of domestic demand would undermine the development of the indigenous ICT industry,

while foreign-owned companies would still lead the growth of exports, but would be less inclined to expand their base in Ireland. The ICT user industries will maintain a focus on ICT spending to drive cost reductions and efficiencies rather than to support business growth. However, Ireland will be able to defend its current position in the main ICT markets. Mismatches in demand and supply of ICT skills would increase, because of a "patchwork" model of development across Ireland.

The demand for high-level ICT skills in this scenario would increase at a much slower average growth rate, around 3% (against 5% in the first and 7% in the second, more optimistic scenario). This scenario does not appear very likely, but highlights the potential negative consequences of a more pessimistic economic climate and the lack of initiative and investments.

Main Assumptions

The main assumption is that the recovery from the economic crisis in the Economic and Monetary Union could be slower than expected because member states' structural reforms may take more time than expected. A more gradual return to growth than currently expected would lead to a projection of almost unchanged annual GDP at least until the end of 2014. International recovery outside Europe will also take longer than expected and international demand for goods and services will grow slowly. The Irish economy would not therefore be able to take advantage of a positive and growing export trend so GDP would show a steady trend. The level of confidence in the Irish economy would not show much improvement. Consequently, ICT spending would remain steady. The innovation capability would be limited with enterprises more focused on the cost agenda. ICT investments by users would be postponed and investment strategies extremely conservative so that the more advanced technology innovations would not be exploited.

None of the new market opportunities would show fast adoption in Ireland or in many of the export markets, such as Europe and US. Both development and adoption of new technologies would be subdued, while engineering activities to develop the technologies would have limited diffusion due to the lack of high-level ICT skills. Most innovation would come from the multinationals and indigenous internationalised SMEs. In the user industries, ICT would be adopted mainly to achieve savings and to improve productivity where this cannot be postponed. The Irish ICT sector's competitiveness would be low and subject to intense competition from other small high-tech countries (e.g. Israel and Singapore). The attractiveness of ICT careers would be low because of reduced career prospects and ICT wages stall or even decrease slowly compared to other sectors and countries. The attractiveness of Ireland as a country in which to do business and to live would be limited because of a high and steady unemployment rate with high personal tax. Due to the slow recovery from the crisis, funds addressed to the ICT educational system will slow down.

Some efforts to match demand and supply would be implemented but without launching significant investments. Specifically, the most appropriate and frequent initiatives would be up-skilling initiatives, mainly driven by the ICT industry. Enterprises' training budgets would remain more or less at the same level they were during the economic crisis.

The attraction of ICT talent would also stall, especially for those coming from non-EEA countries.

In this scenario, the implementation of the national ICT Action Plan 2012 as well as of the e-Government 2012-2015 Plan may be delayed because of a lack of funds.

Impact

The demand for high-level ICT skills would increase with a growth rate of 2.7% per year mainly driven by the broad ICT sector. This demand may be driven by the increased demand for highly specialised skills, both ICT technology and e-business skills, while the demand of mid-level, operational, practical skills would decrease, both from industry and from end-users.

This trend would occur in end-users IT departments, where there would be reduced demand for operational skills (due to cloud, increasing automation and general lack of investment). However, it would also be a trend in the export part of the ICT sector, where the focus is on developing new innovative technologies that require high-level skills.

Table 7: The Slower Growth Scenario – Demand for High-level ICT Skills by Sector, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Computing	50,008	51,270	52,590	53,930	55,320	56,820	58,280	59,710	2.6%
Electronic & Electrical Engineering	15,342	15,840	16,330	16,850	17,380	17,940	18,510	19,080	3.2%
Total	65,350	67,110	68,920	70,780	72,700	74,760	76,790	78,790	2.7%

Source: IDC, 2013

Table 8: The Slower Growth Scenario- Demand Growth for High-Level ICT Skills by Type, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2012-18
Broad ICT Sector	40,502	42,110	43,740	45,420	47,110	48,810	50,470	52,080	3.6%
Other Sectors	24,848	25,000	25,180	25,360	25,590	25,950	26,320	26,710	1.1%
Total	65,350	67,110	68,920	70,780	72,700	74,760	76,790	78,790	2.7%

Source: IDC, 2013

Likelihood

At the time of this report, this scenario seems the least likely. The consequences of this scenario should be considered as potential risks to be avoided. For example, if the international economic crisis continues, Ireland should consider the option to continue and increase investments in the ICT sector, as a means of counteracting slower growth in other sectors of the economy.

Chapter 5 Forecast of Domestic High-level ICT Skills Supply

The process of engagement with enterprise for this study has confirmed that they plan to use four key approaches to acquiring the new ICT skills they will need in the future:

- Hire new high-level ICT graduates;
- Hire experienced people from other organisations;
- Hire from abroad;
- Retrain and up-skill existing staff;

As hiring experienced people from other organisations will not add to the overall national supply of skills, the increased demand for high-level ICT skills will have to be met from the following sources:

- output from the higher education and training systems, including targeted reskilling and conversion programmes;
- upskilling of those at work through continuing professional development;
- inward migration of high-level ICT professionals.

Forecasts by the Higher Education Authority for graduate output by NFQ level from mainstream undergraduate and postgraduate programmes for the period 2013-2018 are set out in Table 9 [19]. The forecast model covers three discreet ISCED discipline areas as follows:

- ISCED 481 - Computer Science;
- ISCED 482 - Computer Use;
- ISCED 523 - Electronics and Automation.

These are the key fields directly focused on ICT supply within the broader categories of Science and Engineering[20]. The HEA forecast model uses real trends in graduate numbers within the relevant ICT disciplines over recent years and extrapolates in the immediate years ahead, based on known trends in year-one enrolments in the relevant fields of study. A modest allowance is made to reflect improvements in retention rates expected as a consequence of the increase in entry points to ICT programmes observed in recent years.

[19] The data for mainstream output is from all the HEA funded institutions, including the seven Universities, 14 Institutes of Technology and three designated colleges.

[20] There are also notable ICT elements within other programmes in Science and Engineering and within the broad fields of Humanities, Business, Social Science and Medicine. These have not been included in the forecast. At the same time, there would be some element within the ICT skill supply output which would flow into related non-ICT employment. Beyond 2016, the last two years are averages of the previous two years, so 2017 is an average of 2015-16, and 2018 is an average of 2016- The forecast can be updated each year as new first-year intake data becomes available.

Table 9: Mainstream ICT Graduates by NFQ Level and Detailed Field of Study

Mainstream ICT Graduates by Level and Detailed Field of Study											
NFQ Level 6	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Computer Science	201	130	115	149	157	156	82	136	133	127	119
Computer Use	77	76	77	114	141	146	155	139	145	147	147
Electronics and automation	90	94	102	121	149	135	97	125	126	121	117
Total NFQ Level 6	**368**	**300**	**294**	**384**	**446**	**437**	**334**	**400**	**404**	**394**	**383**
NFQ Level 7	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Computer Science	324	387	369	448	545	740	699	739	681	715	708
Computer Use	112	100	84	151	209	263	212	198	220	223	213
(523) Electronics and automation	328	365	396	440	474	471	490	497	483	485	489
Total NFQ Level 7	**764**	**852**	**849**	**1,039**	**1,228**	**1,474**	**1,401**	**1,434**	**1,384**	**1,423**	**1,411**
NFQ Level 8	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Computer Science	712	653	813	1,068	1,175	1,344	1,690	1,909	2,419	2,164	2,291
Computer Use	117	115	175	152	167	163	205	219	269	244	256
Electronics and automation	267	269	305	299	329	401	585	818	829	824	826
Total NFQ Level 8	**1,096**	**1,037**	**1,293**	**1,519**	**1,671**	**1,908**	**2,480**	**2,945**	**3,516**	**3,231**	**3,374**
NFQ Level 9	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Computer Science	594	604	794	769	941	1,035	1,173	1,466	1,409	1,691	1,550
Computer Use	96	43	71	46	82	90	84	107	135	149	142
Electronics and automation	90	60	221	158	135	148	223	265	373	408	391
Total NFQ Level 9	**780**	**707**	**1,086**	**973**	**1,158**	**1,274**	**1,479**	**1,839**	**1,916**	**2,249**	**2,082**
NFQ Level 10	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Computer Science	80	88	71	67	75	84	75	80	82	85	87
Computer Use	0	0	0	1	4	6	9	8	8	8	8
Electronics and automation	29	45	41	41	49	59	51	52	54	56	57
Total Level 10	**109**	**133**	**112**	**109**	**128**	**149**	**136**	**140**	**144**	**148**	**153**

Source: Higher Education Authority

The joint Government-Industry ICT Action Plan, published in January 2012, contained a comprehensive range of measures with specific time bound targets aimed at increasing the numbers and quality of ICT graduates from the education and training system in the short, medium and long term. The overarching target included in the Plan is to double the output of level 8 graduates from mainstream undergraduate ICT disciplines between 2011 and 2018. Since publication significant progress in meeting the targets in the Plan has been achieved. These include a 10% increase in acceptances onto level 8 Computing programmes in 2012. Overall technology courses accounted for 20.5% of all honours degree level first preference CAO applications in 2013. As Table 9 shows the level 8 graduate output in 2013 is forecast at more than 25% higher than in the baseline year 2011. The Action Plan target of doubling level 8 graduate output by 2018 is now expected to be reached by 2015. Significant progress has also been made in implementing measures and targets in the Plan to increase the mathematical proficiency of students entering third level including:

- the allocation of increased teaching time to mathematics in primary schools;
- the full roll out of Project maths and associated CPD for all second level mathematics teachers;
- an increase of 58% in the number of students taking higher level maths at Leaving Cert since 2011 to 25.6% of all LC students in 2013 compared to an Action Plan target of 30% by 2020;
- almost 650 participants on a tailor-made CPD programme: *Mathematics for Teaching (Level 8), Professional Diploma* for second level teachers

Conversion and reskilling programmes

Recognising that increased undergraduate ICT enrolments would take time to feed through to increased output, the 2012 ICT Action Plan also provided for the immediate roll out of targeted reskilling and conversion courses. Since March 2012 almost 1,500 places have been provided on intensive NFQ level 8 ICT graduate skills conversion programmes developed by public and private higher education providers in collaboration with industry partners, specifically to address recruitment difficulty areas identified in EGFSN research[21]. These programmes are fully funded by the Department of Education and Skills and the first 700 graduates became available in 2013.

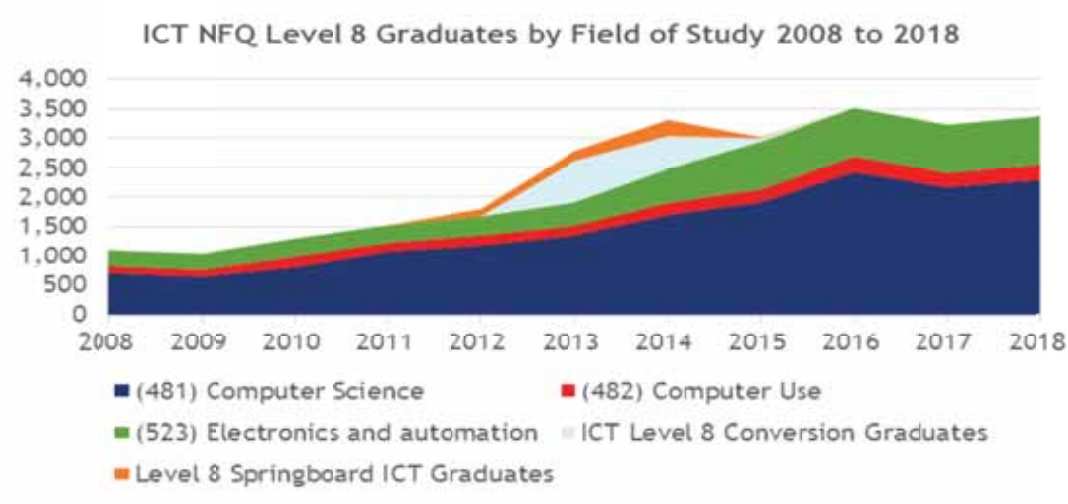
Since 2011 some 3,700 people have also enrolled on ICT programmes under the first two rounds of the Springboard reskilling initiative. A further 2,000 ICT programme places were made available under the third phase of Springboard launched in June 2013. Springboard programmes provide a flexible opportunity for unemployed and previously self-employed people with workforce experience to acquire new qualifications in areas of emerging employment opportunity. Funding is only available for accredited programmes which meet specific skills needs identified through the research of the Expert Group on Future Skills Needs and in collaboration with industry partners.

In line with the commitment in the ICT Action Plan over 400 people graduated from Springboard ICT programmes with awards at NFQ levels 8 and 9 in 2012 and a further 1,300 people with awards at these levels are expected to graduate by mid-2014. All of the Springboard 2013 programmes are of less than one year in duration; 43% of NFQ level 8 ICT programmes will lead to a major award of at least 60 ECTS at honours degree level or above and over 80% include an industry work placement. An evaluation of the outcomes of the Springboard and ICT Level 8 Conversion programmes is

[21] EGFSN Research "Addressing High-Level ICT Skills Recruitment Needs, January 2012.

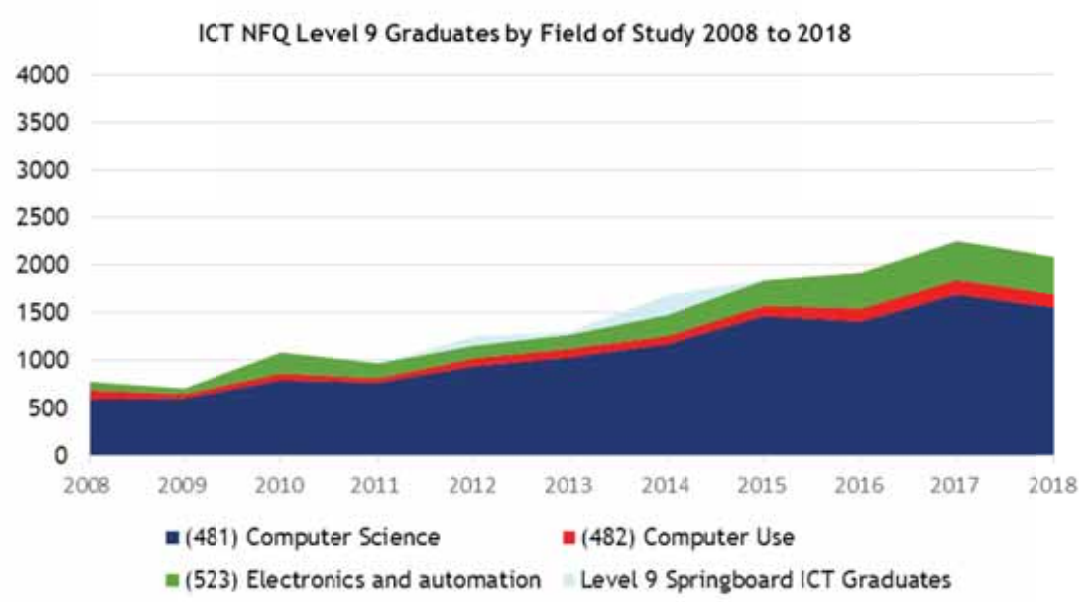
currently underway with a view to informing decisions about further provision from 2014. The graphs in Figures 32 and 33 below show the significant increases expected in the output of mainstream ICT graduates in the coming years as well as the impact of the ICT level 8 Conversion programmes and Springboard level 8 ICT programmes rolled out on the supply of graduates at the key NFQ levels 8 and 9 by ISCED field of study.[22]

Figure 32: ICT NFQ Level 8 Graduates by Field of Study, 2008 to 2018



Source: HEA, 2013

Figure 33: ICT NFQ Level 9 Graduates by Field of Study, 2008 to 2018



Source: HEA, 2013

[22] The ICT NFQ Level 8 Conversion Programme supply output data provided above is the expected actual graduation rate for 2013. The 2014/15 numbers are expected enrolments less a 20% attrition rate. The Springboard data above is based on expected graduate numbers on the basis of current enrolments (at August 2013) and historical completion rates for Springboard ICT programmes (graduation rate of about 67%).

In relation to the NFQ level 10 supply, it would be valuable for firms to consider the potential use of the Employment – Based Postgraduate programme operated by the Irish Research Council. This supports the employment of a Masters or PhD award based in a private company or public organisation (a new proposal call took place late July 2013).

Supply of graduates onto the labour market

All graduates from the targeted ICT skills conversion and reskilling programmes are immediately available to the labour market. The supply of mainstream graduates available to the labour market in any given year does not equate to the output of graduates for that year as each year a proportion will elect to proceed directly to further studies, take up employment abroad or will otherwise be unavailable for employment in Ireland. The proportion of graduates who progress to further study declines as the level of the programme increases.

For example, approximately 70% of students who complete a NFQ level 7 Ordinary Degree programme will progress directly to an honours level 8 programme, while only about 13% of graduates from level 9 masters programmes will progress to further studies.

Available data also suggests that the level of employment opportunities in the labour market influences student choice with only 5% of 2011 level 9 computing graduates progressing to further study compared to the 13% for all level 9 graduates. Likewise some 25% of level 8 computing graduates in 2011 progressed to further study compared to 41% for all level 8 graduates.

Based on the trends reported in the HEA Survey of First Destination of 2011 graduates, Table 10 provides an indication of the supply of ICT NFQ Level 8+ graduates, including from the mainstream supply, ICT level 8 Conversion programme and Springboard programme (major awards) which will be available to the labour market out to 2018. The available supply of mainstream graduates is based on reported proportions of 2011 mainstream graduates who are either in employment in Ireland or seeking employment[23]. For the conversion and reskilling programmes only the forecast supply of graduates at major ward level is included in this Table[24] .

Table 10 also shows the projected output of level 8+ graduates as a proportion of the potential job openings for the Central Growth Scenario "Fighting to Stay on Course" presented in Table 4 of Chapter 4.

[23] HEA First Destination Survey 2011: For Level 8 (ISCED 481/482) 61% of output estimated available, i.e. those in employment or seeking work in Ireland; 25% output in further study; 9% in employment overseas; 5% otherwise unavailable. For NFQ level 9 (ISCED 481/482) 81.6% of output estimated available; 4.8% in further study; 12.7% in employment overseas; 0.9% otherwise unavailable. For Level 8 (ISCED 523) 45.7% of output in a given year is available, 41% in further study; 9.2% in employment overseas; 4.2% otherwise unavailable. At NFQ level 9 (ISCED 523) 70.2% of output available; 13.3% in further study; 13% in employment overseas, 3.5% otherwise unavailable.

[24] For the Level 8 ICT Conversion programmes 100% of the forecast supply is included; for Level 8/9 Springboard 40% of the forecast supply is included. Graduates from Springboard programmes which provide minor or special purpose awards in programmes tailored to meet specific industry roles in ICT and other sectors represent an additional valuable source of high level skills available to employers outside of graduates with major awards in ICT disciplines.

Table 10: Potential ICT Graduate supply and potential Job Openings for ICT Professionals

Potential ICT graduate supply and potential job openings								
	2011	2012	2013	2014	2015	2016	2017	2018
L6/7 Computing								
L6/7 mainstream supply-@ 30% of output	259	315	392	345	364	354	363	356
Potential job openings	-	499	505	509	533	528	522	506
Graduate supply as % of job openings	**-**	**63%**	**78%**	**68%**	**68%**	**67%**	**70%**	**70%**
L6/7 Electronic & Electrical Engineering								
L6/7 mainstream supply -@30% output	168	187	182	176	187	183	182	182
Potential job openings	-	288	297	312	335	351	354	350
Graduate supply as % of job openings	**-**	**65%**	**61%**	**56%**	**56%**	**52%**	**51%**	**52%**
L6/7 Total								
L6/7 mainstream graduate supply	427	502	573	521	550	537	545	538
L6/7 Springboard graduate output	-	**184**	**201**	**284**	**8**	-	-	-
Potential job openings	-	787	802	821	868	879	876	856
Graduate supply as % of job openings		**87%**	**97%**	**98%**	**64%**	**61%**	**62%**	**63%**
L8+ Computing								
L 8 mainstream supply -@ 61% of output	744	819	919	1156	1298	1639	1468	1554
L 9 mainstream supply -@ 81.63% of output	665	835	919	1026	1284	1260	1502	1381
L10 mainstream supply-@ 100% of output	68	79	90	84	88	90	93	95
Total Computing L 8+ mainstream graduate supply	***1477***	***1733***	***1928***	***2266***	***2670***	***2989***	***3063***	***3030***
Computing NFQ L 8+ job openings	-	3963	4275	4501	5017	5302	5468	5564
Graduate supply as % of job openings	**-**	**44%**	**45%**	**50%**	**53%**	**56%**	**56%**	**54%**
L8+ Electronic & Electrical Engineering								
L 8 mainstream supply -@ 45.7% of output	137	150	183	267	374	379	376	378
L 9 mainstream supply -@70% of output	111	95	104	156	186	262	287	274
L 10 mainstream supply -@100% of output	41	49	59	51	52	54	56	57
Total Electronic & Electrical Engineering L 8+ mainstream graduate supply	***289***	***294***	***346***	***474***	***612***	***695***	***719***	***709***
Electronic & Electrical Engineering L 8+ job openings	-	1189	1273	1348	1495	1589	1646	1720
Graduate supply as % of job openings	**-**	**25%**	**27%**	**35%**	**41%**	**44%**	**44%**	**41%**
L8+ Total								
L 8/9/10 mainstream graduate supply	1766	2027	2274	2740	3282	3684	3782	3739
Total L 8 ICT Skills Conversion programme graduate output	-	-	705	559	56	-	-	-
Total L8/9 Springboard graduate output	-	**163**	**178**	**359**	**16**	-	-	-
Total L8+ graduate supply	***1766***	***2190***	***3159***	***3658***	***3354***	***3684***	***3782***	***3739***
Total L 8+ job openings	-	5152	5548	5849	6512	6891	7114	7284
Total NFQ L8+ graduate supply as % of job openings	**-**	**43%**	**57%**	**63%**	**52%**	**53%**	**53%**	**51%**

Source: Higher Education Authority

The supply of mainstream ICT NFQ Level 8 ICT graduates is closer to 50% of the potential job openings at level 8+ with the projected supply of computing graduates being significantly greater than electronic and electrical engineering graduates at these levels. Projected output from the Springboard/ICT conversion programmes at major award level in 2013 and 2014 brings the graduate supply to 57% and 63% of the projected level of job openings for these years.

Given the availability of ICT NFQ level 6/7 mainstream graduates, and having regard to the output from the conversion programmes, the supply of graduates from the education and training system would meet almost 100% of the projected job openings at these levels in 2013 and 2014 and thereafter account for about two thirds of the level of potential job openings. It should be noted that a quantum of these would take up ICT user positions. The level and quality of graduates is a critical component in the supply of skills both in meeting the short term increase in demand for graduate hires and over time adding to the stock of experienced professionals. The following two areas provide an additional albeit lesser scale source of ICT skills supply.

Skillnets

Skillnets Ltd is an enterprise-led body funded through the National Training Fund (NTF) to provide companies with new opportunities to develop relevant, effective responses to their training and development needs. Skillnets works within a mandate and Funding Agreement with the Department of Education and Skills (DES) which makes provision for funding from the National Training Fund (NTF) at the discretion of DES within the annual budgetary estimates process (€14.5m in 2013).

Since 2011 Skillnets has supported over 500 jobseekers on a range of ICT programmes developed to meet the specific needs of industry. This includes over 130 people that have commenced the ICT Ireland Skillnet MSc in Applied Software Technology; 90 people on the ISA Software Skillnet Postgraduate Diploma and MSc in Product Management; and over 40 people that have undertaken the ITAG Skillnet Software Testing Conversion Programme. In addition to the above networks which focus exclusively on the ICT sector, many other networks for other sectors e.g. Construction I.T. Alliance or mixed sectoral networks e.g. Digital Media Forum Skillnet are also addressing identified ICT skills shortages for network member companies and employees.

Further Education and Training Awards

It can also be noted that 260 persons gained a QQI -FETAC NFQ Level 6 ICT Award in 2012. These awards are more vocationally orientated and as well as equipping individuals for employment opportunities at this level, they also form a progression pathway for individuals to higher education. There were also 810 persons awarded a QQI -FETAC NFQ Level 5 ICT award in 2012, The Further Education and Training sector spans NFQ levels 1-6. There are a number of providers of further and adult education and training – the main ones being FÁS and the Vocational Education Committees (which are being merged into 16 Education and Training Boards).

In addition, more than 1,600 places are currently being rolled out on courses relevant to ICT, Digital Media, Gaming and Telecommunications under the Momentum programme. The training, which is aligned up to levels 5 and 6 on the NFQ, is targeted at areas of labour market demand and there is a particular focus on the needs of unemployed people under the age of 25.

Chapter 6: Policy Measures Addressing Current and Future Demand for Skills

6.1 Introduction

The availability of high-level ICT skills will play a key role in the competitiveness of the broad Irish ICT sector and in enabling domestic and multinational enterprises to respond to the twin challenges of ICT innovation and global competition. In addition, these skills are necessary to maintain Ireland's attractiveness to FDI. The research for this study has shown that the strong demand for high-level ICT skills is likely to continue in the Central Growth Scenario, and even more so in the Higher Growth Scenario, where the availability of adequate skills is a critical success factor to trigger higher growth. In order to keep up with increasing demand, all potential policy levers will need to be used to improve supply, including:

- Increasing domestic supply, through actions in education, including by building up acceptances to increase graduate output;
- Companies improving the talent development and retention of their ICT professionals, including measures which create a talent flow to support the career path and training of new graduates.
- Investing in targeted re-skilling and skills conversion programmes for job seekers with relevant experience and the right aptitude;
- Promoting inward migration of foreign talent, which in 2012 represented 14.8 % of the current stock of electrical & electronic engineers and 27% of the current stock of programmers and software developers (National Skills Bulletin 2013).

There is consensus amongst stakeholders that no "silver bullet" solution to this challenge is possible and that successfully addressing the strong demand for high-level ICT skills depends on the active collaboration of all the actors in the ICT ecosystem. Encouragingly, two thirds of the enterprise interviewees foresee an increase of their training investments in the near future.

The Government has recognised the challenge of the increasing demand for high-level ICT skills and has already launched several initiatives and plans of action to increase the supply. There is also a planned review of the ICT Action Plan scheduled. This section presents the results of a gap analysis comparing the current Irish policy portfolio with the list of potential actions needed to satisfy the future demand of these skills, which emerged from the research for this study. Based on this analysis, it is possible to highlight and select high priority actions and gaps leading to final recommendations.

6.2 Actions Needed to Satisfy High-Level ICT Skills Demand

Based on the previous analysis presented and the characteristics of the potential demand of high-level ICT skills, a list of actions were identified, clustered along the following main themes:

Education

Attract people to ICT careers

- Attract more females to ICT
- Raise awareness of the attractiveness of ICT careers
- Implement innovative learning techniques and tools (including e-learning)

Increase domestic ICT skills supply from Level 8 upwards

- Increase the numbers of graduates in computing and electronic and electrical engineering, improve acceptance rates and reduce drop-out rates
- Increase the quality/ diversity of skills as required by the new trends in the ICT market

Timing of impact: medium-long term

Measures to implement the above group of actions, which are largely targeted at increasing the supply and quality of ICT graduates from the education system, are provided for in the 2012 ICT Action Plan. Progress in meeting key targets in the plan is ahead of schedule. While a significant number of the actions are being implemented by the education system, enterprise stakeholders are also committed to a range of measures in the Plan to increase awareness of ICT career opportunities. A number of reinforcing and new actions are further highlighted by this research which should inform the review of the Action Plan. Two main strands of action are suggested:

- The first is to increase the attractiveness of ICT careers, with awareness raising and overcoming the gender gap (encouraging more female students to choose computing and electronic and electrical engineering degrees). Furthermore, the use of innovative e-learning tools and approaches could be used to improve the efficiency of teaching and the ease of learning.
- The second is to increase the net supply of high-level graduates and to improve the quality and depth of the subjects offered in this area.

Match ICT Skills Demand and Supply

- Promote innovative curricula and ICT education: align the design and delivery of ICT skills training and education to enterprise needs.
- Promote internships and structured workplace programmes to enhance student's skills and experience of the workplace.

Timing of impact: medium-long term

Matching the demand and supply of new graduates requires constant interaction between the education and training system and the enterprise system in order to bridge the gap between two different perspectives and value systems. Enterprises often complain that the education system is not aligned with their needs, but they can often focus on narrow definitions of skills, tailor-made for their specific requirements, while education institutions must provide a solid base of skills enabling individuals to grow and adapt to different working environments. However, the current paradigm change in the ICT market, towards the Third Platform, requires an effort of transformation and upskilling by the education system, expressed through renewed curricula, greater attention to enterprise demands and perhaps a more flexible approach to teaching. To implement these changes, it is necessary to further develop systematic communication and interaction between the higher education system and enterprises.

Another main source of concern for enterprises is the inability of young graduates to become immediately productive, because of their lack of knowledge and practical understanding of the working environment. From that point or view, the promotion of structured undergraduate workplace programmes and internships to provide students with experience of working environments before the end of the education process is a well-appreciated tool.

Improve Training and Employability

- Improve continuing professional development of individuals and employers upskilling of their workforce.
- Utilise Conversion programmes involving the reorientation of people with the right aptitudes from other related disciplines to ICT.
- Improve ICT professionalism, including through certification and accreditation.
- Promote "training of the trainers" to raise the quality of training and update course contents.
- Foster e-leadership skills, combining both business and ICT skills, digital entrepreneurship skills, and strategic and management skills.

Timing of impact: medium-long term.

An important strand of concrete actions is focused on the development of training and measures improving employability in the context of a life-long learning framework. Given the increasing fluidity of the labour market, individuals must take greater responsibility for the constant updating and adaptation of their skills to demand trends, so that their "employability" remains high. This does not mean that individuals must be solely responsible for organising and carrying the cost of their training, but they certainly must play an active role in looking for and demanding high quality training. The most evident signal of this trend in the ICT sector is the increasing number and variety of skills certification and accreditation schemes, particularly useful in a young industry, where many middle-career practitioners have few formal education titles but strong practical experience.

According to a 2012 survey carried out by consulting company empirica Gmbh on behalf of the European Commission, 30% of European CIOs consider IBTC (Industry Based Training and Certificate) certificates a "must have" for recruitment or promotion of ICT professionals, and an additional 45% of them consider these an asset. The same survey found that 48% of ICT professionals already hold such certificates, with higher proportions in countries, such as the UK and Germany.

A new area of action is fostering the development of so-called "e-leadership" skills, which according to CEN (the European Committee for Standardisation) include the capabilities needed to:

- Exploit opportunities provided by ICT, notably the Internet;
- Ensure more efficient and effective performance of different types of organisations;
- Identify, explore and take advantage of possibilities for new ways of conducting business/administrative and organisational processes; and/or
- Establish new businesses.

The final report of the "E-Skills for Competitiveness and Innovation" study recently produced for DG Enterprise of the European Commission by empirica, IDC and INSEAD, specifies that: "E-leadership is a type of leadership, distinguished by the type of goal that needs to be accomplished and what resources a leader must coordinate and align. In the case of e-leadership, both the goal and the resources involve using ICT. Examples of e-leaders may include a Chief Marketing Officer responsible for using social media to enhance promotion and the customer experience, a Chief Information Officer, a Chief Enterprise Architect, a relationship manager between IT and a business unit, or a founder of an enterprise that relies on ICT to operate and innovate. Effective organisations are

demanding e-leaders with a T-shaped portfolio of skills, representing expertise in both using ICT and developing organisations".

This description points out a growing demand posed on CIOs by the business environment, which highlights the increasing need of upskilling for top level and second tier managers, as well as the importance of providing a sound managerial and technical skill basis to young talent in the ICT sector.

The development of foreign languages proficiency among ICT professionals would be valuable especially for the localisation of products and services.

Attract and Retain Talent from Abroad

Finally, an important set of actions that be found as practice in other countries, concern the ability to attract and retain ICT talent from abroad. These measures can be subdivided into the following four areas of action:

Attraction Measures

- General Visas and Employment Permits
- Points based system of immigration
- Specific high-skilled IT visa for international students
- Labour shortage list/Labour Market Test
- Work Experience Programme/Graduate Visa

Development of Points of Contact

- Government websites
- Career Fairs

Post Immigration Assistance Initiatives

- Government language assistance
- Migrant assistance
- Integration courses

Other Incentives

- Tax incentives
- Other incentive programmes

Gap analysis of Current Measures

The following tables present a gap analysis between the actions needed to satisfy the strong high-level ICT skills demand forecast in this study, and the key policy initiatives currently being pursued. The main goal is to identify, which actions are already planned or in place and which are missing. The policy measures are listed in the left column while the actions are in the top rows. A cell with a tick shows where an action is covered by a policy measure. The bottom rows of the tables show how many times the action indicated in a column is covered by policy initiatives. This should be

considered only as an indicative count, since it is not possible to compare policy initiatives of different size, timing and relevance.

The gap analysis is based on two policy plans that have been selected because they are directly related to ICT skills, leaving out the general policy programmes not specifically focused on the ICT issue:

- ICT Action Plan 2012;
- Action Plan for Jobs 2013.

For the Action Plan for Jobs 2013, the policy initiatives selected are specifically addressed to ICT skills. To assess the policy initiatives, they have been classified by the type of actions needed in order to satisfy the ICT skills demand; the actions' content are explained in the above section.

The ICT Action Plan 2012 (see Table 12 below) includes two main groups of initiatives. One is addressed at conversion and up-skilling actions to increase the domestic supply of high-level ICT skills in the short term period, 2012-2014, through the provision of accredited education and training programmes developed in collaboration with enterprise and delivered by public and private higher education providers.

The second group of initiatives in the Plan are aimed at ensuring an increasing output of appropriately skilled graduates from the education system in the medium-term period, 2015-2018.

Table 12: Actions Needed vs. ICT Action Plan 2012

Actions needed to satisfy forecasted demand													
	Education						Matching skills demand and supply		Training and employability				
Key Policy Document	Attract people to ICT careers				Increase domestic supply								
ICT Action Plan 2013	Women	Raising awareness	Incentives to study STEM/ ICT	Innovative learning	Number	Quality	New learning / align HEI & enterprises	Internships workplace experience	Continued learning, staff upskilling	Conversion to ICT	Improving ICT expertise	Training the trainers	Fostering e-leadership skills
Upskilling													
Springboard					∫	∫	∫	∫		∫	∫		
Jobbridge Program								∫					
Level 8 Conversion Program					∫	∫	∫	∫		∫	∫		
Graduate Skills Conversion Program					∫	∫				∫			
Skillnets					∫	∫	∫		∫				
Attraction													
Bonus Points for Maths			∫			∫							
Promotion of career opportunities	∫	∫	∫		∫	∫	∫						
Transition Year		∫						∫					
Scratch Programme							∫					∫	
Project Maths			∫	∫		∫							
CPD for 2nd level teachers									∫		∫	∫	
Numeracy and Literacy Strategy						∫					∫		
HEI streamlined programmes						∫							
ICT Foresight Group		∫					∫	∫					
Undergraduate work placements		∫						∫					
Retention measures					∫	∫							
Alternative ICT path for drop-outs			∫		∫								
TOTAL	**1**	**4**	**4**	**1**	**7**	**10**	**6**	**6**	**2**	**3**	**4**	**2**	**0**

The Action Plan for Jobs 2013 includes six groups of initiatives, which are relevant for improving the supply of high-level ICT skills and filling demand gaps (see Table 13).

The strategic initiative for Big Data includes the development of an Industry-led Technology Centre in the field and research investments, which will help to create R&D and technology skills in the area. Actions to map Big Data skills gaps and then leverage the Conversion Programme foreseen by the ICT skills plan to fill the gap will also help to increase supply. The launch of an Irish Centre for Cloud Computing and commerce with a capacity-building programme will increase the demand for cloud skills, and will also offer opportunities to train and develop such skills.

A measure in the Action Plan for Jobs 2013 which is relevant for employee upskilling is to promote ICT professionalism through the European E-Competence Framework, which can support the certification and recognition of skills in this area. This is a positive initiative to align the Irish labour market with main EU trends.

Other measures, specifically those contained in Job Plus, within the Action Plan for Jobs 2013 (which are not listed in Table 13) concern measures to reduce unemployment, particularly long-term and youth unemployment.

Three measures appear particularly interesting for the ICT sector needs. They are:

- The promotion of upskilling management in enterprises and encouraging them to manage talent better. This is not simply encouraging training; this addresses the need by enterprises to be more aware and effective in managing HR, which can attract, support and retain the best resources, both within Ireland and from other countries. As indicated in this study, upskilling is one of the main ways to fill skill gaps in the short term. An Accenture study for example provides specific indications and recommendations to do so ("Filling the Skills Gaps in Ireland, 2012).
- Promoting a foreign language education policy. The interviewed stakeholders for this study indicated this as a major need.
- Enhance public-private sector workers' mobility: even if it is often overlooked, promoting mobility in the internal labour market is an important tool to deal with demand-supply mismatches. Concerning ICT, the public sector has traditionally been less attractive for highly skilled ICT professionals, who are needed to keep pace with the new technology developments (e.g. cloud computing, Big Data, etc.). Promoting flexibility would help ICT professionals to move between the private and the public sector markets and enhance upskilling. Again, this flexibility is one of the best tools to solve short and medium term skill gaps.

Finally, the gaming industry had asked for a specific development initiative ("promote a coordinated and industry informed approach to continuous professional development for the games industry, utilising both public and private higher education and training providers as appropriate", from the 2011 report The Games Sector in Ireland: An Action Plan for Growth). The plans reviewed here do not include this, even if general gaming industry requirements for multi-lingual and digital marketing skills development are more or less covered in the ICT Action Plan.

Table 13: Actions Needed vs. Action Plan for Jobs 2013

Actions needed to satisfy forecasted demand													
	Education						Matching skills demand and supply		Training and employability				
Key Policy Document	Attract people to ICT careers				Increase domestic supply								
Action Plan for Jobs 2013	Women	Raising awareness	Incentives to study STEM/ ICT	Innovative learning	Number	Quality	New learning/align HEI & enterprises	Internships workplace experience	Continued learning, staff upskilling	Conversion to ICT	Improving ICT expertise/ certification	Training the trainers	Fostering e-leadership skills
Ireland Leader in Big Data													
Critical R&D Mass						√	√						
Industry-led tech centre D/Analytics						√	√						
Fund S&T research						√	√						
Map & Address Big Data Skills gaps		√			√	√							
Use Conversion Programme to develop B/D skills					√	√			√	√			
ICT Skills													
Promote awareness of ICT Action Plan		√	√		√	√	√	√					
Improve awareness of ICT Conversion		√								√			
Promote ICT Professionalism through EU e-CF		√							√				
Align Education & Enterprise Needs													
Review of Apprenticeship								√					
Momentum Prog					√	√	√	√					
Promotion of Mgt upskilling				√		√			√				
Promote foreign language education policy						√							
Enhance public-private sector workers mobility						√	√		√				
Irish Centre for Cloud Computing/ capacity building					√	√	√	√					
TOTAL	0	4	1	1	5	11	7	4	4	2	0	0	0

Source: IDC 2013

Overall, the policy initiatives implemented to meet the demand for ICT skills are mainly focused on education, with 49 out of the 89 initiatives targeting the education system. Of these, 33 are targeted at increasing the domestic supply – both in terms of quantity and quality. The policy plans examined are less focused on training and employability, with 17 initiatives addressing training and employability goals.

Enterprises have a key role to play in actively developing and managing their ICT skills and talent to support their business growth and employment. Given that actions aimed at the mainline education system generally deliver results in the medium to long term, training driven by enterprises may impact more in the short to medium term. Enterprise-level training activities and the improved management of ICT professional career paths would also increase the attractiveness of ICT careers. It is also worth noting that based on the interviews conducted that a majority of enterprises surveyed are expecting their training budgets to increase. Consequently, a supporting policy built around maximising the level of enterprise – led training activities could accelerate the effects of the training initiatives companies are planning.

Although the Irish public initiatives meet a wide range of the actions needed, there are three types of actions where public initiatives are lacking as shown in Table 14:

- Initiatives addressed at attracting women to the ICT profession;
- Initiatives managed through innovative learning, including e-learning;
- Initiatives addressed to developing e-leadership skills.

Developing e-leadership skills is one of the most relevant actions to consider since many ICT innovation trends require skills that can provide a bridge between technology and business to a greater degree than previously to develop new solutions and offerings. Many trends also require deeper insight into business processes. Consequently, multi-disciplinary skills that can manage increasingly complex processes are becoming more and more in demand.

Most of the advanced innovation trends of the Third Platform, including the “Internet of Things”, which is part of the vertical specific solutions developed on the basis of the Third Platform, will require a pool of talent with a combination of ICT skills expertise and soft skills such as project management capabilities, collaboration, problem solving, and communication skills.

Table 14: Gap Analysis of Policy Measures: Summary Table

	Actions needed to satisfy forecast demand												
	Education						Matching skills demand and supply		Training and employability				
	Attract people to ICT careers				Increase domestic supply								
Policy Measures	Women	Raise awareness	Incentives to study STEM/ ICT	Innovative learning	Number of skills	Quality of skills	New learning/align HEI & enterprises	Internships workplace experience	Continued learning, staff upskilling	Conversion from other disciplines/occupations to ICT	Improving ICT expertise/ certification	Training the trainers	Fostering e-leadership skills
TOTAL	**1**	**8**	**5**	**2**	**12**	**21**	**13**	**10**	**6**	**5**	**4**	**2**	0

Source: IDC, 2013

Finally, initiatives addressed at attracting international talent were assessed, based on a review carried out by Forfás of the range of inward migration tools used by several countries. These are important initiatives, as confirmed by the interviewees, since the attraction of international talent, including expatriate talent, is a valuable source of skills for Ireland. Table 15 shows that Ireland has a wide portfolio of tools sustaining the attraction of international talent. It is useful looking at them by type and comparing them against key actions identified in the Forfás Paper which assessed policies and actions being taken by several countries to attract and retain international ICT talent.

Attraction Measures

Attraction measures mainly include tools used to provide entry permits. Ireland's "toolbox" includes the Green Card Employment Permit, which can be obtained for high-skilled occupations where

High-level strategic skills shortages exist such as ICT professionals, professional engineers and technologists. Green Card Employment Permits are issued to the employee in respect of permanent job offers or an offer of two years duration and not subject to a labour market needs test. They are available for all occupations, other than those deemed ineligible, where the annual salary is €60,000 or more and for specified strategically important occupations salaried between €30,000 and €60,000. A named employer and specific occupation is required on the application. Work Permits Employment Permits are issued to the employee for occupations, unless otherwise specified, with a salary level generally above €30,000, and with a remuneration figure lower than the €30,000 in respect of

- Applicants in respect of specialised language support and technical or sales support with a fluency in a non-EEA language for companies with formal support from State Enterprise Development Agencies;

- A non-EEA student who has graduated in the last 12 months from an Irish third level institution, and has been offered a graduate position from the highly skilled occupation list;
- A non-EEA student who has graduated in the last 12 months from an overseas third level institution and has been offered a graduate position as an ICT professional from the High Skilled Occupational list.

Work Permits Employment Permits are subject to a labour market test and are linked to a job offer of less than two years duration. They can be renewed for up to further three years duration.

Table 15: Gap Analysis of ICT Talent Attraction Measures

Key International Actions identified in Forfás Paper												
	Attraction						Point of Contact	Post Immigration Assistance			Other Incentives	
	General visas	Point-based system	Specific high-skilled/ ICT visa	LSL/ LMT	Work experience programme/ graduate visa	Government websites	Career fairs	Government language courses	Migrant assistance	Integration courses	Tax schemes	Other initiatives/ programmes
Current Irish Skills / Talent Attraction Measures												
Green Card Scheme			√	√								
Hosting Agreement			√									
Work Permit	√											
Intra-Company Transfer				√	√							
Graduate Scheme					√							
Irish Naturalisation and Immigration Service (INIS)						√						
Dept. of Jobs, Enterprise and Innovation						√						
Dept. of Foreign Affairs						√						
Enterprise Ireland "IT'sHappening Here.ie"						√						
Private Immigrant Advocacy Organisations									√			√
Office for Promotion of Migrant Integration									√			√
Vocational Educational Committees								√				
Pilot Executive Tax Relief Scheme											√	
TOTAL	1	0	2	2	2	4	0	1	2	0	1	2

Source: IDC, 2013

Legend: LSL = Labour shortage list; LMT = Labour market test

Several changes have made recently (from April 2013) to improve the operation of the Employment Permit system. These changes include:

- A streamlining of the employment permit application form.
- A speeding up in the time to process applications.
- A more coherent service across both the Employment Permits regime and the Visa regime.
- An updating of the highly skilled occupation list.
- A reduction in the advertising period for a vacancy before it becomes eligible.
- An updating of the ineligible categories of employment for employment permits to cater for particular shortages in a non-EEA language.

The ambition is to increase the attractiveness of the employment permits regime resulting in 700 additional permits for the ICT sector in 2013 (in addition to the 1,200 permits issued in 2012).

The Action Plan for Jobs 2013 recognises that the current entry system has some limitations and in the area of ICT skills has identified a series of measures (listed in Table 16) mainly aimed at streamlining, improving and providing more flexibility to the employment permits system. An interesting suggestion for example is to create a "trusted partner" system, where potential employers could pre-qualify, thereby being able to recruit quickly from abroad when needed. More generally, the Action Plan for Jobs points out the need to align the employment permits system more closely to enterprises' needs. This need emerged as well from our stakeholder interviews.

In addition, the Action Plan for Jobs identifies actions to update programmes to incentive immigrant entrepreneurs willing to launch Start Ups.

Table 16: Other Talent Attraction Measures Planned in the Action Plan for Jobs 2013

Action Plan for Jobs 2013
ICT Skills/Talent Attraction /Employment Permits
Improve efficiency of employment permits process (e-forms, simplification, performance audit..)
Periodically align/update Employment Permits with demand trends
Allow more economic sectors to ask for ICT professionals/have access to employment permits
Wage threshold limit reduction for permits in key areas
Simplify labour market need test; expand eligibility criteria for residency permissions.
“Trusted partner” system pre-qualify potential employers
Communication campaign about entry options (permits, visa)
Align Skills with Enterprise Needs
Revise employment permit schemes to provide better support of the economy’s evolving skills needs
Developing and Deepening the Impact of FDI
Review the operation of the new Immigrant Investor and Start Up Entrepreneur Programme

Source: Action Plan for Jobs 2013

Points of Contact

This concerns the list of websites where interested foreign professionals may find information and practical advice about migration to Ireland. Some countries (such as Singapore and Australia) have overseas offices as well as web contacts. Ireland has multiple contact points on the web, though we are not able to assess their coordination and user-friendliness. A minority of countries (not Ireland) uses Career or Employment Fairs, most of them specifically targeted at certain sectors (Australia's "Skills Australia needs Expos" or "Contact Singapore" job fairs in universities). They appear to be efficient tools for attracting specific categories of expertise, and certainly more proactive than official websites. If Ireland wants to become more aggressive in attracting inward migration or filling specific gaps, this option should be considered.

Post-Immigration Assistance

These measures concern the follow-up and support of immigrants and their families. Most countries provide national language courses. A few of them (e.g. Germany and the US) provide integration courses to assist in the retention of foreign talent. The Department of Education and Skills provides English classes for adult migrants. Ireland has several Private Immigrant Advocacy Organisations, which provide legal services, or courses on immigrant rights. There is an Office for Promotion of Migrant Integration, which mainly provides information and organises Intercultural Forums.

Other Incentives

Several countries use special tax schemes to attract highly skilled labour (e.g. Canada, Denmark, and Sweden). Ireland has introduced a pilot tax relief scheme for highly paid executives with skills that are not available in Ireland. The need to use tax incentives and other incentives to attract high profile immigrants has been underlined by the stakeholder interviews.

There are other options which might be explored by Ireland: for example programmes to attract/retain experienced workers. Singapore's "Workforce skills qualifications" programme for example offers experienced professionals on the job training to further their skills in order to retain them in the country.

Chapter 7: Conclusions and Recommendations

The results from this Study show that Ireland is likely to face an average increase in demand for high-level ICT skills of around 5% per annum out to 2018. The range of technology skills that will be needed is broad and employers will seek to meet this demand through hiring new graduates as well as experienced people, also from abroad. The interviews with the stakeholders clearly show this mixed approach to meeting the skills demand. It is positive that enterprises are not only looking for experienced staff but also new graduates that they can train and bring onto a career path. Technologies are changing fast and therefore so are the demand for specific technology skills.

Consequently, a strong core technology education will form a good basis for future technology skills to be developed. The wide range of measures adopted by the Government through the ICT Action Plan and the Action Plan for Jobs is already delivering a significant increase in the supply of ICT graduates. At the same time, the demand for high-level ICT skills continues to increase both in terms of the numbers required and the right skillsets. It seems clear that the demand must be met with the current measures both for educating and re-skilling employees and for attracting talent from abroad. There is no “silver bullet” solution to this challenge. All of the potential policy levers available to increase the supply of ICT talent will need to be fully utilised and their respective contribution reported on an on-going basis. Their successful implementation will require the collaboration of all relevant actors.

Many policy actions already exist to address both education and inward migration needs, including actions on the part of industry to promote awareness of ICT career opportunities to young students and their parents. The Study has confirmed that enterprise stakeholders are keen to play an active role in engaging further with education institutions in terms of curricular development as well as awareness raising. It is also positive that enterprises expect to increase training budgets in recognition that continuing professional development has a key role to play for development of new technologies. However, since Ireland has strong ambitions of "punching above its weight" in the international ICT markets, more is needed. Although this study has established as its Central Growth Scenario "Fighting to Stay on Course", it is possible that Ireland could realise the Higher Growth Scenario for some segments of the Broad ICT sector.

Ireland is not well placed to go head to head with low cost locations to compete for high-volume, commoditised ICT services. Ireland needs to play to its creative, innovative and highly educated ICT talent and create centres of expertise at that level instead; in short, compete on knowledge and quality - not cost alone. However, this of course has implications on the lead-time for developing the skills that will be needed: highly educated and experienced, as shown by the increasing demand for Level 8+ skills. Consequently, a range of different approaches will continue to be needed: the building up supply of future graduates; retraining experienced staff from other occupations (or perhaps with outdated technology skills); attracting the diaspora, and overseas talent. In the longer term there is a need to continue to transform both the primary and secondary level education system to ensure a stronger stream of domestic ICT skills. The vision should be for Ireland to continue to be an internationally renowned location for ICT skills/ talent availability to drive business and employment growth, and to attract mobile inward investment. Recognising that

implementation of a number of these actions is already underway, including the development of the STEM skills pipeline within the education system at primary and secondary level, the following set of recommendations are made. They are denoted by time-period for implementation: Short-Term (1-2 years) and Medium-Term (3-4 years), and by whether they are a proposal for a new action or reinforcing an action already underway.

1. Review the scope and governance of the ICT Action Plan
▪ As part of the planned review of the ICT Action Plan, review its scope to encompass all sources of ICT skills supply and ensure clarity of responsibilities for the overall coordination and implementation of actions. Report on the progress of the updated ICT Action Plan on a half-year basis to the Minister for Education & Skills and Minister for Jobs, Enterprise and Innovation. (new action) **Time frame:** Short-term. **Lead:** Department of Education and Skills, Department of Jobs, Enterprise and Innovation.

2. Boost the Quantity and Quality of ICT Skills Output
▪ Ensure third level Computing and Electronic/Electrical Engineering programmes remain focused on the development of the core technology skills that enterprises need in line with internationally accepted curricula, allowing for sub-specialisation in years 3 and 4. Support the development of softer skills including teamworking, collaboration, problem solving and communications. Establish a timetable for implementation. (reinforcing action) **Time frame:** Short-term. **Lead:** Universities/IoTs, Higher Education Authority.
▪ Review and streamline where required existing internship programmes each with differing requirements. Expand the volume of structured ICT undergraduate internships opportunities in line with the planned increase in domestic supply and explore ways to increase the absorptive capacity of enterprises, particularly indigenous companies (new action) **Time frame:** Short-term to Medium-term. **Lead:** HEA, Employer Bodies, Companies, IDA Ireland, Enterprise Ireland.
▪ Run additional iterations of the NFQ Level 8 Conversion programme starting in 2014 as a strategic response to meeting ICT skills demand. Change eligibility criteria for the retention of social welfare payments while on the programme back from 9 months in a 12 month period to 3 months. Jobseeker register data should be "mined" to identify and inform suitable candidates of conversion opportunities. Draw upon international best practice including the "IT 50 plus initiative" in Denmark and the "Nokia Bridge Programme" in Finland. (reinforcing action) **Time frame:** Short-term to Medium-term. **Lead:** Department of Education and Skills, HEA, Department of Social Protection.

3. Inspire Future Talent
▪ Attract more talent with the right aptitude to careers in ICT, especially women. Strengthen advocacy and career advice provided to young people, especially girls, at second level – and to their parents on the range of rewarding ICT career opportunities available. Establish and report on initiatives to raise female acceptances on ICT programmes from 15% to 25% by 2018. Draw upon the best practice to attract more females i.e. Austria's "Women in Technology" programme, Denmark's "National Pact for Women in ICT"; annual events such as EU initiative "Cyberellas are IT" and International Telecommunication Union "girlsinict" portal and other programmes, Dell (WITEM) Accenture, Intel, Microsoft and Coder Dojo. (reinforcing action) **Time frame:** Short-term to Medium-term. **Lead:** Science Foundation Ireland (Discover Science & Engineering), HEA, ICT Ireland, Engineers Ireland, Companies.
▪ Organise one-day ICT skills events and practical workshops, with ICT skills competitions for different ages, to raise overall awareness and to attract undiscovered talent of all ages to ICT careers, including those pursuing non-formal entry to ICT careers. (new action) **Time frame:** Short-term. **Lead:** Employer Bodies, Companies, Science Foundation Ireland (Discover Science and Engineering).

4. Promote Ireland Internationally as the Centre for Global ICT Talent
▪ Establish a single website with public and corporate involvement to attract international ICT talent - building on the best of existing websites and balancing the needs of both indigenous and FDI companies. It should draw upon the example of the "Make it in Germany" and "Contact Singapore" portals. Utilise the EURES system more fully for the sourcing of experienced ICT professionals from within the EU/EEA area[25]. (new action) **Time frame:** Short-term to Medium-term. **Lead:** IDA Ireland, Enterprise Ireland, Companies, Dept of Social Protection (EURES).
▪ Organise career fairs abroad to attract back expatriate ICT talent and high-level ICT talent in locations with a surplus of ICT skills. Such career fairs should be focused around a group of companies with actual jobs to fill. The potential use of Irish embassies abroad could be considered for such events.(new action) **Time frame:** Short-term to Medium-term. **Lead:** Enterprise Ireland, IDA Ireland, Dept of Social Protection (EURES), Companies.

[25] For June 2013, there were 80 vacancies for computer professionals for Ireland posted on the EURES Job Mobility portal, compared to 23,700 such vacancies for the UK : Source : http//eures.europa.eu

5. Addressing the Skills Challenge
▪ Enterprises to move further towards being "skills producers" of talent including the development of experienced employees and the career pathways of new graduate entrants. ICT talent management and retention systems should be advanced for attracting and retaining the best ICT talent, from both within Ireland and from other countries (Engineers Ireland Continuing Professional Development Programme is a best practice example). An annual advanced ICT talent management and retention seminar should be run to share best practice among companies in upskilling and HR talent management. (new action) **Time frame:** Short-term to Medium-term. **Lead:** ICT Ireland, Engineers Ireland, Companies.
▪ Build up ICT skills learning platforms by public and private bodies which provide for on-line training at various levels for ICT professions, students and unemployed persons - including for industry-based training and certification aimed at up skilling ICT practitioners and retraining career changers. This should provide modules and programmes at various levels, up to Master's Degree. This will help to foster ICT as a profession. (new action) **Time frame:** Short-term to Medium-term. **Lead:** Universities/IoTs, Skillnets, SOLAS/ Education & Training Boards, Companies.
▪ Establish initiatives to develop e-leadership professional skills (persons with deep expertise in ICT with competence in leadership and management) to drive increased business value and innovation from the creative application of ICT within enterprises – in collaboration between third level institutions and enterprise. Draw upon learning at a European level (e.g The software Campus in Germany, IT-Vest in Denmark and the UK Cranfield IT Leadership programme). (new action) **Time frame:** Medium-term. **Lead:** Universities/IoTs, Irish Computer Society, Companies.

6. Maintain the ICT skills development capacity of Higher Education Institutions
▪ Invest in maintaining the ICT skills development capacity of HEIs. This should include up-grading and maintaining the laboratory infrastructure to an up-to-date industrial standard. Create opportunities for existing ICT teaching staff to continually develop their knowledge of the latest technology trends through collaboration between institutions and enterprise; including for short in-service courses. (new action) **Time frame:** Medium-term. **Lead:** Universities/IoTs, HEA, Companies.

Appendix 1: Members of the Steering Group

Tony Donohoe (Chairperson)	IBEC
Bill Doherty	EMEA Cook Medical
Joe Hogan	Openet Telecom
Jarlath Dooley	Version 1
Regina Moran	Fujitsu
Peter Cosgrove	CPL
John Blake	Microelectronic Industry Design Association
Jennifer Condon	Enterprise Ireland
Garrett Murray	Enterprise Ireland
Donal Flavin	IDA Ireland
Joan Mulvihill,	Irish Internet Association
Muiris O'Connor	Higher Education Authority
Gerard Lyons	NUIG
Barry Feeney	Institute of Technology, Tallaght
Aidan Harney	Engineers Ireland
Marie Bourke	Forfás
Gerard Walker (project manager)	Forfás

Shauna O'Reilly, Intern, Forfás, assisted the work of the Secretariat.

Appendix 2: Members of the Expert Group on Future Skills Needs

Una Halligan	Chairperson
Marie Bourke	Head of Secretariat and Department Manager, Education, Skills and Labour Market Policy, Forfás
Inez Bailey	Director, National Adult Literacy Agency
Peter Baldwin	Assistant Secretary, Department of Education and Skills
Ray Bowe	IDA Ireland
Liz Carroll	Training and Development Manager, ISME
Ned Costello	Chief Executive, Irish Universities Association
Margaret Cox	Managing Director, I.C.E. Group
Bill Doherty	Executive Vice President, EMEA, Cook Medical
Tony Donohoe	Head of Education, Social and Innovation Policy, IBEC
Bryan Fields	Director, Curriculum Development / Programme Innovation, FÁS
Sonia Flynn	EMEA Director for User Operations, Facebook
Anne Forde	Principal Officer, Department of Education and Skills
Joe Hogan	Founder, Chief Technology Officer and Vice President Openet Labs & IP Management
Jerry Moloney	Director of Skills, Enterprise Ireland
Frank Mulvihill	Former President of the Institute of Guidance Counsellors
Brendan Murphy	President, Cork Institute of Technology
Dermot Nolan	Department of Public Expenditure and Reform
Alan Nuzum	CEO, Skillnets
Muiris O'Connor	Higher Education Authority
Peter Rigney	Industrial Officer, ICTU
Martin Shanagher	Assistant Secretary, Department of Jobs, Enterprise and Innovation
Martin D. Shanahan	Chief Executive, Forfás
Jacinta Stewart	Chief Executive, City of Dublin VEC

Appendix 3: Recent Publications by the Expert Group on Future Skills Needs

Report	Date of Publication
National Skills Bulletin 2013	July 2013
Monitoring Ireland's Skills Supply: Trends in Education and Training Outputs 2013	July 2013
Future Skills Requirements of the Manufacturing Sector to 2020	April 2013
The Expert Group on Future Skills Needs Statement of Activity 2012	April 2013
Guidance for Higher Education Providers on Current and Future Skills Needs of Enterprise: Springboard 2013	February 2013
Vacancy Overview 2012	February 2013
Regional Labour Markets Bulletin 2012	January 2013
Monitoring Ireland's Skills Supply: Trends in Education and Training Outputs 2012	July 2012
National Skills Bulletin 2012	July 2012
Key Skills for Enterprise to Trade Internationally	June 2012
EGFSN Statement of Activity 2011	April 2012
Vacancy Overview 2011	February 2012
Guidance for Higher Education Providers on Current and Future Skills Needs of Enterprise (Forfás report based on EGFSN identified future skills needs)	February 2012
Addressing High-Level ICT Skills Recruitment Needs: Research Findings	January 2012
Monitoring Ireland's Skills Supply: Trends in Education and Training Outputs	July 2011
National Skills Bulletin 2011	July 2011
EGFSN Statement of Activity 2010	May 2011
Developing Recognition of Prior Learning: The Role of RPL In the Context of the National Skills Strategy Upskilling Objectives	April 2011
Vacancy Overview 2010	March 2011
Future Skills Needs of Enterprise within the Green Economy in Ireland	November 2010
Future Skills Requirements of the Biopharma-Pharmachem Sector	November 2010
Monitoring Ireland's Skills Supply - Trends in Education and Training Outputs 2010	July 2010
National Skills Bulletin 2010	July 2010
Future Skills Needs of the Wholesale and Retail Sector	May 2010

Appendix 4: Terms of Reference

Introduction

The Study will focus on projecting the future demand (over the period 2013 – 2018), for high-level ICT Skills (quantity, quality and diversity) arising both within (a) the ICT sector and (b) across other sectors of the economy. A related objective will be to identify any additional tailored measures which could be introduced to enhance the domestic skill supply of high-level ICT talent and help retain and attract high –level ICT talent.

Background

Against a background of increasing demand by IDA and EI clients companies for people with high-level ICT skills in the ICT sector in 2011, the EGFSN conducted research into identifying the then current high-level ICT skills recruitment difficulties, the nature of the skills difficulties, and the supply of those with high-level ICT skills. This resulted in the launch of the Governments ICT Action Plan – Meeting the high-level skills needs of enterprise in Ireland. This plan focuses on the supply side and contains targets to double the domestic output of ICT NFQ level 8 graduates by 2018, to better align course provision, to reduce drop-out rates and to introduce an NFQ Level 8 Conversion Programme to help address current shortages.

High-level ICT skills demand growth is being driven by (a) an expansion in existing companies (b) a continuing flow of inward investment, (c) the formation of new enterprise start-ups, (d) a shift within sectors towards more high value-added activities, and (e) through technological convergence business opportunities, such as for cloud computing, digital media, energy efficiency, e-health and 'big data' analytics activities.

A substantial part of current domestic demand for high-level ICT skills is being satisfied through inward migration. Companies are sourcing approx. 55% of their high-level ICT skills needs (for expansion and replacement needs) through inward migration, although with increasing difficulty, as these skills are also in high demand globally. A main recruitment difficulty is for ICT professionals with several years' experience and for personnel with ICT and native language fluency skills.

Objectives of the Study

The main objective of the Study is to assess the demand over the period 2013 – 2018, for high-level ICT skills (specifically for computer engineers, electronic engineers and those with a combination of high-level ICT and business / analytic / foreign language skills) across the whole economy. There will be a specific focus on the ICT sector - given that it is the major employer of such skills (employing on average 65 % of such high-level ICT skills). A related objective is how Ireland can retain and attract high-level ICT skills to address immediate high-level ICT skills recruitment needs.

Methodology

The demand forecast exercise

This element of the Study will present three plausible demand forecast scenarios for high-level ICT skills from within (i) the ICT sector and (ii) across other sectors of the economy, over the period

2013 – 2018. Each of the three scenarios will depict credible futures for the demand for high-level ICT skills founded on key drivers and trends and derived in a logical and deductive way. The bandwidth between the two more 'extreme' scenarios should be interpreted as indicative of the degree of uncertainty in terms of the assumptions being made. There will be one central scenario proposed that is anticipated most likely to occur.

The baseline for each scenario will be the level of demand for 2012. Each of the scenarios will forecast the annual level of demand for high-level ICT skills (for NFQ levels 6/7 and levels 8/9/10) broken down by (i) expansion demand and (ii) replacement demand for people with the following skills:

(a) Computing engineering skills (including computing software engineering and computer programming and multi-media gaming with a substantial computing content), and;

(b) Electronic & electrical engineering skills (including communications and mechatronics and electronic/computing engineering).

The analysis will also encompass roles of a comparable level requiring a mix of technical and business/analytic/foreign language skills.

The development of the demand forecast scenarios will be based on a mapping of the main international trends and key drivers of change impacting on the level and nature of skill demand. The skill demand forecast exercise will also include, for the central scenario proposed, an outline of the current and emerging skillsets & competences for the above defined occupational categories.

The qualitative research exercise

The aim of the qualitative exercise is to inform the shaping of the skills demand forecast scenarios and to identify emerging skillsets and competency requirements for high-level ICT staff. The exercise will consider the nature of the demand for ICT and related skills at (i) NFQ levels 6&7 and at (ii) NFQ Levels 8/9/10 and whether there are any current skillset gaps, and if so, proposals around how these might be addressed, including the continuing professional development of those at work.

This exercise will also elicit information on the scale and nature of high-level ICT skills recruitment from abroad and proposals for any additional measures to attract and retain ICT talent, especially for ICT professionals with several years' experience. Forfás has produced a concise scoping document which examines measures in place across several countries aimed at attracting overseas talent. This will be made available to the successful tenderer.

It is proposed that this qualitative research will comprise:

- Interview surveys by telephone with approx. 40 enterprises selected from across different sectors of the economy that employ a high percentage of high-level ICT staff.
- Interview surveys (by meeting / or telephone) with twenty key informants.
- Discussions with companies and key informants at two workshops – one to be held in Dublin and one in Cork.

The Government ICT Action Plan, Meeting the high-level skills of enterprise in Ireland[26] contains domestic ICT NFQ level 8 graduate outflow projections for the period 2012–2018. This includes a plan to double graduate output from 1,000 to 2,000 by 2018 and the generation of additional output from up-skilling and conversion actions. This Study will replicate the projected domestic high-level ICT graduate outflow and any additional supply side forecast analysis made available from the HEA within the Study timeline.

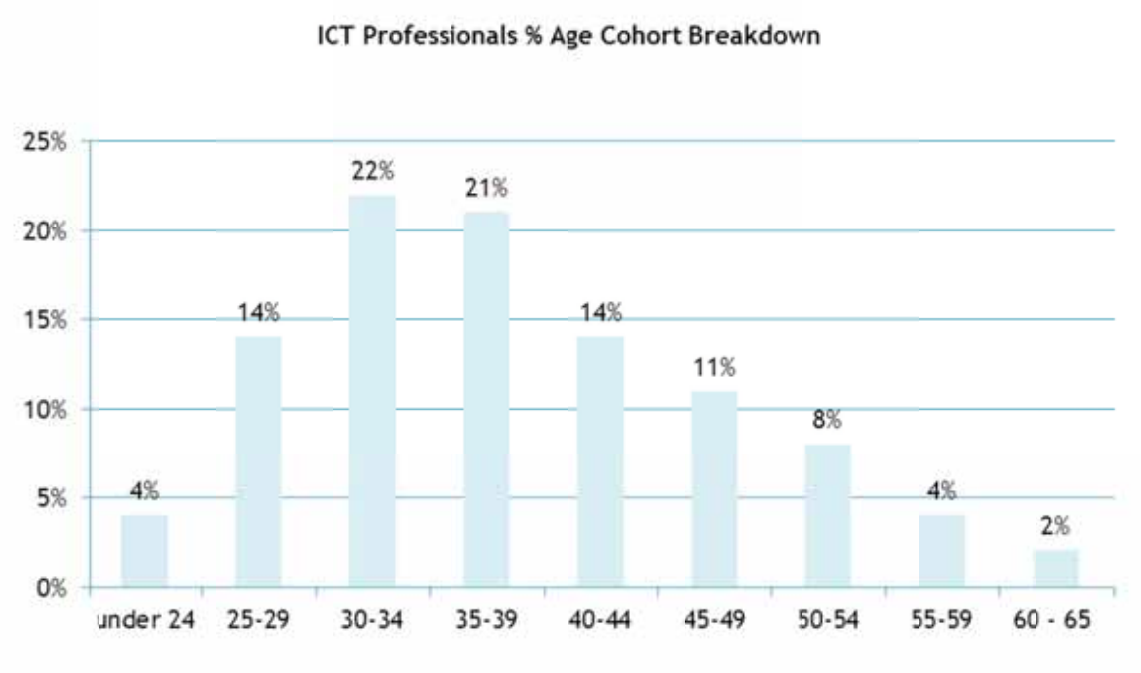
Outputs

A report (80-90 pages-excluding appendices), with an Executive Summary, presenting the following:

- Annual demand forecast scenarios for (a) computer engineering skills and (b) electronic & electrical engineering skills arising from (i) the ICT sector and (ii) across other sectors of the economy - for over the period 2013-2018. There will be one central skill demand forecast scenario proposed that is anticipated most likely to occur.
- The implications of the central skill demand forecast scenario for emerging skillsets and competences for computing engineering and electronic/electrical engineering occupations
- (including roles requiring a mix of comparable technical and business/analytics/foreign language skills).
- Identification of any additional tailored measures:
- that could enhance the domestic skill supply of high-level ICT and related skills output (quantity, quality and diversity of skills required) over the period 2013-2018 - including the continuing professional development of those at work.
- that could be introduced for attracting and retaining high-level ICT and related skillsets (from within and outside the EEA) over the period 2013-2018.
- Assessment of the current stock and scale and nature of high-level ICT skills recruitment flows from abroad - both from the European Economic Area (EEA) and outside the EEA.
- Recommendations made will advise on optimising the use of existing resources – both Government and the private sector.

[26] http://www.hea.ie/files/ICT_AP.pdf

Appendix 5: Age Profile of ICT Professionals - 2011



Source: Forfás

Appendix 6: National Skills Bulletin 2013

The following difficult to source ICT skills were highlighted in the National Skills Bulletin 2013

- Web developers with high-level skills and experience
- Cloud computing specialists, spanning a range of skills levels
- Mobile technology application developers, with demand particularly strong for high level skills
- Senior programmers with expertise in relationship databases, especially SQL server
- Games developers with skills (both entry and advanced level)
- Computing architects and administrators with expertise in Big Data analytics infrastructure and technologies. Also for customer relationship management applications and SQL server database administration.
- IT Project managers with technical skills combined with programme management
- IT user support for networking and PC maintenance with skills in Cisco, CCNA, and MS MCITP
- IT security experts – partly due to the increased use tablet and handheld devices- particularly those with high level expertise in security, malware, digital forensics and web security
- IT testing and troubleshooting-especially in the financial and telecommunications industries

Appendix 7: Glossary of Acronyms

ABSEI	Forfás Annual Business Survey of Economic Impact
BYOD	Bring-Your-Own-Device
CAGR	Compound Annual Growth Rate
CAO	Central Application Office
CIO	Chief Information Officer
CRM	Customer Relationship Management
CSO	Central Statistics Office
DLP	Data Loss Prevention
EGFSN	Expert Group on Future Skills Needs
ESN	Enterprise Social Network
FDI	Foreign Direct Investment
HEA	Higher Education Authority
IC	Integrated Circuit
ICT	Information Communication Technology
IBTC	Industry Based Training Certification
IOT	"Internet of Things"
ISCED	International Standard Classification of Education
LOBs	Line of Business Managers
M2M	Machine to Machine
MNCs	Multinational Companies
NFQ	National Framework of Qualifications
RFID	Radio Frequency Identification
ROI	Return on Investment
R&D	Research and Development
SaaS	Software-as-a-Service
SOC	Standard Occupational Classification
SLA	Service Level Agreement
STEM	Science, Technology, Engineering, Mathematics
SWOT	Strengths, Weaknesses, Opportunities, Threats

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