

Addressing High-Level ICT Skills Recruitment Needs

Research Findings

January 2012



Foreword

The availability of high-level ICT skills for the ICT sector and other sectors such as International Financial Services, Banking and Business Services is of strategic economic importance to Ireland in terms of continued growth in investments from inflows of new foreign companies, new Irish owned start-ups and expansions of existing businesses. This is resulting in increased sales, exports and high quality jobs. The ICT sector itself currently employs around 75,000 people in 8,000 companies. An increasing share of employment within the sector is comprised of people with high level skills. This is a sector that has continued to grow and increase employment even during the recession. The overall picture is of a vibrant sector which is forecast to continue to increase in employment over the coming years.



A range of skills recruitment challenges has emerged for high level ICT skills both from companies within the sector and from businesses across the economy. These high level ICT skills are also in short supply globally. The aim of this research was to establish the nature and scale of the ICT skills recruitment difficulties and has informed the *ICT Action Plan: Meeting the High-Level Skills Needs of Enterprises in Ireland*.

Companies interviewed emphasised the need to increase both the total number and quality of honours level ICT graduates and ICT professionals with several years of experience. Boosting the supply of high-level skills from domestic sources is the most sustainable way forward and will ensure that these issues do not persist into the future. We also need to acknowledge the significant role of inward migration especially in meeting the native foreign language fluency requirements of business.

The EGFSN has worked actively to support the Department of Education and Skills and the Higher Education Authority on the range of initiatives which are in the *ICT Action Plan: Meeting the High-Level Skills Needs of Enterprises in Ireland* to address the issues raised by companies. It is clear that the successful implementation of the initiatives will require sustained support at the highest level from those businesses in the sector.

I would like to record my appreciation to Forfás, IDA Ireland and Enterprise Ireland for their excellent support and sharing of expertise in the course of the research and especially to those companies and industry bodies who took the time to participate in the interviews.

Una Halligan

Chairperson, Expert Group on Future Skills Needs



Overview

Ireland is a successful major centre for ICT operations with ten of the top ICT companies in the world having substantial operations here. The large talent pool of ICT professionals that exists here is valuable both for foreign-owned and Irish companies. The cluster of internationally renowned firms and Irish companies offer a range of attractive career opportunities for professionals.

A range of skills recruitment difficulties have been raised through the work of the Expert Group on Future Skills Needs (EGFSN), specifically the immediate issue of high-level ICT skills within both the ICT sector and from other sectors such as international financial services, banking and business services. Forfás, with the support of IDA Ireland and Enterprise Ireland, engaged in discussions with a selected range of foreign-owned and Irish companies employing approximately 30,000 employees, to establish the nature of positions involved, the reasons for recruitment difficulties and to identify measures to help address them. Consultations were also held with key stakeholders including IDA Ireland, Enterprise Ireland, ICT Ireland, Software Ireland, IT@Cork, Engineers Ireland and Dublin Chambers of Commerce. Discussions were held with the heads of the computing departments of all Universities and Institutes of Technology at a meeting chaired by the Higher Education Authority. An in-depth analysis of third-level ICT supply statistics and trends was undertaken to inform the research.

This paper presents findings by the EGFSN into current recruitment difficulties within the ICT Sector and other sectors. These indicate that difficulties mainly relate to the supply of people qualified to ICT Honours Bachelor Degree and above. Immediate skills demand, which varies across companies, is at:

- i. graduate-entry level (NFQ Level 8);
- ii. ICT professionals with 2-8 years experience; and
- iii. ICT professionals with 8+ year's experience (while smaller in number, their recruitment is linked to the additional hiring of a team of graduate and professional staff).

Inward migration is heavily relied upon to address these needs. It will take time to solve these skills demands. The primary way of increasing the domestic supply of high-level ICT skills in the short-term is through targeted reskilling and skills conversion programmes for job-seekers. Companies have indicated the need to plan five years out for the building up of the high-level ICT skills supply.

Even with the successful implementation of actions proposed, in the short-term companies will continue to need to rely on inward migration for sourcing ICT personnel with 8 years+ experience and for personnel with native foreign language skills, until the level of domestic supply can be built up over the next five years. The most difficult of these needs to source will be for personnel with 8+ years experience as they are in demand and short supply globally. A level of inward migration in Ireland will continue to be valuable in the medium to long term as many multinational firms located here are European / global centres and view their labour market in the wider European / global context.



Research Findings

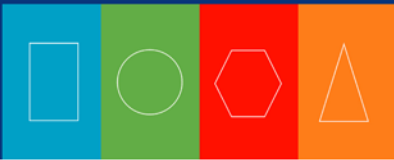
Current skills recruitment difficulties mainly relate to high-level ICT Honours Bachelor Degree (Level 8) and above. These difficulties result from a steep decline in the domestic supply of ICT graduates over recent years. Year 2010 acceptances for Level 8 computing programmes remain 20% less than for year 2000, although the numbers of acceptances have increased by 29% over the last three years. Companies are sourcing approx 55% of their high-level ICT skills supply needs (for expansion and replacement needs) through inward migration, although with increasing difficulty, as these skills are also in high demand globally, for example, Germany currently has 400,000 unfilled vacancies in 'MINT' business areas, Maths, Informatics, Natural Sciences and Technology.

While the annual increase in the ICT sector employment (+4% for 2010) is modest, an increasing share of employment within the sector is being accounted for by people with high-level skills. This is a result of a shift in subsector employment from hardware towards software; a general shift in the skills mix; and a pattern of simultaneous creation and loss of jobs, resulting in lower-skilled jobs being replaced with higher-skilled ones. There is a resilient demand arising within the ICT sector due to:

- An expansion of the business operations of companies over the last year, inflow of foreign R&D investment and formation of new start-ups;
- Potential for foreign companies to win mobile investment from the parent company and the availability of high skilled personnel to enhance their business proposition;
- An increasing share of employment within the sector comprises staff with high-level skills, a result of a movement of business activity from hardware towards software services and an ongoing pattern of simultaneous job creation and loss.

Immediate skills demand is at (i) graduate-entry level; (ii) ICT professionals with 2-8 years experience; and (iii) ICT professionals with 8+ year's experience (while smaller in number, their recruitment is linked to the additional hiring of a team of graduate and professional staff). This requirement varies across companies. It ranges from those looking only for level 8 graduate-entry staff, to those seeking a balance between new graduates and experienced personnel. There are some companies seeking only postgraduates (MSc and PhDs) and specialised personnel with several years experience, for example, software development architecture professionals with 15 years experience.

On the other hand, discussions with companies indicate that they are continuing to fill a substantial number of managerial, professional, administrative and sales and marketing positions without too much difficulty, especially firms located in main commercial centres.



Addressing the ICT Skills Recruitment Issue

a) Boosting the High-Skills Supply Pipeline

Boosting the high-skills supply pipeline, in terms of the numbers and quality is the best way to address skills recruitment difficulties. This will ensure a steady flow of graduates who can eventually fill the experienced level being sought in subsequent years. In the medium-term, action should focus on increasing the number of acceptances for high-level ICT undergraduate programmes to help meet demand.

b) Addressing immediate Skills Recruitment Difficulties

Immediate skills recruitment issues relate to positions which require C++, C#, Java, Python; SQL databases; Microsoft.Net Framework, HTML, XML, and Windows /Unix/Linux / operating platforms. Foreign language fluency skills with cultural awareness are required for technical support and sales and marketing jobs.

It seems clear that the majority of the demand for ICT professionals with 8+ years experience and a significant part of the requirement for native foreign language fluency skills cannot be met through the domestic supply in the immediate term. In both cases, inward migration will continue to be required to fill a majority of these positions. This supply can only be built up over time through boosting the domestic supply of graduates. In the intervening period, part of this demand may be met by enterprises upskilling their existing staff to fill those more experienced positions. Ireland should seek to position itself as an attractive centre for internationally mobile ICT talent.

c) Sustaining Ireland's attractiveness for high skilled ICT staff - both national and non-nationals

Inward recruitment will continue to be valuable in terms of (i) helping bridge the high-level ICT skills gap, especially for professionals with several years experience and (ii) for the cross fertilisation of ideas and practices which underpin innovation.

d) Ensuring the Upskilling of the Current Workforce

The continuing professional development of staff within enterprise is essential in ensuring that emerging skill gaps are addressed, as companies move towards higher value products and services. Valuable measures include in-company training programmes and publically supported development programmes, such as those offered by Skillnets.



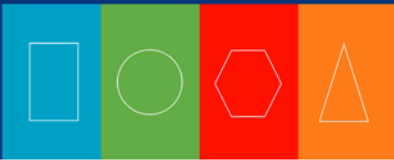
Importance of Supply of Talent

The supply of high-level ICT skills is important in terms of meeting current demand and driving future demand, supporting new business growth and inward investment. If the skills supply were available there is the potential for foreign companies to win more mobile investment within their group and for Irish companies to keep more of the work here rather than contract it out to their overseas offices, or outsource to third parties overseas. Companies have indicated the need to plan five years ahead for the building up of the high-level ICT skills supply, both quantity and quality. The large talent pool of ICT professionals that are currently employed here is valuable both for foreign-owned and Irish companies. The cluster of internationally renowned firms and smaller Irish companies offer a range of attractive career opportunities for professionals.

The recommendations made in the EGFSN Report *Future Requirements for High-Level Skills in the ICT Sector*, Forfás (2008) remain relevant today. These relate to the need to increase the domestic high-level ICT skills supply in terms of numbers, quality and diversity of skills. The report identified that domestic supply of Honours Degree graduates in computing and electronic engineering had fallen steeply from a peak in 2002, although intake into these courses had then bottomed out. The decrease in interest has been steeper for females. Under the continuing recovery scenario modelled in the report, where the sector remains competitive, a significant gap was apparent between the demand and the supply of computing and electronic engineering graduates when demand from the ICT and from other sectors of the economy was taken into account.

Inward migration (which then currently met a substantial part of total demand) would continue to be required to help bridge the anticipated high-level ICT skill gap. The report concluded that the priority should be on increasing the domestic supply of high-level skills as the most sustainable way forward.

Continuing into 2011, the level of demand for high level ICT computing / software skills from the ICT sector and related business sectors remains strong. The numbers of acceptances for courses has increased by 29% over the last three years, and these will start to graduate from 2012 onwards.

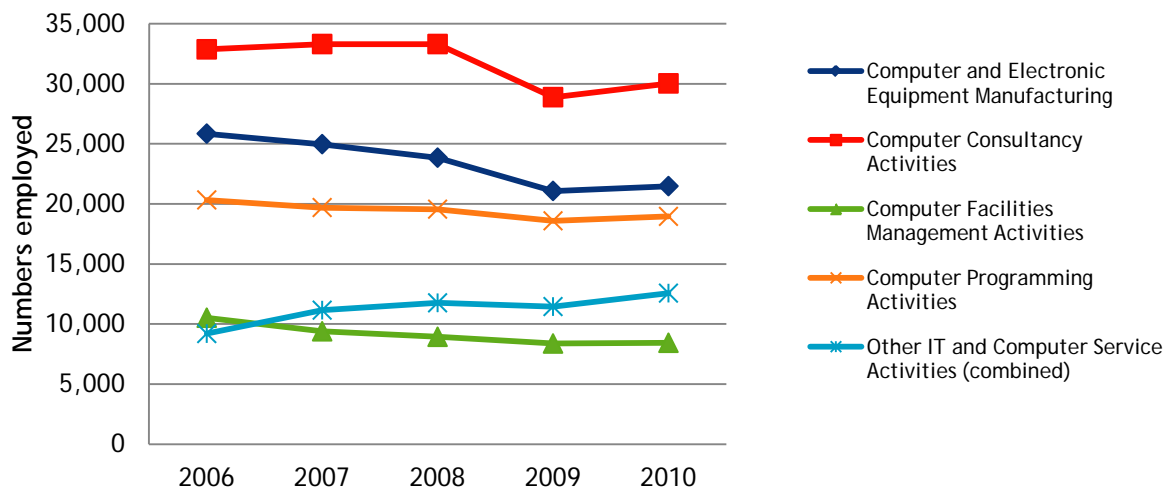


Employment Profile ICT Sector

From CSO Business Demography data there are approximately 75,000 employed in the ICT sector within 8,000 companies. Forty-five firms, however, account for 50% of total employment, with the largest 225 firms accounting for 70% of employment¹.

From Forfás Employment survey data, there are 750 foreign-owned companies (clients of IDA Ireland) employing 62,000 staff² that export an estimated €50 billion p.a. There are 500 Enterprise Ireland assisted software companies employing 10,000 staff generating €1 billion export sales p.a.³.

Table E 1: ICT Agency Assisted Employment 2006-2010 -Full-Time and Part-Time (IDA Ireland and Enterprise Ireland Agency Assisted Companies)



Source: Forfás (2011)

While the annual increase in ICT sector employment (+4% for 2010) is modest, an increasing share of employment within the sector is being accounted for by people with high-level skills. This is a result of:

- a shift in subsector employment from hardware towards software;
- a general shift in the skills mix; and
- a pattern of simultaneous creation and loss of jobs, resulting in lower-skilled jobs being replaced with those with higher skills

¹ The source for this employment total and proportion of employment by company size is CSO Business Demography Data for 2009 (published June 2011) - Definitions of ICT Total used is NACE Rev.2 categories 261+262+263+264+268+951+582+61+62+631+465. The number of employees is calculated on an annualised equivalent basis for the reference year.

² Source: Forfás Employment Survey 2010.

³ Source: Enterprise Ireland Strategy for the development of the indigenous software industry 2009 - 2013.



Immediate Skills Recruitment Difficulties

Research findings indicate that the immediate skills recruitment difficulties being experienced mainly relate to positions requiring high-level ICT Honours Degree (NQF Level 8) and above. The demand, in terms of positions, is of an order of scale for:

- **Computer Software Engineers:** for the design and development of applications & systems (800): Specific skillsets required are;
 - Programming languages - Java, JavaScript, C#, C++, C+++, Visual Basic; .Net; SQL data base; Perl, Ruby, Python, Objective-C, Objective - Orientated Programming (OOP).
 - Knowledge of operating platforms - Windows, UNIX / Linux processing environment.
 - Web Development - understanding of Web 2.0 development technologies, XML, Microsoft ASP.Net (web application framework to build sites, applications and services), Personal Homepage Tools (PHP), Microsoft Sharepoint family of software products, HTML skills.
 - Cloud Computing - as a different commercial business model, project management, network skills, data centre experience with operating systems - Microsoft Windows Azure, CITRIX, IBM Tivoli, skills in products such as VMware and hyper-V are in demand.
- **ICT - Network specialists and engineers (100):** e.g. Server Message Block (SMB), wireless sensor testing, collaboration functions, process management, search modules and document management platform, router configuration and management, experience with scripting language Java, C, C+ and network configurations.
- **ICT - security experts (100):** Internet security and network security models and solutions - certified IT systems, architecture, engineering and management (e.g. Cisco information security systems), firewall configurations administration, authorisation mechanisms.
- **ICT Telecommunications (200):** Mobile software applications development and programming (.Net and Java have mobile modules as part of their certifications).
- **ICT - Project managers with technical background (150):** IT professionals with ability to define objectives, control processes and manage people in a new regulatory environment.
- **Sales and Marketing personnel with IT Technical Background and relevant industry knowledge (150):** To support business development; Oracle and SAP business applications and services and other software solutions for specific business solutions.
- **Personnel with foreign languages skills and ICT technical background (300):** To fill positions in IT technical support, accounting, marketing and business development; requirement for fluent oral and written French, German, Spanish, Dutch, Flemish and Swedish.



Reskilling / conversion training programmes can partly contribute towards addressing some of the above immediate skills needs. What is needed is for programmes which incorporate the core primary skills required and which bring persons up to NQF level 8 computing and electronic engineering accreditation. Core 'soft skills' required are analytical skills, commercial awareness, communications, team working, creativity and entrepreneurial skills.

Immediate skills demand is at (i) graduate-entry level; (ii) ICT professionals with 2-8 years experience; and (iii) ICT professionals with 8+ year's experience. This requirement varies across companies.

Firms with foreign language requirements are mainly sourcing such staff from abroad, although efforts are being made to recruit from applied foreign language programmes at third-level. Foreign language fluency is not yet perceived as a main requirement for Irish companies whose key export markets are currently the USA and UK. However, given goals for growth and diversification for EI agency assisted companies, this seems likely to change. Reason(s) cited as to why graduates don't pass the recruitment filter of larger companies include missing core technical skills (such as no Java, C#, C++), lack of knowledge of the Software Life Cycle⁴; Test and Quality Assurance and Code Maintenance⁵.

Firms are also willing to recruit some persons who have not quite the technical skills profile they are looking for and train them, especially persons with analytical thinking, initiative, creativity and good communications skills. These are increasingly valued for the development of business solutions for customers.

Emerging Skills Demand

Emerging skills demands are around cloud computing, service design, database management, social networks and media, development of e-commerce applications and internet marketing.

⁴ The Software Life Cycle comprises the core processes involved in creating a software product: acquisition; supply; development; operation and maintenance activities - to international standard ISO 12207.

⁵ Source: Third Level Computing Forum Workshop January 2011.



Factors Affecting Skills Demand and Supply

Demand Side

Over the last year, there has been an expansion of business operations, the formation of new start-ups and a continuing inflow of foreign investment. Total annual expansion and replacement demand in the ICT sector for NQ Level 8+ computing and electronic engineers for the period 2012-2013 is estimated at 2,500 per annum⁶. There is a competitive jobs market for ICT talent with companies competing for the available supply, reflected in the high level of job vacancies advertised at any time (4% to 5% vacancy rate). The vacancy level reflects demand from companies to meet their expansion and replacement needs.

ICT Sector Earnings Increase

The ICT sector recorded the largest average hourly earnings increase of any sector in 2010 (+8.4%), compared to the national average reduction of -0.1%. Average earnings for the sector at €990.47 per week were the highest of any sector - total average €674.56 per week⁷.

Supply Side

There is an ongoing gap between the domestic supply of high-level computing graduates compared to demand from the ICT and related sectors such as international financial services, banking and business services (estimated 65% -70% of current supply is taken up by the ICT sector)⁸. Inward migration numbers for the ICT sector are estimated at approximately 55% of total demand, of which a significant proportion is from outside the EU/EEA⁹. Inward migration is an important source of supply especially for personnel with experience¹⁰. Multinational companies view their labour market in a wider European / global context.

Upskilling those at Work

The upskilling of those at work is essential for companies to address workforce skills gaps that arise as they move towards higher value products and services. Companies are funding such in-company training. In addition, Skillnets provides public funding to networks of enterprises to engage in training. Within Skillnets there are four networks dedicated to training in the ICT sector - ICT Ireland Skillnet, Software Skillnet, Information Association of Galway Skillnet and Digital Media Forum Skillnet. Each network is comprised of a consortium of companies who contribute towards the funding costs of programmes.

⁶ Based upon 'Continuing Recovery' scenario modelled in EGFSN 2008 ICT High-Level ICT skills in ICT Sector Report.

⁷ CSO Earnings and Labour Costs Publication, June 2011.

⁸ To meet annual expansion and replacement demand.

⁹ A total of 876 employment permits were issued to non-EEA nationals in 2010 for ICT and Engineering positions

¹⁰ Approximately 20% of software engineers are non -Irish - Source : EGFSN National Skills Bulletin 2011 (forthcoming).



Trends in CAO ICT Level 8 Acceptances

Trends in CAO acceptances and related graduate output are contributing to current skills recruitment difficulties. The 2010 Level 8 computing acceptances level of 1,427 (representing 4.5 % of total NQF Level 8 acceptances) is 20% less than the 1,809 acceptance numbers for the year 2000 (which represented 8.7 % of total NQF Level 8 acceptances).

Table E2: Trends in Level 8 Acceptances by Discipline, Period 2000 - 2010

Discipline	2000	2006	2009	2010
Computing	1,809 (8.7%)	926 (3.5%)	1,380 (4.4%)	1,427 (4.5%)
Total All Acceptances	20,728	26,488	31,420	31,729

Source: HEA (2010) -An Analysis of CAO Acceptances 2010 (Note: The EGFSN High-Level ICT Skills 2008 report uses a somewhat wider definition of computing courses).

Trends in Graduate Numbers

Over the period 2007-09, there was a reduction of 499 to 336 in ICT honours level graduate awards in the University sector, a fall of 32%. Institutes of Technology (IoTs) experienced a reduction from 460 to 411, a relatively smaller fall of 11%. In 2009 the IoTs produced more ICT honours degree graduates than the University sector, a reversal of the position in 2007.

The overall reduction in graduate output results from the decrease in acceptances for courses over the period 2002 to 2007. The numbers of ICT honours level graduates will begin to increase in 2012 given the 29% cumulative increase in acceptances over the past three years (+10%, +15%, +2% respectively). Seven percent of graduate output is accounted for by international fee-paying students. Firms are recruiting from this cohort.

Table E3: ICT Skills Area Graduates 2007-09 (Awards by Universities and IoTs)

	2007	2008	2009
Honours Degree	959	797	747
Ordinary Degree	379	394	451
Total Levels 7/8	1,338	1,191	1,198
Master Degree	603	611	557
PhD	83	80	88

Source: HEA Data, April 2011



The number of 1st Preference 2011 CAO applications for NFQ Level 8 computing courses is the highest in four years. Table E4 below provides information on this trend.

Table E4: NFQ Level 8 1st Preference Applications (Numbers and % of Total Applications)

Discipline	2008	2009	2010	2011
Engineering	2,374 (4.2%)	2,402 (4.1%)	2,596 (4.2%)	2,647 (4.2%)
Computing	1,928 (3.4%)	2,301 (3.9%)	2,623 (4.2%)	2,957 (4.8%)
Science	3,277 (5.8%)	3,848 (6.5%)	4,121 (6.6%)	3,959 (6.4%)

Source: HEA 2011

Non-Progression Rates

There is a high dropout rate of Level 8 computing and electronic engineering students (those who do not progress from their first to second year of study) which is 16% for Universities and 25% for IoTs. This compares to average dropout rates from all disciplines of 9% for Universities and 16% for IoTs. This needs to be addressed¹¹. The level of maths proficiency is a main predictor of non-progression. An evaluation should be carried out of the existing €1.5 million p.a. maths learning supports in third level institutions to determine the most effective and then best practice should be introduced across the system. Alternative ICT / engineering course progression routes could be provided for those students (approximately 350 p.a.) who do not progress to the second year of their course. At present they represent a loss to the potential ICT skills supply pool.

Multiplicity of ICT / Engineering Programmes

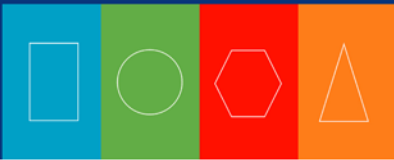
Within third-level institutions there are a multiplicity of ICT / engineering programmes with different titles and content. This branding (often for marketing purposes) is causing confusion amongst parents and students. An improvement would be for all programmes to concentrate on the development of core ICT skills with flexibility for bespoke specialism modules in 3rd and 4th year, and through postgraduate qualifications. There is potential for institutions to collaborate more on the design of curricula and teaching of programmes, to optimise the use of expertise and funding and achieve improved outcomes for students. Current funding arrangements incentivise institutions more to compete against each other. Improved collaboration would help to build comparable international centres of expertise. Two Irish Universities¹² are currently in the top 200 of the QS World University Rankings¹³ for computer science and five in the top 200 for electrical and electronic engineering¹⁴.

11 Over the four year programme period the dropout rates for Level 8 computing and electronic engineering are for Universities 16% non progression into 2nd Year; 3% into 3rd Year; 3% into 4th Year and for Institutes of Technology - 25% non progression into 2nd Year; 7% into 3rd Year; 8% into 4th Year.

12 UCD and Trinity College

13 QS World University Rankings <http://www.topuniversities.com/>

14 Trinity, UCC, DIT, NUIG and UCD- (Queens University Belfast also in top 200).



Internships and Student Work placements

Multinational companies are likely to engage with third-level institutions and operate internships and student work placements. They offer a range of employment opportunities including management, professional, marketing and administration positions. Many Irish firms are mainly looking for experienced staff that can make an immediate contribution. Companies interviewed that run internships are very satisfied with them and students certainly benefit from the work experience. Many Irish companies interviewed, particularly smaller companies, indicated that they do not perceive the value / or believe they have the capacity to take on an intern.

Communication of ICT Career Opportunities

Research on school leaver's choice of third-level courses highlighted a need to better communicate the availability of a range of attractive ICT career opportunities to students, parents and teachers. Discover Science and Engineering aims to increase interest in STEM subjects among students, and promotes career opportunities in ICT and engineering with support from ICT Ireland and Engineers Ireland. The HEA fund five day computer science summer camps in third-level institutions for 5th / 6th year students¹⁵.

Low levels of female participation in ICT programmes

More females need to be attracted onto ICT and engineering disciplines. At present they comprise 15% of all such students. This trend acts to limit the potential pool of higher level Leaving Certificate maths students that ICT departments can draw upon for their intake. The numbers taking higher level Leaving Certificate maths need to increase in order to boost the potential supply of students for ICT computing and other STEM disciplines.

Foreign Language Skills

There is a need to increase awareness of the importance of foreign language skills acquisition to meet a growing demand from enterprise. In the year 2009/10 some 1,440 students were enrolled in foreign languages studies at third-Level (a 13% increase over the year 2007/08). A further 2,320 students were taking foreign languages as a component of their subject choice. The most popular languages taken were French, Spanish, German and Italian in that order. Along with the current main languages utilised, it is anticipated that there will be an emerging need for Russian Chinese, Arabic, Portuguese and Hindi¹⁶.

Conclusion

The ICT Action Plan: Meeting the High-Level Skills Needs of Enterprises in Ireland, January 2012, has been developed in response to these findings.

¹⁵ Over 17 institutions are participating in 2011 attracting 350 students.

¹⁶ Survey by ICT Ireland and Irish Software Association - The need for language skills in the high-tech Sector.



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