Department for Employment and Learning

Research Study on High-Level Skill Needs in NI ICT Sector

Final Report

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Oxford Economics in association with FGS McClure Watters

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Contents

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Scope of study

As per the terms of reference, the scope of this research was to undertake:

1. An assessment of the future requirement, both quantitative and qualitative, of **high-level** ICT skills:

    a. A quantification of the likely future demand, to the extent that is meaningful, for high-level ICT skills from within the ICT sector – building on the existing e-skills research which focused on all skill levels (and skill demands for IT professionals outside the ICT industry and skill demand from all IT users across the whole economy);
    b. A relative breakdown of high-level ICT skills by discipline, particularly computer science, software engineering and electronic engineering, based on enterprise needs and international best practice / experience; and
    c. An identification of qualitative changes in the nature of the future requirement for high-level skills.

2. An assessment of the adequacy of:

    a. The current flow through the ICT skills supply pipeline; and
    b. The pool of ICT skills in the existing workforce in the ICT sector to satisfy the likely demand profile in the sector.

3. An exploration of the potential of complementary supply mechanisms.

4. Identify what actions are needed to ensure that the future high-level skills needs of the sector can be effectively addressed.

Sector footprint and high-level skills definition

Sector footprint

The ICT industry definition used throughout this report is based directly on the e-skills UK sector footprint. This comprises the following SIC sub-sectors:

e-skills ICT sector footprint

SIC (2003) 4 digit	Sub-sector
2233	Reproduction of computer media
3002	Manufacture of computers & other information processing equipment
3220	Manufacture of television & radio transmitters
6420	Telecommunications
7210	Hardware consultancy
7221	Publishing of software
7222	Other software consultancy and supply
7230	Data processing
7240	Data base activities
7250	Maintenance and repair of office, accounting and computing machinery
7260	Other computer related activities

Note the focus of this study is primarily on the high-level skill needs of the ICT industry rather than skill demand for ICT professionals across the whole economy. The latter, and demand for lower-level ICT skills, is covered in other research by e-skills. This is why throughout the report we refer to the 'ICT industry' rather than the 'ICT profession'.

Also note that due to data limitations (the Labour Force Survey is the only recent source of occupation data in NI), it is not possible to forecast future skill needs of the ICT industry from a detailed occupational perspective. As a result this makes it difficult to quantify which particular ICT occupations are likely to be in higher / lower demand in future and which are likely to experience skill supply shortages under alternative scenarios.

High-level skills definition

The definition of high-level skills used in this study draws on the classification of four levels of ICT skills from the ROI report *Future Requirement for High-Level ICT Skills in the ICT Sector*, two of which are lower level and two higher level.

Lower level

1. Generic – basic IT literacy (user of common PC applications and internet services)
2. Specialist – routine administration (installation, security etc) and lightweight development (e.g. web design, Visual Basic)

High-level

3. Advanced – heavyweight development (development of systems using high-level languages such as C++, and network and hardware design)
4. Researcher – creation of new intellectual property

By effectively only considering advanced and researcher skills, this has helped to focus the research on high-level skill needs of the ICT industry in NI (like the ROI report does) as opposed to the demand for ICT skills across the whole economy, which the e-skills research already does for both NI and UK.

In practical terms for quantifying future high-level ICT skill needs, given what data is available, high-level skills are assumed to range from NQF level 4 (foundation degree) to NQF level 8 (PhD), with professional / accredited qualifications of sufficient standard falling between NQF level 4 and 8. (Though some lower level of specialist qualifications may require this higher formal qualification for entry)

Skills classification

NQF	Description	Terminology
8	Doctorate	Postgraduate
7	Masters, postgraduate certificate and diploma	
6	Honours degree	First degree and sub-degree
5	Sub-degree including foundation degrees	
4	Certificates of higher education	
3	NVQ Level 3 A-Levels	Intermediate a
2	NVQ Level 2 GCSE grades A*-C	Intermediate b
1	NVQ Level 1 GCSE grades D-G	Low
Entry	Entry level certificate in adult literacy Other qualifications No qualifications	

While the quantitative forecasting analysis is only able to focus on high-level skill needs from a formal qualification perspective, the report also considers, from a more qualitative angle, a broader set of skill needs of persons in the ICT industry with higher formal qualifications. This is spelt out clearly in section 1.6 which sets out a framework for holistically assessing future high-level ICT skill demand.

Executive summary

"Skills are the essential ingredient for the Northern Ireland ICT sector. Without the attraction, retention and extension of skills, it will not be possible to sustain the development of the sector" Matrix ICT Horizon Panel report (2008)

The ICT sector in NI is one of DETI's key priority sectors alongside financial services, hi-tech / advanced manufacturing and life sciences. It thereby automatically has scope to be a major contributor to achieving government policy goals including those in the Programme for Government such as closing the productivity gap.

This research, commissioned by DEL in February 2009, investigates the future requirement for high-level skills within the ICT sector in NI.

Other recent research / reports, published by e-skills UK, Matrix and Invest NI, suggests that NI does not have sufficient high-level skills to meet the demands of the ICT sector.

To investigate this further in a recession / post-recession era and to fill gaps from existing research, a number of research techniques were employed for this study;

- Literature review – reviewing key literature from NI, the UK and ROI;
- Consultations – face-to-face and telephone consultations with NI industry, education providers and other key stakeholders, as well as a focus group session with the Matrix panel of experts;
- National and international evidence – researching international countries that have fostered and developed highly successful ICT sectors, specifically looking at policies to address high-level ICT skills shortages. Countries considered included the UK, ROI, Australia, Israel, South Korea and Finland; and
- Skills forecasting – quantifying the likely future quantum of high-level skills by investigating three different growth scenarios for the ICT sector - a baseline scenario and two upper aspirational scenarios – and comparing projected supply of high-level ICT skills against demand from these scenarios.

Each of these research techniques has provided an insight into the future demand and supply of high-level ICT skills, demand-supply gaps and policy remarks to address key issues highlighted by the research.

Demand for high-level ICT skills

The skills required by the ICT industry in NI are complex. For example, one only has to look at the Matrix ICT Horizon Panel range of technical skill requirements for the various focus areas to realise that the industry skills required today and tomorrow are very specialised and often quite organisation-specific. Furthermore the sector itself has a wide reach (R&D functions, software design, software implementation, sales and marketing activities and system and process development) and therefore requires a certain element of soft skills combined with high-level technical skills.

A framework has been designed to ensure that all aspects of high-level ICT skill needs were considered in this study. The framework has been based around key elements of skill demand identified in literature and consultations and includes both quantifiable and non-quantifiable elements. The quantifiable elements are quantum (expansion demand, gross replacement demand and joiners), level (undergraduate vs masters vs PhD) and discipline (type of ICT specific degree). The non-

quantifiable elements are technical skills (programming languages, platform knowledge, web languages etc), years of experience, commercial (domain knowledge) and generic skills (team work, sales and marketing and project management).

Predicting quantifiable skills demand, including quantum, type and level is difficult, especially in the current economic climate. Added to this, the relatively small size of the NI ICT sector also means that FDI has the potential to have a disproportionately large impact on overall skill demand in the industry. This added investment could quickly and significantly skew demand requirements (quantum, level and discipline) in the sector. Despite the challenges it is important for skills planning that a credible attempt is made do this. The high-level ICT skill demand forecasts in this report are credible in our view, and are tied to the NI Government's official economic forecast model as well as being based around the same skills forecasting methodology used by DEL for wider economy skill forecasts.

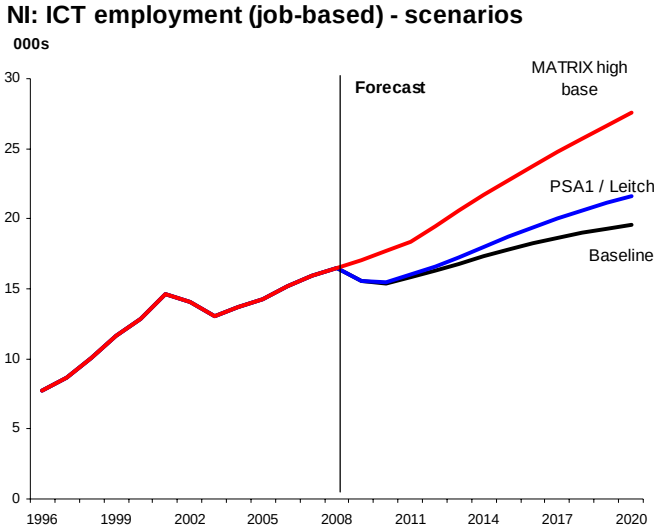
Three scenarios were developed in this research to analyse the short, medium and long-term recruitment and skill requirements of the ICT sector in NI.

- A **baseline scenario** linked to Oxford Economics' summer 2009 'policy neutral' outlook. As the ICT sector recovers and starts to grow again post-recession, it is projected that the long-term annual net requirement from education and in-migration (2010-2020) will be equivalent to approximately 300 persons [though this is still 500 lower than the net annual requirement of the last decade excluding the 'dot com' crash years - this may surprise some but expansion demand growth (2.4% pa, similar to the e-skills projection) is half the rate of the last decade]. Half of the net requirement will be for persons with high-level skills (110 foundation and undergraduate students, 30 masters students and 10 PhD students annually) with computer science the main degree discipline required by industry (based on past recruitment trends).

- A **Leitch upper scenario** based on achievement of PSA 1 (closing the private sector productivity gap) predicts expansion demand over the period 2010-2020 of 3.4% pa employment growth, which translates to an annual net requirement of almost 600. A higher share of this net requirement than for the baseline will be for individuals with high-level skills given the inherent productivity uplift built into the scenario.

- A **Matrix upper scenario** based on projections in the Matrix ICT Horizon Panel report. This scenario predicts employment growth over the period 2012-2020 of 5%, approximately 1,000 net new jobs per annum (initial growth is lower due to the impact of global recession on expected inward investment). Once again, more than half of this net requirement will be for persons with high-level skills.

Fig E.1: ICT employment forecast (baseline and upper scenarios)



Source: DETI, LFS, Oxford Economics

Table E.1: ICT aspirational scenario future skill needs (2010-2020 annual average)

	Oxford Economics summer 2009 baseline	Oxford Economics summer 2009 PSA1 / Leitch upper scenario	MATRIX high base
Expansion demand (people-based)	375	557	901
Gross replacement demand	1,759	1,847	2,232
Entrants other than from education and in-migration	1,836	1,824	2,044
Net requirement from education in-migration	298	580	1,089
o/w high-level skills (NQF 4-8)	145	301	597
o/w high-level skills (degrees only)	113	234	465
Computer science	67	143	284
Engineering & tecnhnology	8	19	37
Other	37	72	145
ICT % total private sector employment (2020)	3.1%	3.3%	4.4%

Source: Oxford Economics

As a brief summary, some of the key skill demand issues, including quantifiable and non-quantifiable elements, which need to be taken into consideration when developing government policy responses, include:

- **High-level skill demand elements** – an overall requirement for ICT professionals with experience, technical knowledge (e.g. as outlined in Matrix ICT Horizon Panel report) and domain knowledge (knowledge of the industry they are working in). When comparing demand and supply trends for the ICT sector it is evident that under the two upper aspirational scenarios the supply of high-level ICT skills in NI would not be sufficient to meet the needs of industry. Developing and delivering high-level skills however is not an easy task particularly given that experience and domain knowledge does not come overnight and universities cannot be expected to provide everything.
- **Demand-supply imbalance examples** – there is a perceived shortage of Masters and PhD ICT graduates in core ICT subject areas (following several years of decline in numbers enrolling and qualifying in more technical Computer Science and Electrical & Electronic Engineering courses); and a shortage of experienced ICT professionals (including with financial services experience) and of ICT professionals with generic skills.

Supply of high-level ICT skills

The research has confirmed a **falling number of ICT enrolments** ranging from the A-Level intake to postgraduate Higher Education. This is supported by literature and reflects an international trend, as well as being consistent with consultation views from education providers and local businesses.

Building upon this evidence the research has also revealed another concerning problem of a **high leakage of NI ICT graduates to other sectors of the economy[1].** While this reflects the transferability of ICT skills to other sectors and the increased employability of ICT graduates, it also raises potential questions over the mis-match between graduate outturns (from some ICT subject areas) and industry demand. Part of the explanation is that some ICT courses (such as Business Information Technology) are producing graduates with lower-level ICT skills not always sufficient for the needs of the ICT industry but sufficient for other industries.

Similarly issues of increasing concern flagged by consultees are (1) a perceived **drop in quality of some courses the industry is recruiting from (less so core subjects such as Computer Science and Electrical & Electronic Engineering and more so courses with lower level ICT learning such as Business Information Technology**, which are not specifically geared to produce graduates for the software sector**), and (2) the general quality of the ICT graduate intake and output.** The evidence on reduced UCAS points of people entering ICT courses (especially compared to other disciplines such as finance), plus a relatively high share from the clearing system, supports this view from industry. While QAA Audits, Professional Bodies accreditations and external examiners all indicate that Higher Education ICT course standards in NI are not falling below standards in the rest of the UK, if UCAS entry points are falling for GB ICT courses then remaining at UK standards still means an absolute fall in quality and decline relative to other subject areas.

As a brief summary some other supply-side skills issues facing the ICT sector include;

- **Re-skilling –** the consultation process revealed a need for continuous re-skilling of ICT professionals in the sector and, despite its importance given the rapid changes which occur within the ICT sector, re-skilling is a significantly under-researched area. In particular, there is little reference to the nature and quantum of re-skilling requirements in existing literature.
- **Negative perception of the ICT sector –** a challenge which was touched upon throughout both the literature and consultations was the negative perception of the industry in the eyes of pupils and parents. Consultations with industry and education suggested that the perception of the industry as 'men in boiler suits' was reflected in enrolment trends at secondary school and higher education.
- **Gender participation** - the gender participation gap (the industry remains male dominated although there is some evidence of improvement).
- **ICT curriculum** – it is believed there is a mismatch between the curriculum at secondary level and course content of undergraduate ICT courses (computing / IT / technology is specified as a subject requirement for only 4% of higher education IT-related courses in UK); and some ICT HE courses are seen as too general by industry with not enough good solid programming elements.
- **Other supply issues –** consultations revealed the importance of a vibrant research community to build a global reputation and attract high-level ICT researcher skills.

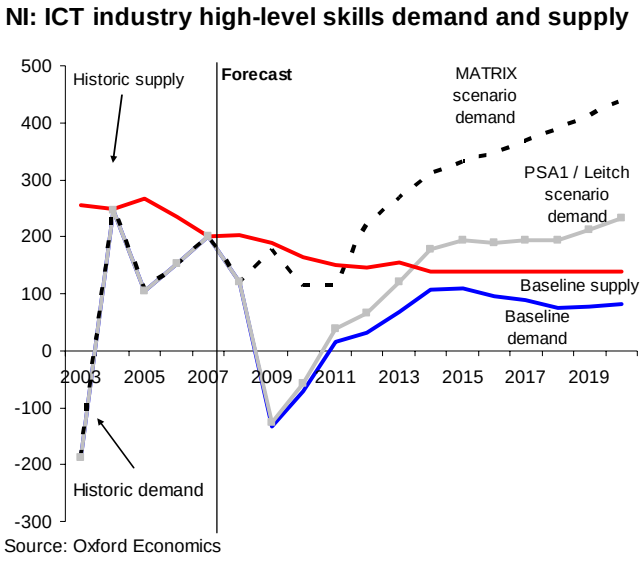
[1] Though an important caveat is that official data may not always correctly classify the employment destination industry sector

Demand-supply gaps

Under the baseline demand and supply scenario for high-level ICT skills in the NI economy, it is projected that in the short-term the supply of high-level ICT skills (which assumes a bottoming-out in enrolment declines) will be greater than the level required by industry. This is not least because the recession will (a) reduce the short-term requirement for ICT skills considerably as employers adjust to the new economic conditions; and (b) provide a pool of ICT labour available in the years ahead.

However the baseline outlook for the NI ICT industry is well below what might be considered optimal from a policy point of view and below what the Matrix report aspires to. In the NI economy-wide baseline, not only would the PSA1 productivity target remain unmet, but in the aftermath of the recession unemployment rates are likely to remain high. Looking at a credible aspirational scenario for the ICT industry, as this research has, suggests that the supply of high-level ICT skills, in the Matrix scenario, would fall significantly short of what would be required unless enrolment trends not only stop declining but reverse. This would lead to a failure to achieve the potential of the ICT industry or alternatively requirement a significant import of high-level ICT skills (which NI does not have a particular tradition in).

Fig E.2: Projections for high-levels skills demand by and supply into NI ICT industry



Source: Oxford Economics

Table E.2: Projections for high-levels skills demand by and supply into NI ICT industry

	Annual average (2010-2020, roundest nearest 10)			Annual average (2015-2020, roundest nearest 10)		
	Demand ICT high-level skills	Supply high-level ICT skills to labour market (baseline)	Balance (supply less demand)	Demand ICT high-level skills	Supply high-level ICT skills to labour market (baseline)	Balance (supply less demand)
Baseline						
Postgraduate (NQF 7-8)	20	50	30	20	50	30
First degree and sub-degree (NQF 4-6)	60	90	30	70	90	20
Total high-level skills	80	140	60	80	140	60
OE PSA1 / Leitch upper scenario						
Postgraduate (NQF 7-8)	40	50	10	50	50	0
First degree and sub-degree (NQF 4-6)	130	90	-40	160	90	-70
Total high-level skills	160	140	-20	200	140	-60
MATRIX upper scenario						
Postgraduate (NQF 7-8)	70	50	-20	90	50	-40
First degree and sub-degree (NQF 4-6)	250	90	-160	300	90	-210
Total high-level skills	320	140	-180	390	140	-250

Source: Oxford Economics
Note: Figures may not add due to rounding

The implication is that to realise the vision of the Northern Ireland economy aspired to by Matrix, there is a requirement to increase the supply of high-level ICT skills from current levels but perhaps more crucially, also increase the quality of supply not just in terms of the new intake / output from education but in the current workforce as well.

Policy remarks

The key ICT skill demand and supply objectives which are taken into consideration when developing policy remarks include:

- Increasing the quality of ICT skills in the NI economy from graduates through to existing ICT professionals;
- Increasing the quantity of ICT graduates and professionals, including increasing enrolments in ICT education from secondary education through to higher education and encouraging in-migration;
- Addressing the high leakage of ICT graduates to other sectors within the economy; and
- Thinking about high ICT skill requirements holistically including quantum, level, subject, experience, technical requirements, domain knowledge and generic skills.

Taking the evidence collectively and reflecting on previously published research, our final policy remarks are as follows. Note many of these remarks are applicable whether the outcome for the ICT industry in NI is realisation of the projected baseline or Matrix growth trajectory. However obviously the urgency and priority of some are higher for the aspirational scenario where under a 'do nothing' supply-side scenario, large skill shortages will emerge.

- **Dealing with the recession** – there is a need for careful management and continuous monitoring of the sector given the predicted excess short-term supply of high-level ICT skills (which has potential for another 'boom bust' in ICT skills demand and supply).
- **Career attractiveness** – the research justifies continuing and expanding upon existing career attractiveness campaigns (such as Bring-IT-ON), remembering that for young people choosing a subject relies on several key factors such as long-term career prospects, parental guidance, likeability and earnings potential. Also, publicising "good news" from the ICT industry in NI during the recession could be a potentially powerful tool.

- **Re-train and re-skill** – using the recession as a time for skill providers and the industry to re-train and re-skill the current workforce. This can include taking existing students unable to find work onto more advanced courses (for example the Software Professional Course) or adding perhaps business skills and top-up technical skills / new programming languages to the existing ICT workforce (for example through Invest NI's Business Improvement Training Programme).
- **Work placements** – encouraging work placements to help provide business readiness skills to young people and in helping businesses struggling to fund full-time posts. Given that work placements can be expensive for business, especially during quieter periods, government support for work placement schemes could be considered.
- **Introduction of a 'top tier' course** – a course with a lower entry requirement is rarely taken by the brightest students with the highest level of skills. A 'triple A' rate course (or higher like actuarial studies at QUB), perhaps with a very high profile prize or placement job offer, could significantly raise the image and calibre of the ICT training output (although there are very understandable concerns from universities about there being an insufficient critical mass / number of students both interested and with sufficient UCAS points to meet these higher entry criteria – equally however we believe the ambition from the Matrix vision needs to be matched by equal ambition on the ICT supply-side and whatever is required to do this should be supported).
- **Closer links between education and industry** – ensuring skills outturns are appropriate by encouraging closer linkages between education and industry (much like the Higher Education/Industry workshop which was held in October 2008). This essentially means dealing in precise terms about the programming languages, packages and techniques required by current firms and new types of firms as envisaged in Matrix for example (in other words there should be a balanced discussion involving existing ICT companies and those representing potential future areas of industry development – for example those involved in the Matrix process could provide a valuable contribution to this type of workshop).
- **Closer alignment of secondary IT curriculum with university curriculum** – ensuring the input to universities is appropriately geared towards the requirements of university study to avoid teaching of more basic modules (which otherwise could be taught in school). That said it is also important to remember the distinction between what might be considered computer literacy at school level and what might be a more advanced set of skills with respect to ICT.
- **ICT high-level skills supply chain study** – any efforts to boost ICT course enrolments, increase female ICT course intakes etc will have limited impact if a high proportion of ICT graduates continue to leak into other sectors. It is imperative that the full reasons for this leakage are better understood as supply measures to address different factors could be very different.
- **Attracting and retaining high-skilled migrants** – to be successful on a global ICT stage and to develop a 'layering' of ICT skills supply capacity (to provide flexibility for unpredictable FDI), NI will require a flow of skills from outside the region to enlarge, broaden and deepen the skills base. This will necessitate cultivating and promoting an image of an ICT hub or ICT culture and ensuring jobs are promoted widely. A small, peripheral region such as NI, where a large FDI project can have a disproportionate impact on demand within the industry, will not be able to rely on domestic supply of skills. In addition increasing the supply of non-NI domiciled undergraduate ICT students in local universities from current almost negligible levels and making non-EU ICT students eligible for postgraduate funding could provide an important supply boost.

1 Introduction and background

1.1 Role of skills

"Skills are the essential ingredient for the Northern Ireland ICT sector. Without the attraction, retention and extension of skills within the sector, it will not be possible to sustain the development of the sector" Matrix ICT Horizon Panel report (2008)

Skills are widely accepted as the key 'raw material' in the modern knowledge-based economy. A key driver of productivity, attracting FDI and determinant of economic returns (both at a personal and economy-wide level), skills have rightly taken centre stage of modern economic development policy. It is also one of a few areas in which NI's devolved government can exert a real influence and plan for.

Following the publication of the Leitch Report, 'Prosperity for All in the Global Economy – World Class Skills in the United Kingdom', and 'Tomorrow's Skills: Towards a National Skills Strategy in the Republic of Ireland', it is our understanding that DEL brought together a group of key stakeholders to review the potential implications, and possible lessons to be learned for Northern Ireland from these contrasting strategies. A Statement of Skills was published to outline how DEL will continue to implement 'Success through Skills'. The Department's 'Success through Skills' strategy published in 2004 remains the overarching framework for the delivery of skills in Northern Ireland.

The implementation of the Strategy has been grouped under four themes:

1. Understanding the demand for skills;
2. Improving skills levels of the workforce;
3. Improving the quality and relevance of education and training; and
4. Tackling skills barriers to employment.

The first three themes identified in the 'Success through Skills' strategy are investigated and analysed more fully in this report for the purpose of examining the high-level skills needs in the NI ICT sector.

The Matrix report, published in 2008, also identified skills as the 'heartbeat' of the economy. The Matrix report was born out of the Regional Innovation Strategy and identifies five key technology sectors, of which ICT is one, that are essential for the future growth and development of the NI knowledge-based economy. The first Matrix report is a culmination of more than 18 months of intense engagement with a cross-section of NI's high-tech businesses and academics and identifies a series of recommendations which they consider are essential to 'secure a genuine leadership position in the exploitation of specific technology areas in the global market over the medium and long term'. One of the key recommendations identified by the report centred on the supply of skills in NI.

"Northern Ireland must have a flexible and responsive skills system that leads Europe in terms of its ability to meet changing demand and is superior to all identified competitors" Matrix

It was recognised by Matrix that all key technology sectors in NI were experiencing some form of demand-supply imbalances and that there was a need to address the entire supply chain from primary school to third level education as well as within the workforce.

1.2 Importance of ICT in NI economy

The ICT sector is a key driver of the NI economy, not only in terms productivity, employment and skills, but also its contribution to the value added of many other sectors in the economy including financial services, security, healthcare and many consumer products.

The NI government sees the growth of the ICT sector as an important component of the future growth and development of the economy. The Department of Enterprise Trade and Investment (DETI) and Invest NI have identified 4 key priority sectors which they believe are essential to the success and longevity of NI. The ICT sector is one of these sectors along with financial services, life sciences and hi-tech manufacturing.

The Matrix ICT Horizon Panel has also identified the ICT sector as a key contributor to future economic growth and development in the NI economy. The Horizon Panel 'believes that "Northern Ireland must aim to become a leading knowledge-based economy to achieve its potential". The extensive research carried out by the ICT Horizon Panel, including an intensive consultation phase with leading ICT businesses in NI, revealed that NI already has first-class ICT capabilities and with these capabilities has the potential to create a globally recognised ICT sector.

As a useful backdrop to this report, a summary of the direct and catalytic contribution of the ICT sector to the NI economy has been provided below. Annex E provides a comparison of statistics on the NI ICT sector from Oxford Economics and literature, some of which differ. The figures below are Oxford Economics' estimates from official sources, which are listed in Annex E, along with explanations for differences with other published statistics on the NI ICT sector.

Direct economic contribution

The following statistics set out the direct contribution of the ICT sector to the NI economy. This shows that while the industry is not yet a major employer compared to some, ICT 'punches above its weight' in terms of its contribution to service sector exports and investment.

- **Employment**: 1.9 per cent of total employment or just less than 1 in 50 total jobs (it should however be noted that ICT's share has doubled since the mid-1990s and is still regaining some lost ground from the dot com crash in 2002).

- **GVA**: 3.6 per cent of total GVA / wages and profits. This is significantly higher than its employment share because estimated sector productivity is 70 per cent higher than the economy private sector average (a positive feature to help to achieve Government's PSA 1 target on closing the private sector productivity gap with the UK excluding Greater South East).

- **Earnings**: Average full-time basic earnings (data only available for SIC 72 computer & related services) are one-third above the economy private sector full-time average[2].

- **Exports**: 60 per cent of recorded service sector exports outside the UK by high export potential service companies are from IT (£103m – note this refers only to SIC 72 computer & related services)[3].

[2] Indicator / target 7 of PSA 3 - increasing employment, is for 5,500 of 6,500 new jobs from inward investment to provide salaries above the NI private sector median and 2,750 to provide salaries one quarter above the NI private sector median – average paying software jobs would therefore help to achieve this target

- **Investment**: The software and computer services sector contributed 12 per cent of total Invest NI assistance and planned investment by indigenous and external client companies in 2007/08 (or 37 percent of the services total).

Looking forward it is important to highlight that ICT's export focus will become even more important in the decade ahead. This is because the local (and national) economy will have to rebalance growth away from debt-driven, domestic sectors such as retail, construction and public services too (as the next UK Government will have to rein in spending to close the fiscal deficit) and look to external demand once the global economy recovers. While cost competition means that manufacturing goods production is likely to continue to be lost to cheaper locations (although costs here and transportation costs are rising), service sector exports such as ICT, which require specific skill sets, are less 'replaceable' for producing these exports.

Catalytic contribution

Looking beyond ICT's direct economic contribution, the role of ICT in the wider economy is well articulated in the existing ICT skills literature. This is illustrated by some of the references below.

Matrix ICT Horizon Panel report (2008)	"The ICT sector forms the backbone of several industries and is an important value adding component of consumer products, such as mobile phones. ICT today is a dominant force in enabling companies to create new products, exploit new distribution channels and deliver differentiated services to customers. ICT is also an important catalyst for social transformation and economic transformation"
e-skills UK IT insights: Regional skills gap analysis NI (2005)	"IT is at the heart of the UK economy and is a key source of competitiveness for all sectors, opening new markets, increasing performance and driving productivity" "IT will become the new utility – a fundamental service alongside electricity, gas and water"
e-skills UK Technology counts: IT & Telecoms Insights (2008)	"ICT systems are now established at the heart of every organisation. They underpin the delivery of high quality, cost effective public services … developing IT-enabled business solutions is key to the UK's success in technology-intensive sectors such as financial services"

While it is far beyond the scope of this research to quantify in £s the catalytic benefits of ICT linkages to other sectors, Table 1.1 provides a useful illustration of ICT forward linkages (who the ICT sector sells to). This is in terms of SIC 72 services (dominated by software) procured as a share of total domestic procurement across all sectors of the economy, using DETI's NI input-output tables[4]. Computer and related services are shown to be particularly important inputs to financial services and education. Furthermore as the Matrix ICT Horizon Panel report highlights, ICT innovations are critical to sectoral developments in health care, telecoms, financial services and life sciences, the latter two of which are also DETI-designated priority sectors.

[3] This is equivalent to 2 per cent of total recorded exports including manufacturing exports. Electrical & optical equipment exports are significantly higher at £1.3bn, although as this covers all of SIC 30-33, this will include a significant element of non-ICT exports (applying the e-skills sector footprint)

[4] Note lack of sectoral detail on imports from input-output tables means that it is only possibly to analyse domestic procurement patterns, plus lack of input-output detail on other e-skill sub-sectors means we can only include here procurement from SIC 72

Table 1.1: Computer & related service (SIC 72) purchases % total domestic intermediate consumption

	UK (1995)	NI (2003)
Agriculture, forestry and fishing	0%	0%
Mining & quarrying	1%	1%
Manufacturing	1%	1%
Utilities	1%	1%
Construction	1%	0%
Retail & distribution	3%	4%
Hotel & restaurants	3%	3%
Transport & communications	5%	5%
Financial services	6%	8%
Business services	4%	3%
Public administration & defence	2%	5%
Education	7%	9%
Health & social w ork	1%	2%
Other personal services	4%	3%

Source: ONS, DETI, Oxford Economics

1.3 ICT skills institutional structure in NI

It is useful at this early point in the report to identify key stakeholders which play an important role in ICT skills development in Northern Ireland. Whilst some of these organisations provide an overarching strategy for skills policy in Northern Ireland (e.g. DEL, Invest NI), others such as e-skills UK and Momentum play a more specific role in identifying skills issues and promoting the development of skills within the ICT sector.

E-skills UK – SSC for Business and Information Technology
e-skills UK is a not-for-profit, employer-led organisation, licensed by government as the Sector Skills Council for Business and Information Technology. It is the voice of employers for all IT-related skills issues in Northern Ireland and across the UK. In NI, e-skills UK is responsible for 'the development of the Sector Skills Agreement (SSA), all authoritative research on IT related skills issues including Labour Market Intelligence, the development and currency of all IT related skills frameworks and industry standards such as the National Occupational Standards' (e-skills UK).

Momentum
Momentum is the trade association for over 160 ICT companies in Northern Ireland. It was established to represent companies with a common interest in promoting and developing the industry both locally and internationally. Momentum's role is to deliver a wide range of services and organise an extensive programme to improve the competitiveness and excellence of ICT companies. This also includes representing the ICT industry at all levels of government and identifying ways to keep the supply of trained people sufficient to meet demand.

ICT Future Skills Action Group
The ICT Future Skills Action Group is an advisory body comprised of representatives from government, education and industry. The role of the group is to work alongside employers, Momentum and e-skills to:

- Establish current and future skills needs for the ICT sector, including estimating potential numbers and skill levels required;

- Explore opportunities for job and wealth creation for the ICT sector in other economic sectors e.g. financial services;
- Coordinate existing resources and activities within the sector;
- Advise, design, develop, test, trial and evaluate new interventions which are able to meet existing and future skill needs within the ICT sector;
- Act as a 'champion' for the ICT sector both with Government and the private sector, and to promote the sector and its opportunities to potential new entrants, who can either be individuals or FDI firms; and
- Advise government on projected requirements and international opportunities for Northern Ireland and make recommendations on the steps required to meet these needs.

Matrix

Matrix, the Northern Ireland Science Industry Panel, is a business-led expert panel, formed to advise government on the commercial exploitation of R&D and science and technology. Matrix identifies key areas of science, technology and innovation in which Northern Ireland has a lead over it competitors, and advises on the policies required to exploit these strengths and deliver economic success. One of the areas identified for potential growth and development is the ICT sector and specifically the three focus areas of package application software, near shoring and embedded systems.

DEL

DEL's corporate aim is "to promote learning and skills, prepare people for work and to support the economy". This aim is supported by two objectives: (1) to promote economic, social and personal development through high quality learning, research and skills training; and (2) to help people into employment and promote good employment practices. DEL's work on promoting skills is guided by the Skills Strategy which focuses on raising the level of skills of the current workforce, enhancing the quality of those entering the workforce and addressing the employability skills of persons not in employment.

Invest NI

Invest NI's role is to help new and existing businesses to compete internationally and to attract new investment to Northern Ireland. Invest NI is part of DETI and provides government support for business by delivering the Government's economic development strategies. Invest NI offers the Northern Ireland business community and potential investors high-quality services, programmes, support and expert advice, including support for skills development. Invest NI has also played a key role in attracting large-scale ICT FDI.

DETI

DETI's corporate aim is 'to promote the development of a globally competitive economy in Northern Ireland', with the key objective to, 'encourage the development of a high value added, innovative, enterprising and competitive economy, leading to greater wealth creation and job opportunities for all'. One of DETI's key priorities is to increase productivity and growth of the economy. The Department proposes a range of aims and objectives to achieve this priority. One is to increase the level of skills to aid productivity improvements in manufacturing and tradable services, which ICT is part of. Skills are identified as one of the main attractions for foreign investment into the economy, and DETI identifies that it will be important to ensure that the future supply of skills is consistent with the demands of existing and prospective businesses.

1.4 Existing ICT skills literature

Given (1) the growth potential of NI's ICT sector and its importance to the NI economy both in terms of direct and catalytic benefits; and (2) the major skills supply challenge facing the sector, there has been a plethora of ICT skills research published from a variety of sources including e-skills UK, Invest NI and Matrix. We have included a brief description of each of the main pieces of research below. Chapter 3 and Annex B provide a more detailed explanation of the contents of each of the reports reviewed for this study.

Note while findings from existing research are absolutely central to this report and are referred to throughout, DEL, the commissioning department for this research, views this study as complementary to existing research. While this study, as far as is possible, aims to bring some of the main messages 'under one roof'[5], other research should still be regularly referred to alongside this study as one study alone cannot fully address all of the complexities of ICT skills issues in sufficient detail. For example the UK e-skills research in 2008 spans 9 reports.

E-skills UK - IT Insights: Regional Skills Gap Analysis in NI

In 2005 the Sector Skills Council e-skills UK conducted research to assess the skills needs of the IT sector in the UK. In 2006 an additional study was undertaken to supplement the original findings which now underpins the current Sector Skills Agreement (SSA) for IT in Northern Ireland. This report was published in 2007. The e-skills SSA for Northern Ireland showed the skills needs for the IT sector in Northern Ireland were likely to change in the future and the demand for high-level skills was likely to grow. Some of the key changes identified in the report include:

- The IT industry will have on-going demand for technical skills in system integration, networking, web design, security and IT architecture, to support both custom development and package integration;
- There will be an increasing need, in the IT industry, for consultancy and change management skills to help their customers derive business benefit from the services the industry is offering
- In-house professionals will need broader business skills and an improved understanding of the sector they are working in; and
- There will be a migration of IT programming skills and jobs offshore, with consequent need for new skills in managing these services.

Invest NI – NI ICT Sector Review

In 2006 Invest NI commissioned OCO Consulting to conduct a detailed audit of NI's ICT sector. Building upon some of the work in the e-skills UK report, it identified the main ICT technology clusters in NI and quantified for the first time the NI IT skills base. Based on current expansion plans as articulated in 2006, the OCO report predicted future potential growth. In order to meet these demand projections the report suggested that graduate numbers would need to increase substantially. Given that the number of ICT graduates was falling at the time, it stated that there was a need for further development and promotion of the ICT sector.

Matrix – ICT Horizon Panel Report

[5] It would be impossible to draw together each and every literature finding as this would clutter the report and over-burden and confuse readers with too much information.

In 2007 the NI Science Industry Panel of Experts (Matrix) was set up to provide focused advice on the future policies necessary for NI to promote economic growth and wealth creation and provide greater opportunity for exploitation of its science and technology capabilities. Supported by DETI, one of the key sectors identified was ICT as explained previously. The Matrix process identified a need to provide evidence on the importance of the ICT sector, potential growth and global leadership opportunities and the challenges moving forward. At the end of 2008 the Matrix ICT Horizon Panel report was published. The report identified three specific areas of development - package application software, near shoring and embedded systems. In order to develop these sub-sectors, the Matrix report highlighted the importance of the attraction, retention and extension of skills within the sector as absolutely pertinent to its development. The report also echoed concerns from other research on the decline in quantity and quality of ICT graduates in NI.

E-skills UK – NI IT Snapshot

The most recent report by e-skills in NI, the Northern Ireland IT Snapshot, was published in March 2009. This provides information on changes in ICT skills demand in NI based on data from a survey of 300 employers of IT professionals. Despite the current economic recession, the IT snapshot reported that over a third of companies were still willing to recruit in 2009. While experienced professionals remained the preferred recruitment choice, IT graduates were also noted to be in demand.

Future Skills Action Group – ICT Future Skills Action Plan

A Future Skills Action Group was established in 2007 to bring together education providers and businesses experiencing first hand skill challenges in the ICT sector and to develop a set of short-term actions to address these skills needs. The ICT Future Skills Action Plan was devised to act as a starting point to begin to address the downward trend in ICT enrolments at university and build on the actions already contained in the SSA. The Future Skills Action Plan published in 2008 identifies three thematic areas for action to address key supply side issues:

1. Skills provision – relevance, quality and accessibility
2. Career attractiveness – information and promotion
3. Additional sources of talent – national and international outreach

Expert Group on Future Skills Needs (EGFSN) - Future Requirement for High-Level ICT Skills in the ICT Sector (ROI)

The 'Future Requirement for High-Level ICT skills in the ICT Sector', published in June 2008, was the outcome of an extensive study conducted by the Expert Group on Future Skills Needs in ROI. This report showed that the market for high-level skills in ROI is also changing in a similar way to that in NI. Companies consulted identified a particular shortage of people with very high-levels of technical skills. The research also reported that '"the projected domestic supply of graduates at Level 8 (Honours Bachelor Degree) would not be sufficient to meet whole economy demand under more positive growth scenarios and would only roughly meet demand under a more negative scenario". The shortages projected for the sector in ROI range up to some hundreds per annum for electronic engineers qualified to Honours Bachelor Degree level or above, to an average of about 2,000-3,000 per annum for computing graduates qualified to this level. The report also showed that the interest in studying computing and electronic engineering remained relatively weak because of factors such as a feeling of insecurity about the sector, slow growth in pay, competition from other sectors and changes in performance in mathematics at second-level.

1.5 Why this research matters and value added

While the depth and scope of existing research is impressive and provides recommendations for some of the key issues, for a high-level picture of future skill needs, it can sometimes suffer from providing too much detail and as illustrated below, has some important gaps. In fact one of the motivating factors for this study was to produce a report for NI that closely mirrored the ROI report *Future Requirement for High-Level ICT Skills in the ICT Sector*, which it could be said is more high-level and does address the major questions such as the potential scale of demand-supply imbalances (but admittedly does not go into the same detail as the other NI research).

Overleaf we summarise why, in our view, this research is needed and adds value to existing research.

Why this study is needed and how it adds value

ICT a Government priority sector	▪ To maximise the potential of ICT and secure a successful future for the sector, it is critical to understand current and future skills demand and supply patterns and foresee potential demand-supply imbalances so that actions can be taken today to prevent skills acting as a barrier to the sector's development.
Up-to-date quantified skill demand forecasts	▪ While employment forecasts for the ICT sector in NI are available from e-skills, these are now due for update or at least a re-visit, especially in light of the global recession. ▪ Oxford Economics' NI Policy Simulation Model (NIPS), the NI Government's accepted economic forecast model which is used in DEL's wider economy future skill needs research, is also used in this research to provide skill forecasts for the ICT sector. Used alongside Oxford Economics' respected skills forecasting model, this allows the production of the detailed and independent employment and skill forecasts required by DEL and thereby helps to ensure consistency across DEL's other skills forecasting research. ▪ The forecasts used in this research are taken from the very latest summer 2009 'run' of the NI Policy Simulation model, which fully captures the severity of the recession and Oxford Economics' views on the timing and extent of recovery. Given e-skills reports tend to be produced at set intervals rather than 'on demand' (with the possible exception of IT snapshot reports – though they do not provide long-term forecasts), the advantage of having this report is that DEL does not have to wait for the next e-skills full NI report to understand the implications of latest economic developments on likely future skill needs and imbalances.
Gaps in analysis of the quantum of future long-term skill needs and assessment of demand-supply imbalances	▪ While the Matrix ICT Horizon Panel report provides an incredibly comprehensive overview of technical skill requirements across its sectoral focus areas, it does not focus on an explicit quantification of skill needs. ▪ The type of analysis Oxford Economics provided DEL with for the NI economy as a whole (the net requirement from education and migration by qualification level and subject) is what is required to fill gaps and validate existing numbers at a sectoral level for ICT, to complement the existing skill needs research by e-skills, Matrix and others, and to use to directly compare the future quantum of skills demand against measurable supply outputs.
Focus on high-level skills	▪ Existing e-skills UK skills forecasting research has focused on all skill levels. For example the e-skills UK IT & Telecoms Insights 2008: Employment forecasts report profiles all skill requirement levels for IT professionals and more general IT users. This research however requires an explicit focus and attention on high-level skills and within this grouping, a focus also on subject disciplines.
Update skills supply-side analysis	▪ Worrying ICT supply-side trends have been well documented in existing research. Using latest supply-side data and new analysis on UCAS points of ICT choices and acceptances (as a possible proxy for 'quality' of the ICT industry's future intake), this report updates and develops further previous analysis of ICT skills supply trends. ▪ It also probes in more depth the ICT high-level skills supply chain by examining the actual through put of ICT graduates to employment in the ICT industry and leakages to other sectors (which as shown later is a critical supply issue).
Reassess ICT skills policy actions	▪ Based on the findings of the entire research process, as well identifying via international literature and consultations gaps and opportunities for interventions, DEL asked this study to assess whether the existing host of ICT skills policy actions are still sufficient and fit for purpose for securing the high-level skills of NI's ICT sector today and where it wants to be in future.

1.6 Framework for holistically assessing future high-level ICT skill demand

In order to holistically assess high-level ICT skill needs, a framework has been designed to ensure that all aspects of ICT skill needs were considered in this study (Fig 1.1). Each of the skill requirement elements is described below in Table 1.2. This framework is based around the key elements of skill demand identified in literature and consultations. Note we identify in Fig 1.1 and Table 1.2 which elements can be quantified – these elements are then analysed in chapter 5.

Fig 1.1: Framework for holistically assessing high-level ICT skill needs

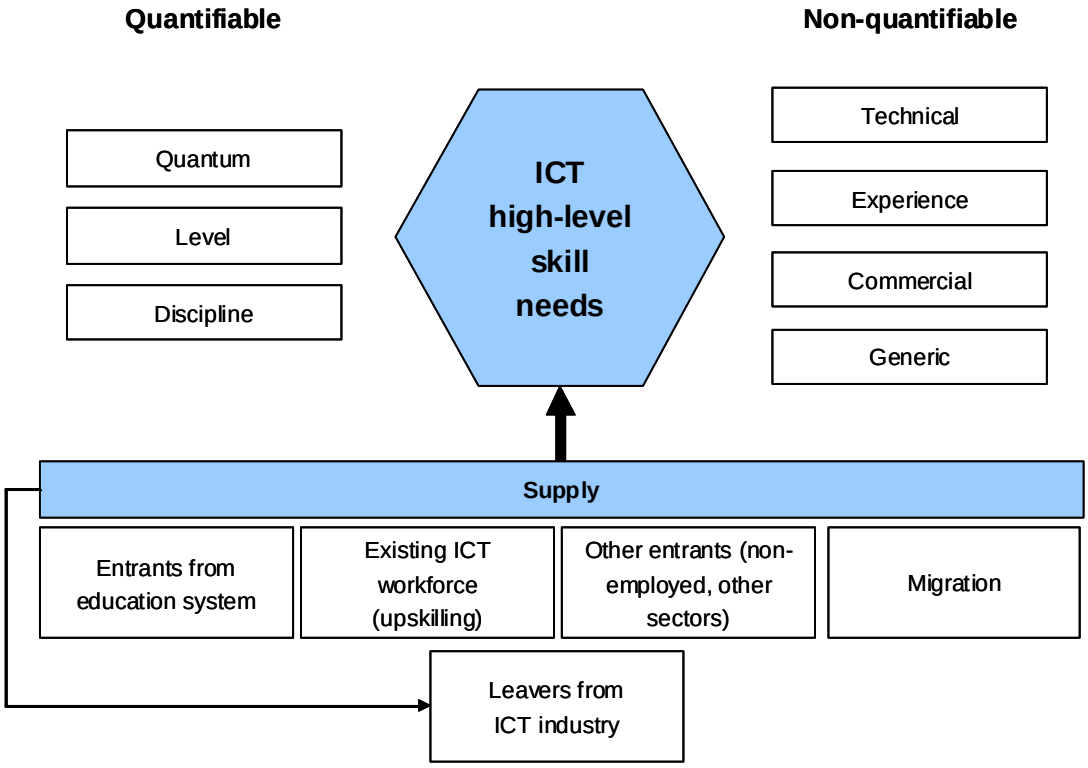


Table 1.2: Framework for holistically assessing high-level ICT skill needs

Element of demand	Quantifiable	Description
Quantum	Yes	Quantum covers: ▪ Expansion demand (change in total employment stock, which is driven by FDI, outsourcing, wider economic conditions etc) ▪ Gross replacement demand (leavers from the industry) ▪ Gross job opportunities = expansion demand + gross replacement demand (consistent with the e-skills UK approach and definitions) ▪ Joiners - entrants other than from education and migration Joiners - net requirement from education and in-migration (residual)
Level	Yes	Linked directly to the 'quantum' analysis: ▪ Net requirement from education and migration by NQF level 1 and below to 8 (but focusing on higher NQF levels 4-8) For example this looks at demand for undergraduates versus masters versus PhDs
Discipline	Yes	Linked directly to the 'level' analysis: ▪ Degree level net requirement from education and migration by broad JACS subject area (but focusing on ICT-specific subject areas) Note analysis is undertaken for demand from both the ICT industry and wider economy (for the latter, this is based on analysis from Oxford Economics' NI Future Skill Needs research – summer 2009 update)
Technical	No	Largely as set out in the Matrix ICT Horizon Panel report. Examples of technical skills include: ▪ Programming languages ▪ Platform knowledge ▪ Web languages ▪ Systems architecture skills ▪ Network and encryption skills for security solutions
Experience	No	▪ This is mainly concerned with the demand for experienced ICT professionals (and desired number of years of experience) versus demand for ICT graduates
Commercial	No	▪ Demand for knowledge of the domain / market / client needs that an ICT company's products and services are to serve
Generic	No	Demand for generic skills such as: ▪ Team working ▪ Sales and marketing ▪ Communication and inter-personal skills ▪ Project management

In an ideal world all elements of future skill needs from Fig 1.1 and Table 1.2 would be quantified so that planned outturns from the supply-side could be aligned directly to these quantified demand needs. In practice quantification of all skill demand elements is not possible due simply to data limitations. For example the Labour Force Survey, the main official data source used in all skills forecasting exercises in the UK, does not capture information on programming language competency of persons employed in the industry (only the broad subject area for degree holders) or years of experience by industry (the LFS sample is refreshed every fifth quarter so persons are not tracked longitudinally). Other quantitative evidence from SSC surveys and the Matrix ICT Horizon Panel report is available, as is qualitative information on for example the skill and experience criteria for vacancies and very detailed technical requirements across the Matrix ICT focus areas (application / product software, embedded systems solutions, near-shoring and security solutions). However this evidence is not available in such a format that is easily integrated into a quantified modelling framework.

The fact that all elements of skill needs cannot be quantified is not surprising (no SSC within the UK is quantifying all elements). Nor is it necessarily a bad thing. Given the relative small size of the NI ICT sector, the closure or arrival of a large ICT firm from a particular niche has the potential to have a disproportionately large impact on the sector and by consequence on the quantum and nature of skill needs (which if not factored into forecasts and is realised, would immediately reduce the predictive power of modelled forecasts). This is before even considering the current economic uncertainty and somewhat future unknowns over out-sourcing and FDI flows for ICT, particularly in a post SFA (Invest NI Selective Financial Assistance) era in 2013.

In addition as a constantly evolving sector, predicting future discipline / subject and technical requirements is complex. This is particularly so if there are few current examples of ICT businesses in NI with skill requirements of the type required by ICT companies that NI hopes to attract and develop. It is much easier to forecast skill needs for businesses present in NI today and not expected to transform significantly[6]. This issue highlighted here would apply equally to predicting the skill needs of another sector for tomorrow – the green technology industry.

This is not to say that estimating solely the quantum, level and subject discipline of future skill needs is not a worthwhile exercise. As a minimum it should be seen as important to (1) have an informed and realistic view on the employment outlook for the short, medium and long-term (to estimate expansion demand), particularly relative to recent history, (2) understand the approximate scale of gross replacement demand and joiners and the destination / sources of these flows, (3) to know how skill levels (by NQF level) within the sector are changing, and (4) to know what broad subject disciplines degree holders in the sector possess / are demanded of new entrants. The quantitative skills forecasting model used in this study provides analysis for each of (1) to (4).

However as should be becoming clear, a quantitative approach should be seen as just one element of the framework for assessing high-level ICT skill needs and is a compliment to, rather than substitute for, other more qualitative research methods (review of literature, consultations and surveys). Specifically for the nuances of sectoral analysis then, this mixture of ‘art and science’ approach, as adopted for this study, is essential to develop a clear understanding of the future high-level skill needs of NI’s ICT industry across all elements of skill needs.

[6] While the Matrix ICT Horizon Panel report has looked in detail at technical skill requirements across the ICT focus areas, it has not sought to ‘quantify’ the demand

1.7 Phases of research undertaken

In order to meet the terms of reference requirements, a combination of 'art and science' research stages were undertaken. These included:

- A review of existing NI, UK and ROI ICT skills literature (see chapter 3), and other international literature (see section 8.2);
- An overview of the ICT skills institutional infrastructure in terms of organisations which provide an overarching strategy for skills and organisations which play a more specific role in identifying skills issues and promoting the development of skills within the ICT sector (e.g. e-skills UK, Momentum, Matrix, DEL etc);
- A series of face-to-face and telephone consultations with major ICT companies, education providers and industry bodies (see chapter 4 and annex C);
- A focus group session with a number of businesses on the Matrix ICT Horizon Panel, as well as Momentum and DEL (see chapter 4 and annex D);
- A comprehensive and highly detailed data collection and analysis exercise covering various aspects of skills demand and supply in the sector;
- A stock take of ICT courses offered at university and Further Education colleges, including degree content and entry requirements, as well as an overview of the Software Professional Course (annex F);
- Application of Oxford Economics' widely respected skills forecasting model (which is used for wider economy skills forecasting for DEL) for the ICT sector (using sector-specific Labour Force survey data to inform assumptions). The model encompasses expansion demand and a full flows replacement demand module, skill needs by highest NQF qualification level and subject demand for degree subjects (see chapter 5). An update of the NI Policy Simulation model utilising latest data and global, national and industry outlooks was also undertaken to ensure forecasts for the ICT sector were up-to-date;
- Development of basic supply-side forecasts of high-level ICT skills (chapter 6), which allowed, for the first time in NI, a forward-looking assessment of the quantum of potential skill demand-supply imbalances (chapter 7); and
- A review of the numerous existing skill-related policy actions for the ICT sector and in light of the demand-supply imbalance analysis in chapter 7 and a review of international ICT skills actions, an assessment of whether the existing host of ICT skills policy actions are still sufficient and fit for purpose for securing the high-level skills of NI's ICT sector today and where it wants to be in future (chapter 8).

1.8 Report structure

The remainder of the report is structured as follows:

- Chapter 2: NI ICT sector in context
- Chapter 3: Overview of ICT skills literature

- Chapter 4: Evidence from consultations – key messages
- Chapter 5: Tomorrow's ICT sector – quantified future demand for high-level skills
- Chapter 6: Supply of high-level ICT skills in NI
- Chapter 7: Future high-level ICT skill demand and supply
- Chapter 8: Securing the high-level skills future of ICT in NI

This report is also accompanied by a comprehensive and detailed annex section:

- Annex A: Bibliography
- Annex B: Overview of ICT skills literature
- Annex C: Overview of consultations
- Annex D: Overview of Matrix focus group session
- Annex E: Comparative statistics on the NI ICT sector
- Annex F: Supply of ICT skills (an overview of ICT course provision and assumptions to forecast the supply of high-level ICT skills)
- Annex G: International policy action references
- Annex H: Existing policy recommendations in NI

2 NI ICT sector in context

2.1 Sector size

According to official figures (DETI bi-annual Census of Employment and the 2001 Census) and Oxford Economics' estimates, total employment in the ICT sector in 2008 was approximately **16,500**, including 1,500 self-employed (Table 2.1). This is based on the e-skills sector footprint definition. This means that the ICT sector's share of total employment is equivalent to 1.9% or just less than 1 in 50 total jobs. This estimate is higher than figures referenced in other research for various reasons. Other estimates include only IT and often exclude the self-employed which are more difficult to estimate.

The largest sub-sectors are software (which dominates SIC 72) and telecommunications.

Table 2.1: NI ICT employment (2008)

SIC 2003	SIC sector	Employment (000s)	% total ICT employment
2233	Reproduction of computer media	0.0	0%
3002	Manufacture of computers & other information processing equipment	2.7	16%
3220	Manufacture of television & radio transmitters		
6420	Telecommunications	4.3	26%
7210	Hardware consultancy	8.0	48%
7221	Publishing of software		
7222	Other software consultancy and supply		
7230	Data processing		
7240	Data base activities		
7250	Maintenance and repair of office, accounting and computing machinery		
7260	Other computer related activities		
	ICT total employee jobs	**15.0**	**91%**
	ICT self-employment	**1.5**	**9%**

Source: DETI Census of Employment, Census Office for NI, Oxford Economics

Although the figures and commentary on ICT's economic contribution are impressive, ICT in NI is still seen as a relatively under-developed sector in size terms compared to many regions in GB and ROI and as 'fledgling', according to consultations, given the presence of few large ICT companies. This view is echoed in the e-skills UK NI IT snapshot (March 2009).

The latest ABI employee data for GB (2007) shows that in absolute terms, NI has fewer ICT jobs than all other GB regions (Fig 2.1). Wales, which trails second last, has just under 20,000 ICT jobs. According to the ROI report Future Requirement for High-Level ICT Skills in the ICT Sector, employment in ROI's ICT sector is much higher at 70,000 in 2008 having been at 80,000 in 2000 (this is 4 times more than NI for an economy which has less than 3 times more total jobs so in relative terms ROI has more ICT jobs[7]).

The NI-ROI differential in exports is much greater still. ROI's computer service exports totalled €21.7bn in 2007 (Source: CSO) compared to NI's £103m in the same year (SIC 72), twenty times the NI value. Note part or all of 'boxed' software export products from ROI appear to be included in CSO computer service export figures rather than goods as ICT products do not appear as a category in detailed CSO goods export figures. This however does not, in our view, distort the comparison, as NI ICT goods exports are currently small. (Development of ICT 'products', in addition to ICT service exports, is a key objective of the Matrix ICT Horizon Panel)

[7] Note there will be slight definitional differences in the ICT footprint used for UK / NI and ROI. Also according to the Matrix ICT Horizon Panel report, the ROI ICT cluster employs 116,000 people [sourced from PA Consulting – The Irish ICT Cluster (2004)]

The analysis of the density of an individual sector (e.g. ratio of total jobs to ICT jobs) is somewhat distorted in NI by the large size of the public sector. A more appropriate way to assess the size / extent of development of the ICT sector in NI is to look at the share of ICT employment as a per cent of total private sector employment[8]. Using this measure, the conclusion on the relative size of NI's ICT sector is quite different to when compared as a share of total employment (Figs 2.1 and 2.2) - NI ranks behind only London and the South East (% private sector employment). This therefore somewhat contests the conclusions reached in existing literature that the sector is relatively under-developed though it is also worth saying that NI ranks so well partly because its private sector is so small and its employment rate is lower than other regions.

Fig 2.1: UK ICT employee jobs concentration (whole economy)

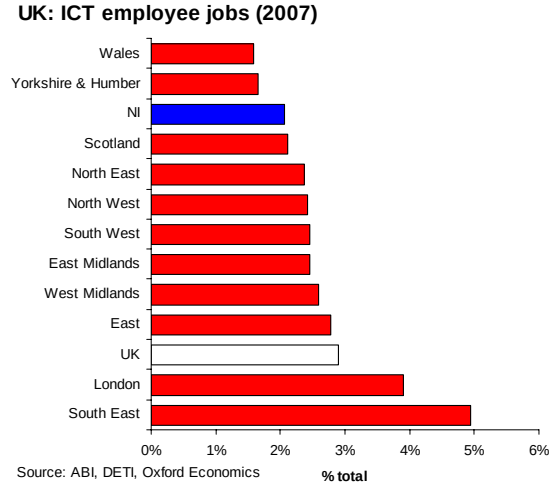
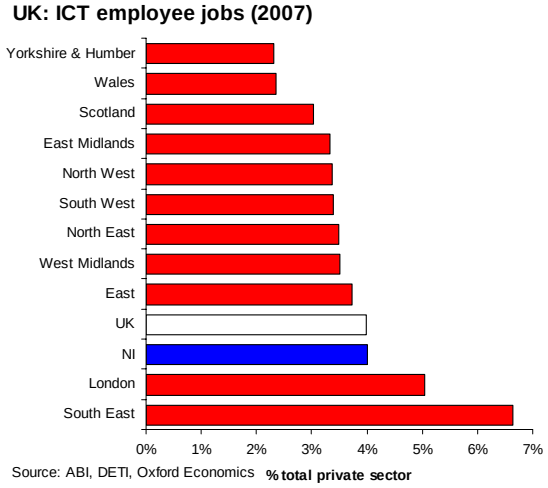


Fig 2.2: UK ICT employee jobs concentration (private sector)



This type of 'relative' analysis is also useful for thinking later about where NI's ICT sector could be and what level of uplift an upper scenario could realistically deliver. A sector larger in relative size to both London and the South East may be unrealistic, unless it is heavily export focused (like in ROI), although this would still require the right support activities being in place from other sectors in the economy. (The aspirational scenarios presented later, whilst ambitious, are plausible using this relative benchmark analysis)

2.2 Employment trends

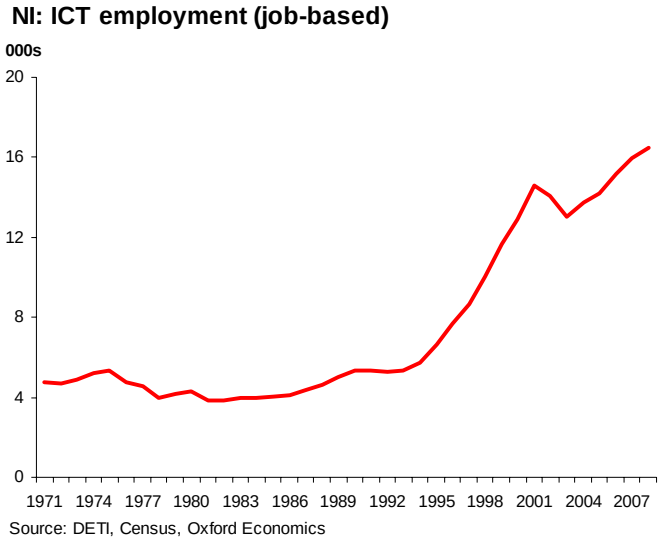
The following charts illustrate historical and recent trends in ICT employment levels in NI. It can be seen that throughout the 1970s and 1980s there was barely any expansion in the sector. This all changed in the 1990s with the internet revolution heralding a period of rapid growth during which employment levels trebled in less than a decade. Of course looking back part of this growth was unsustainable. At the time investment was pouring into ICT companies worldwide and stock values were growing exponentially before any bottom-line profits were being made.

[8] This is done by deducting public administration & defence, education and health & social work employee jobs (SIC L, M and N) from total employee jobs. SIC M and N admittedly include some private elements but as a proxy for public sector jobs this approach is adequate for this purpose.

The ensuing dot com crash hit the NI economy relatively hard and in more ways than a net loss of jobs. Confidence in the sector as a secure employer was badly damaged, partly as it followed a period of such stellar growth, partly due to lack of forewarning and perhaps also partly given the more risk averse nature of the NI workforce given NI's historic dependence on the public sector. Over the period 2001-2003 there were an estimated 1,500+ net job losses, of which almost 1,000 were in ICT manufacturing sub-sectors (one-quarter of the sub-sector's workforce) and almost 700 in computer & related services (10% of the 2001 workforce).

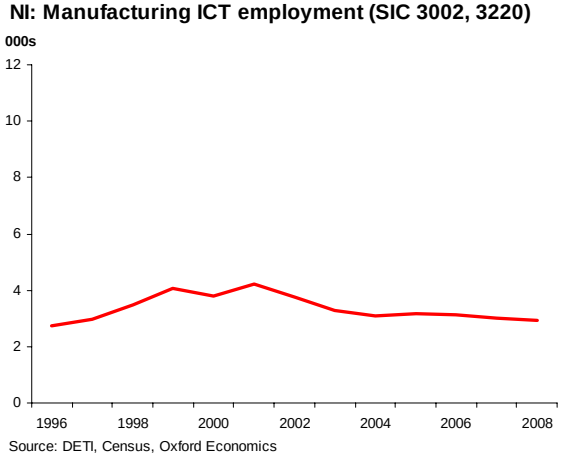
Despite the setback, the ICT sector bounced back relatively quickly with ICT employment returning to its pre-dot com peak by 2006 and continuing to grow thereafter (this is much quicker than for example the expected bounce back in construction employment over the next decade ahead).

Fig 2.3: NI ICT employment



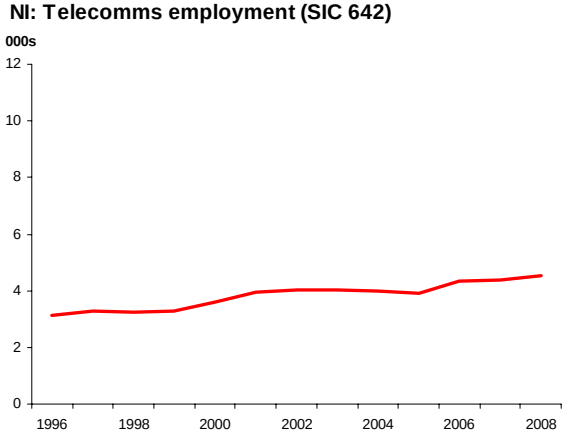
Source: DETI, Census, Oxford Economics

Fig 2.4: NI ICT employment – manufacturing sub-sectors



Source: DETI, Census, Oxford Economics

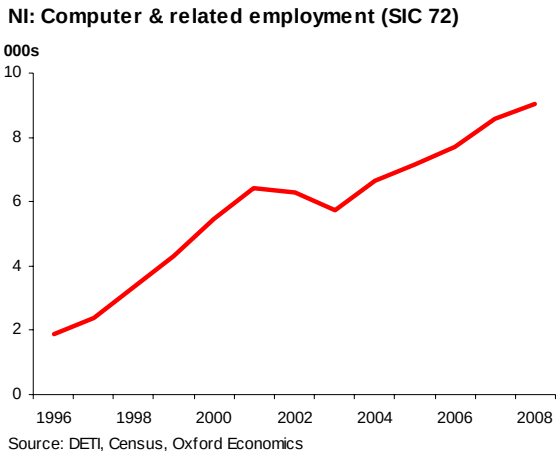
Fig 2.5: NI ICT employment – telecoms



Source: DETI, Census, Oxford Economics

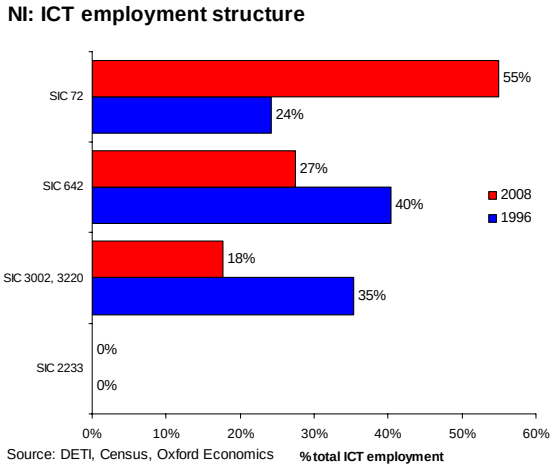
Over the last decade computer & related services, which are dominated by software, has been the most dynamic element of the ICT industry and source of jobs growth (Fig 2.6). Its share of overall ICT employment has more than doubled (Fig 2.7) from one-quarter in the mid-1990s to over half by 2008 (and is expected to rise to over two-thirds in the next ten years).

Fig 2.6: NI ICT employment – computer & relative services



Source: DETI, Census, Oxford Economics

Fig 2.7: NI ICT employment – sub-sector structure



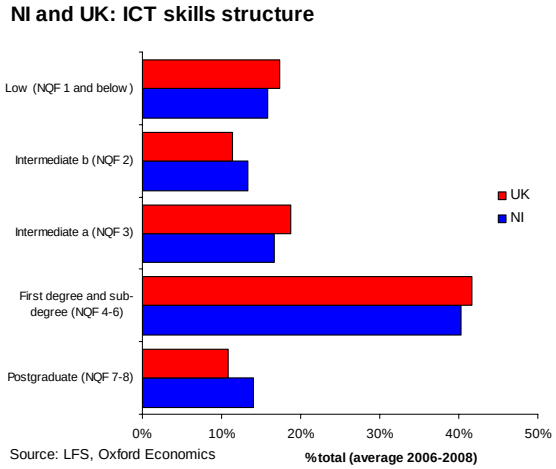
Source: DETI, Census, Oxford Economics

2.3 Skills, degree subject and age structure

Fig 2.8 compares the NI and UK ICT workforce skills structure based on LFS data - the **skill structures** for both are almost identical. According to LFS data averaged over the period 2006-2008, 54% of the NI ICT workforce is qualified to degree level or above (NQF 4-8), i.e. high-level. This compares to 31% for the NI workforce as a whole, emphasising the **highly skilled nature of the industry**.

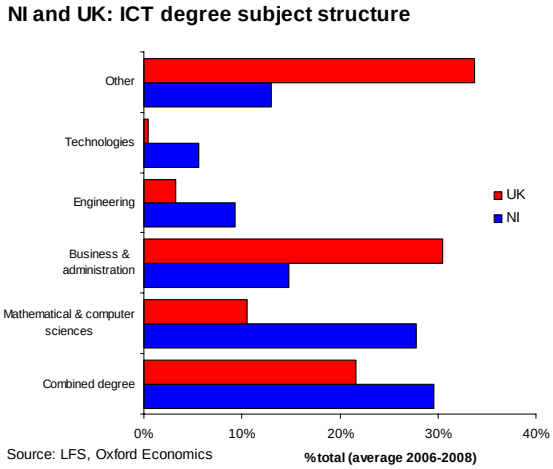
Fig 2.9 compares the NI and UK **degree subject structure** of the ICT workforce, again using LFS data. While there appears to be some interesting differences (for example NI's much higher share of computer science and lower share of business degrees), some of this may be explained by differences in sub-sectoral structures. However more likely it is the small LFS sample size for NI (<20 ICT degree holders on average per annum) which means results may not be fully representative.

Fig 2.8: NI and UK ICT workforce skills structure



Source: LFS, Oxford Economics

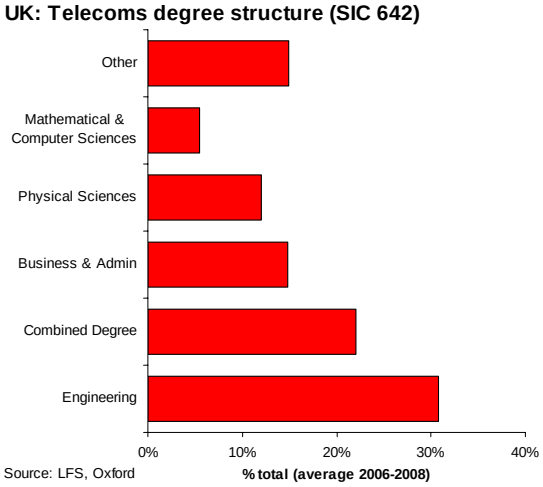
Fig 2.9: NI and UK ICT workforce degree subject structure



Source: LFS, Oxford Economics

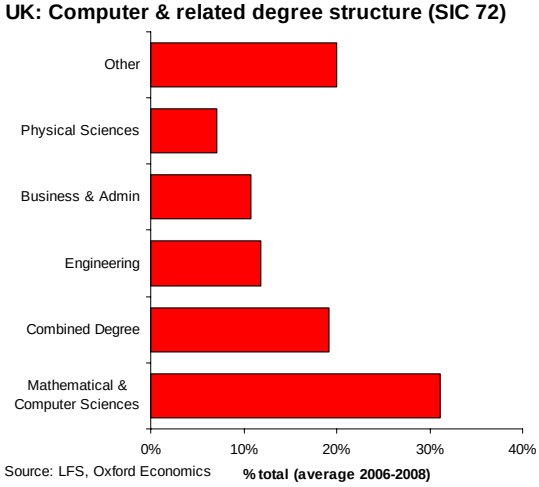
Of course the nature of degree structures will not be uniform across sub-sectors of the ICT industry. Figs 2.10 and 2.11 show significant differences between workforce degree structures for telecoms and computer & related services at UK level (NI sample sizes are too small for this level of detailed analysis). Similarly HESA data for the UK on the undergraduate degree subject of students entering first employment in telecoms and software also shows a contrast (Figs 2.12 and 2.13). It is important however to note that over three-quarters of entrants to software jobs have a computer science background, reflecting the specialised skill requirements of the sub-sector – this matters for assumptions required to forecast demand by subject discipline.

Fig 2.10: ICT workforce degree subject structure– telecoms (UK)



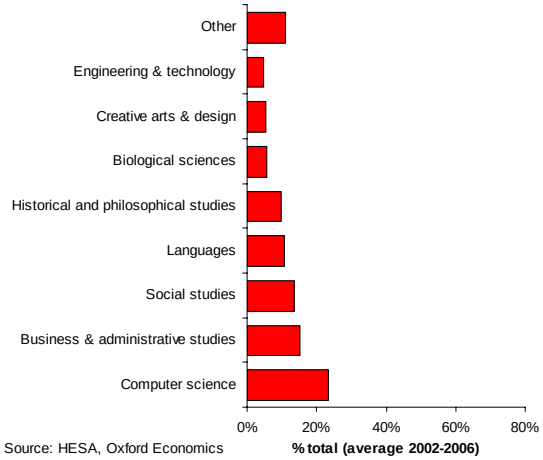
Source: LFS, Oxford

Fig 2.11: ICT workforce degree subject structure– computer & related service (UK)



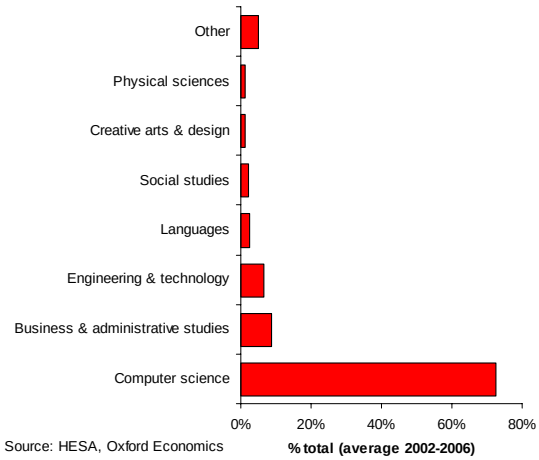
Source: LFS, Oxford Economics

Fig 2.12: Telecoms first destination graduate undergraduate degree subject (UK)



Source: HESA, Oxford Economics

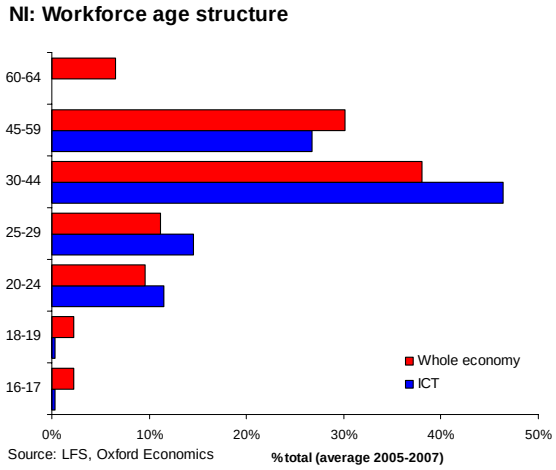
Fig 2.13: Software first destination graduate undergraduate degree subject (UK)



Source: HESA, Oxford Economics

The last element of this sub-section considers the **age structure** of the ICT industry. Our broad ICT industry analysis (Fig 2.14) based on LFS workforce data by age, albeit requiring the usual sample size caveat, shows that the average age of the ICT workforce age is equivalent to the economy average. A different view however suggested by consultations is that the average age (and experience) of some niche ICT professionals in NI is quite high, with specific reference to older employees with a Nortel and BT background and specific skills set. This, it was said, could potentially store up difficulties in the medium and long-term for replacing these skills.

Fig 2.14: ICT and economy average workforce age structure (NI)

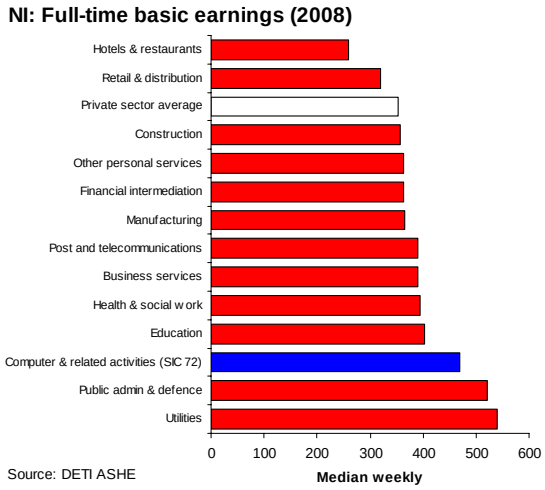


Source: LFS, Oxford Economics

2.4 Earnings

It has already been highlighted how median full-time basic earnings for SIC 72 computer & related services are one-third above the economy private sector full-time average – this would be expected for an industry with a high end skills profile described in this chapter. This result is presented below alongside average earnings for other industries for comparison[9].

Fig 2.15: Sectoral average earnings (NI)



Source: DETI ASHE

[9] Ideally we would like to have also compared here sectoral first destination and longitudinal graduate earnings across the same full range of sectors.. As described later, this may be an important factor in explaining the high leakage of ICT graduates to non-ICT sectors.

3 Overview of ICT skills literature

The purpose of this chapter is to build upon what the existing research and literature reveals about ICT skills issues in NI and for useful comparison and cross-reference, also highlight what literature says for the UK and ROI. Given the research ranges from 2005 to 2009, it is important to also validate what is still relevant today given the dynamism of the ICT industry and changes in the wider economy. Whilst this chapter provides a high-level overview of demand and supply side findings, in the interest of brevity and focus it is not intended provide an individual overview of each report. Annex B however provides a brief synopsis of each report including key aims and contents.

3.1 Literature reviewed

Source	Report	Year published
Matrix	ICT Horizon Panel Report	2008
e-Skills UK	IT Insights: Regional Skills Gap Analysis in NI	2005
e-Skills UK	Technology Counts: IT & Telecoms Insights 2008 (9 reports)	2008
e-Skills UK	e-skills UK Action Plan (April 09 – Mar 10)	2009
e-Skills UK	Creating the IT Nation: Strategic Plan for England 2009-2014	2009
e-Skills UK, NI	Snapshot of the ICT Industry in NI	2009
e-Skills NI, DEL, Momentum and Invest NI	ICT Future Skills Action Plan	2008
Peer Consulting	Economic Appraisal of the SPC	2007
Momentum	Salary Surveys	Ongoing
OCO / Invest NI	NI ICT Sector Review	2006
ROI Expert Group on Future Skill Needs	Future Requirement for High-Level ICT Skills in the ICT Sector	June 2008
Ipsos Mori	Career Opportunities in Computing & Technology in Ireland	2009

The remainder of this chapter is structured as follows:

- Demand for high-level ICT skills
  - Drivers of ICT growth
  - Recent demand trends
  - Current demand
  - Future demand trends
  - Wider economy ICT skill needs
- Supply of high-level ICT skills
  - Factors influencing supply
  - Recent supply trends
  - Current supply
  - Future supply trends
- Demand-supply balance
  - Current demand and supply gaps
  - Future demand and supply gaps

3.2 Demand for high-level ICT skills

Drivers of ICT growth

According to the ROI EGFSN report published in 2008 (which in our view provides the best overview of sector 'drivers'), the key drivers of the ICT sector include:

- Cyclical factors such as the state of the economy and FDI. In the late 1990s high levels of ICT investment resulted in the 'dot com' boom and a high demand for ICT skills. As we have shown in the NI sector context, this was however followed by a decline in growth and loss of jobs;
- The availability and cost of labour. More recently there has been a shift of certain ICT activities to low cost locations such as India and China. These locations offer an increasing number of graduates at more competitive wage levels;
- Technology-driven factors such as the increased standardisation and industrialisation of IT;
- Social factors such as the rise of social computing (Facebook, Twitter) and the shift to greener IT; and
- The rise of the digital natives or those born after 1985 known as the "I-Generation". Keeping up with this generation will require more advanced computing methods, applications and new technologies.

Recent demand trends

Northern Ireland

- Although hit hard by the dot com crash in 2001, the IT Snapshot and previous chapter showed the ICT sector in Northern Ireland has grown substantially over the last 10 years particularly within the software industry, the fastest growing sub-sector of the ICT sector. The key growth factor has been the ability of NI to attract FDI and for local companies to develop profitable niche markets including with the public sector, communication and financial services sectors. This unprecedented growth has allowed companies to expand operations and transfer some programming skills offshore shifting the patterns of demand in NI towards higher level skills.
- In terms of recruitment from education, preferences have been for graduate level and above, with these graduates coming from both technical disciplines such as computer science and electrical engineering as well as non-technical business and management areas.

UK and ROI

- Like NI, the UK and ROI have also experienced high levels of growth since the dot com crash. All three jurisdictions have seen a shift in occupations from traditional entry level jobs towards high-level occupations requiring more advanced ICT skills.

Current demand (at time research undertaken)

Northern Ireland

- Despite the recession, the NI IT Snapshot showed that in the final quarter of 2008 3,700 ICT jobs were being advertised through the press or online in Scotland and Northern Ireland, although job vacancies had been falling throughout 2008. More specifically, one in ten ICT companies had at least 1 vacancy for an IT professional. Over the next 6 months a third of companies are expecting to recruit IT professionals. Recruitment is predicted predominately in software development and technical support as well as IT sales training and management roles.
- The IT Snapshot also showed that 45% of ICT companies were less optimistic than 3 months ago about their overall outlook compared to just over one quarter more optimistic.
- Experienced IT professionals remain the number one choice for ICT companies with 84% of ICT companies saying they will require experienced hires in 2009. However according to the NI IT Snapshot, IT graduates remain in demand with 62% of companies planning to source recruits from here.
- According to the Matrix report there is a high demand for degree level graduates in computing, electronic engineering, production engineering and other numerically intensive courses. It was also mentioned that a combination of business and IT skills is seen as an essential component within the industry.

ROI

- In ROI all companies consulted for the EFGSN report recruited at an experienced level. This is due to the perceived skills gaps in what is taught in higher education and what skills are demanded by industry.

Future demand trends

Northern Ireland

- Some of the key future trends highlighted in the e-skills NI snapshot published in 2009 include:
    - On-going demand for technical skills in system integration, networking, web design, security and IT architecture, to support both custom development and package integration;
    - Increasing need for broad business skills, providing a healthy mix in the workforce; and
    - A migration of IT programming skills and jobs offshore.

Expansion demand

- The e-skills UK SSA for NI indicates that the ICT sector in NI is expected to grow at approximately 2.4% annually between 2006 and 2021. A high proportion of this expansion demand growth is expected to be in occupations which require a high level of skills.
- The Matrix report presents two possible scenarios for the ICT sector in Northern Ireland. One is based on the e-skills UK NI skills gap analysis report of around 2.4% per year from 2006 to 2021. The high base scenario based on the OCO / Invest NI report predicts net job growth of just over 1,000 per year from 2007 until 2010.

Replacement demand

- The Momentum NI ICT industry skills analysis predicts that replacement demand will be approximately 1,610 per annum between 2010 and 2020.
- The e-skills employment forecasts predict that gross replacement demand will equate to 15% of the total workforce. Of this 15% it is believed that 11% will be sourced from areas other than education and migration. The report suggests that 62% will come from other sectors, 26% from unemployment/training schemes and 12% from inactivity excluding students.

UK

- The e-skills UK Technology Counts report (2008) predicts similar growth of the IT and Telecoms sector to the NI projections summarised above. The IT industry is predicted to grow at a rate of 2.5% pa (although only 0.3% pa in telecoms).

ROI

- In the ROI the demand for internships with courses is growing. Employers believe this can smooth the transition from college into the workplace.

Wider economy ICT skill needs

- ICT skills are now becoming as much a necessity as numeracy and literacy in terms of employability. Over three quarters of people now use IT in their job, including 90% of managers, professionals and administrative staff.
- ICT skills are not specific to the ICT industry as the percentage of IT and Telecoms professionals employed by broad industrial groups varies from 17% in financial services, 13% in public administration, education and health to 3% in construction and 4% in distribution, hotels and restaurants (e-skills UK Technology Counts, 2008).

3.3 Supply of high-level ICT skills

Factors influencing supply

- The ROI EGFSN report is the only report which defines sources of supply for high-level skills into the ICT sector. The report identifies three sources of supply - domestic supply, up-skilling of the current workforce and inward migration.

The main factors influencing the quantity and quality of supply are;

- **Wages** - in the dot com boom of the late 1990s, above average wages were prevalent in the ICT sector, especially in ROI. These high wages encouraged high entry to the sector. Whilst the jobs remain relatively well-paid, remuneration is slipping relative to graduate salary levels in other sectors;
- **Job security** - the dot com crash has influenced some of the negativity with regards to career options in the ICT sector;
- **Image of the sector** - the ICT sector has been 'painted' in a negative light since the dot com crash. Not only are the subjects considered hard and complicated, the sector is also deemed to be a male dominated area with low levels of female participation. According to the NI IT Snapshot only 28% of the workforce in Northern Ireland is female; and
- The availability of education and training provision, including the type and level of education and training on offer for both students and professionals in NI, can encourage or discourage students from studying ICT. Access to high-level training and specialist subjects can increase the number and quality of highly skilled professionals and specialist graduates available to the sector.

Recent supply trends

Northern Ireland

- The Matrix report indicated that the number of students enrolled in ICT courses has fallen. The OCO report also highlights a significant decline in the number of ICT Masters and PhD students in NI. These trends are supported by the NI IT snapshot which also shows that the number of first degree IT graduates has fallen.
- The literature also revealed some figures and trends concerning those taking GCSE and A-Level ICT courses:
    - There were 1,924 entries for IT related A-Levels in NI with fewer females applying for these courses;
    - Only 22% of higher education institutions offering IT related courses specify pre-requisites for entry into IT-related courses. This however rises to 62% for Russell Group universities; and
    - Of those with specific A-level requirements, maths dominates with 12% of IT-related courses requiring a maths A-level, compared to only 4% requiring computing/IT/technology A-Levels.

UK and ROI

- The UK and ROI have also experienced similar problems. The e-skills UK report shows that between 2001 and 2005 there was a 50% drop in the numbers of UK applicants to computing, information systems and software engineering. The EGFSN ROI report shows that the number of graduates from degrees in both computing and electronic engineering has dropped following the peaks of the late 90s and early 2000s.
- e-skills UK also report a drop in ICT students in schools and colleges, with the numbers of pupils taking A-Level Computing and GCSE ICT also down.
- Postgraduate conversion courses in ROI leading to higher graduate diplomas in computing have, in the past, made a significant contribution to the ICT skills supply-side. However more recently numbers graduating from conversion courses has fallen from over 1,000 at peak to less than 200 in 2004.

Current supply (at time research undertaken)

Northern Ireland

- According to the e-skills NI IT Snapshot, 60% of ICT professionals are qualified to degree level or above.
- The Matrix report described how the number of new IT graduates entering the Northern Ireland IT workforce was less than the number of computer science graduate qualifiers from Northern Ireland higher education.

UK

- e-skills UK Technology Counts report importantly points out how there is no guarantee that all students on computing or telecoms degrees will necessarily enter the sector. Many students choose to study ICT because of their interest in the subject but not necessarily as a long-term career.

- One quarter of IT qualifiers in the UK had post-graduate qualifications in 2006. A much higher share of telecoms graduates, almost two-thirds, left with post-graduate qualifications.
- The e-skills UK Technology Counts report indicates that gender imbalance remains a significant and worsening issue for the IT and Telecoms sector.

ROI

- According to the EGFSN in 2008, it is estimated that there are approximately 60 PhD graduates in computers science and 45 in electronics and automation.
- In ROI and in particular Dublin there is a high percentage of non-Irish born persons working in the ICT sector, 22% nationally and around 50% in Dublin.

Future supply trends

- The literature to date has not attempted to deliver any indication of future supply trends in the NI or UK. The ROI report has attempted to project medium-term supply trends for ROI.

3.4 Demand-supply balance

Current demand and supply gaps

Northern Ireland

- In Northern Ireland 5% of companies reported skill gaps (e-skills SSA for NI). The most significant skills gaps were in development and implementation of IT systems and services. It was also found that whilst NI has a steady supply of graduates they are lacking in the experience required for many of the positions available within the ICT sector.

UK

- Figures for the UK in 2008 showed that 22% of companies found it difficult to recruit applicants with the right skills. Other figures show that 70% of staff with skills gaps lacked technical skills, 30% lacked business skills and 31% lacked interpersonal skills (e-skills UK Technology Counts Report 2008).

ROI

- In the ROI at the time of the report, there was a particular shortage of people with very high-level technical skills, engineering skills and creativity and experience. Companies preferred graduates to show a mix of skills in computing and business with a focus on the business domain in which the business operates. Some businesses believed that universities are partially to blame for these gaps, as they are not producing the type of graduates needed.
- Also noted in the EFGSN report was that despite possessing the high-level skills required for the ICT sector, many migrants entering the workforce lacked domain knowledge as well (an important drawback to be wary of if relying too heavily on migrants).

Future demand and supply gaps

Northern Ireland

- Taking into account the projected growth of the ICT sector in Northern Ireland, the e-skills SSA for NI suggested that there would not be sufficient ICT professionals above the inexperienced graduate level to meet the needs of the sector in NI.

ROI

- In ROI at the time of reporting (which was well before the economy entered a severe recession), projected domestic supply was predicted not to be sufficient to meet whole economy demand under a more positive growth scenario. Projected domestic supply would only roughly meet demand under a more negative scenario. Shortages projected for the ICT sector range from hundreds per annum of electronic engineers qualified at Honours Bachelor Degree level and up to an average of 2,000 - 3,000 computing graduates per annum.

4 Evidence from consultations – key messages

4.1 Consultation process

Oxford Economics and FGS McClure Watters viewed the consultation phase of the research as important in building upon and reviewing current research and providing a direct insight into the need for high-level ICT skills. In particular the consultation phase of the research investigated the recommendations in the Matrix report to accelerate the future growth of the ICT sector and deliver a globally competitive ICT sector, as well as seeking feedback on the appropriateness of existing ICT skill policy actions.

The consultation process was undertaken between March and June 2009 and consisted of a two stage approach. Firstly approximately 23 individuals were interviewed from a range of different ICT businesses including Kainos, Allstate, First Derivatives and Singularity, as well as a number of Higher Education and Further Education providers and other key stakeholders such as Momentum and e-skills UK. Secondly given the importance of the Matrix report and its vision for the ICT sector, a focus group session was held in June 2009 with key Matrix Panel members, Momentum and DEL.

This chapter intends to provide a high-level, focused recognition of the key demand and supply issues identified throughout the consultation process. In doing so it is possible to compare this information with what currently exists in the available literature and confirm what still holds for today. Annex C and D provide a more in-depth overview of the consultations.

The first consultation phase was structured around the following themes. Consequently this chapter broadly summarises views under the same headings.

- Theme 1: Key drivers, growth trends and prospects
- Theme 2: Demand for high-level skills, occupations and experience
- Theme 3: Supply of ICT skills and the role of education and training
- Theme 4: Demand-supply gaps
- Theme 5: Securing the future of high-level ICT skills

4.2 Demand for high-level ICT skills

Quantum

- Both consultations stages revealed little evidence of ICT job redundancies thus far into the recession but suggested that 2009 graduates may find it more difficult than previous years to find employment.
- Some companies still have expansion plans despite the wider economic recession.
- The initial consultations suggested that long-term ICT growth opportunities still existed in e-government, finance, green IT and business to business support and that changing consumer needs would help to fuel growth i.e. social networking, e-government and financial services regulation.
- Stage one of the consultation process however warned that outsourcing is ‘a risk to growth in NI’ particularly if it means losing high-end jobs to other locations. There has been an increase in the number of companies accessing labour in places such as India or Eastern Europe due to the perceived lack of ICT professional skills in NI. While most of the outsourced jobs have been in low-skilled roles, one local ICT company did suggest that high-skilled roles within their company were being outsourced.

- Reflecting the small critical mass of the sector and lack of spare skills supply capacity, some consultees suggested that Northern Ireland would find it challenging to service a large scale incoming FDI opportunity (100+ jobs) requiring the appropriate mix of graduates and experienced professionals. This is by no means unique to smaller regions such as NI but it is perhaps more difficult for NI than other GB regions to have a flexible domestic supply of high-level ICT skills. In mainland GB ICT professionals can more easily commute between regions or migrate, whereas the Irish Sea divide (and possibly a legacy 'Troubles' image), provides an additional barrier. Similarly the all-island labour market, despite severe recession in ROI, is not yet as fluid as might be expected given different tax rates, levels of remuneration etc. However in saying this, the availability of domestic ICT skills has not proven to be a barrier for the New York Stock Exchange inward investment. In October 2009 the New York Stock Exchange (NYSE) announced its intention to create a hi-tech service centre in Belfast which is expected to create 400 IT jobs in the next two years. The Chief Executive of the NYSE stated that the skills base of the region's workforce proved crucial in 'clinching the deal'.

Level

- Both the consultations and Matrix focus group session revealed a significant demand for high-level skills, including for masters and PhD students.
- Both consultation stages revealed that some ICT courses from the local education system were too general. All ICT degrees, it was said, should contain a strong component of programming.
- It was expressed that Northern Ireland can no longer compete at the lower end of the market. High-level skills need to be developed in order to create a niche in the market.
- The Matrix focus group session divided the type of ICT skills required by organisations into 2 categories – 'doers' (graduates) and 'innovators' (high-end, specialist skills) and suggested that both are currently required by organisations.

Discipline and technical

- Both stages of consultations revealed that non-technical skills such as team skills, communication, sales and marketing skills are very important for business growth and development.
- The initial consultations suggested that there is some demand for specific technical skills such as C++ programmers, SharePoint Microsoft collaboration tool and Cobol experts however these were not as important as 'good, clever people' - a statement which was repeated in the Matrix focus group session.

Experience

- Experienced ICT professionals are currently in higher demand than graduates.
- Consultations suggested that there was some reliance on professionals largely trained by Nortel and BT (i.e. network technicians) and given the older age of some of these individuals, there could be some difficulty in replacing these skills in the medium and long-term. It is unlikely that graduates or even ICT professionals with 2+ years experience will be able to fill these gaps.
- Employers tend to be looking for more experienced (2-5 years) professionals rather than graduates (presumably because with predicted job losses the choice will be greater).
- Not all companies are able to recruit a sufficient number of experienced ICT professionals and as a result, some have expanded operations overseas.

4.3 Supply of high-level ICT skills

- Both stages of consultations signalled that the quality of students graduating from ICT courses has declined.

- While QAA Audits, Professional Bodies accreditations and external examiners all indicate that Higher Education ICT course standards in NI are not falling below standards in the rest of the UK, if UCAS entry points are falling for GB ICT courses then remaining at UK standards still means an absolute fall in quality and decline relative to other subject areas.
- The perception of ICT as a career and sector was seen as dull, boring and 'men in boiler suits.' This has reduced supply into higher education ICT courses. This sentiment was echoed in both stages of consultations.
- Some courses (but much less so courses such as Computer Science) were seen as too general with not enough good solid programming elements. This however may be a reflection of industry's perception and experience with graduates from the breadth of courses that are currently on offer at both universities. As the universities right point out, not all ICT courses, for example Business Information Technology, are actually designed in the first place to produce graduates for the higher skilled end of the ICT industry (e.g. the software sector) but more so for other industries.
- While industry recognised there was a demand for more generalist IT programmes, the demand for more advanced degrees (computer science, software development) was much stronger.

Secondary education

- Universities identified a mismatch between what schools teach for IT and what is taught at university.
- According to one university ICT lecturer, "ICT as an A-Level subject does us no favours". It is said to give potential applicants the false impression that ICT is only about web design, databases and using packages and is often avoided by the better A-Level students in favour of the more established maths and science courses. It was highlighted that this needs to be addressed to ensure that people that do come from school to university are clear about what they will be learning at university and therefore be better prepared.
- In addition it was said that "computing as an A-Level subject seems to be dying" and this urgently needs to be reversed to halt the decline in the number of students taking A-Level Computing and the decline in the number of schools offering it at A-Level.

Further Education

- The initial consultations suggested that industry-education collaboration and input from Further Education was considered very helpful. The Software Professional Course (SPC) was identified as an example of successful collaboration between further education and industry.
- It was also indicated by a number of initial interviews that the Software Professional Course provides a much needed boost to supply.
- Consultations showed that FE colleges respond relatively quickly to training requirements – a positive for the sector.

Higher Education

- The consultation process revealed that there were not enough 'good, solid' graduates or high skilled professionals to fill shortages. This may be related to the perceived mismatch between company requirements from university and what universities can actually provide across all ICT subject areas. (It also reflects a lack of graduates in more technical and in-demand subject areas such as computer science)
- High drop out rates from ICT courses were also mentioned.

- The universities also highlighted the dearth of non-NI domiciled students enrolled on ICT courses, i.e. there has not been a complimentary inflow of foreign students (or even from ROI and GB) to study and eventually work in NI. With increasing student mobility, falling NI demographics and a reliance on local students, it was felt that it will be difficult to build student (and graduate) numbers unless the universities are successful in attempts to recruit students from outside NI.
- In contrast to the above point, NI universities receive a large number of international (typically non-EU) applicants who wish to study ICT at Masters and Doctorate level. However, particularly at PhD level, DEL grants are only open to NI, GB or EU applicants. The universities felt it would help greatly if DEL could extend the eligibility of grants to include international applicants.
- Both stages of the consultations indicated that input from / collaboration with Higher Education was very limited (although the universities would argue that they have "very good relationships with employers and are responsive to their needs in terms of curriculum development").
- It was agreed by both sets of consultations that placement years and international exposure for both graduates and experienced professionals was making and will make a significant difference to performance. It was also said that local universities having year long placements as a compulsory and integral parts of the degree programme is relatively rare in both the UK and ROI.
- The Matrix focus group session in particular pointed out that there was a very limited supply of Masters and PhD students, which should be addressed. Queen's University reported a particular difficulty in recruiting PhD students locally. Graduates, at least up until recently, seemed to have been able to get a well paid job in the ICT industry or elsewhere and saw no benefit to studying for a further 3 years.
- There is a significant lag between identifying a need for specific skills and approval though the university system.
- Consultations acknowledged the role of universities in acting as an educational establishment rather than a "training institute for the software development sector" (which in any case the universities would not wish to become).
- Local businesses also sympathised with the financial pressures experienced by universities to get 'bums on seats'.

4.4 Demand-supply balance

- Stage one of the consultations suggested that there are not enough graduates or experienced professionals with specific ICT technical skills i.e. C++, Microsoft SharePoint.
- Businesses consulted find it difficult to recruit ICT professionals with good non-technical skills such as sales, marketing or communication skills.
- Companies are prepared to outsource or employ migrant labour to fill skills gaps.
- It was highlighted in both sessions that there is currently a shortage of ICT professionals with two to three years experience.
- Adding to this there is a shortage of Masters and PhD students in the sector and subsequently a difficulty in recruiting PhD students. The consultations however did not fully articulate whether there was a 'genuine' requirement for Masters and PhD students by ICT businesses.
- Some of the initial consultations suggested that, at this point in time, NI would find it challenging to service a large scale FDI recruitment operation of 100+ ICT graduates and experienced professionals.

4.5 Remarks for securing the future of high-level ICT skill needs

Both stages of the research revealed a number of remarks for the future development of ICT skills in the NI ICT sector. Remarks included a need to:

- Extend careers advice and marketing to schools – Bring-IT-ON campaign;
- Increase female participation – provide incentives such as bursaries or scholarships;
- Improve the quality of students – increase entry requirements at university;
- Undertake continuous re-skilling of the existing workforce – government funding for higher end skills development;
- Increase research capabilities and collaboration between research centres such as SAP and universities. This could also include measures such as linking a proportion of PhDs with industry needs;
- Improve communication channels between industry and education as well as between companies to address common skill problems;
- A rethink of ICT education from primary school through to higher education;
- Develop global partnerships with universities such as the Massachusetts Institute of Technology (MIT) in Boston; and
- Promote study or work abroad programmes (providing those who participate return to NI).

4.6 Summary – what still holds from existing literature and what's new from the consultation process?

As a summary this section highlights 'what still holds from existing literature' in the context of the 'new evidence' gathered through the consultations.

What still holds from existing literature?

Demand
- High-level focus of skill needs
- Niche or specialist skill needs i.e. C++, Cobol, .net programmers
- Demand for Masters and PhD students

Supply
- Declining number of graduates
- Fall in the quality of graduates
- Re-skilling important to keep up with changes within the sector

Demand and supply gaps
- Skills shortages and gaps for both technical and non-technical ICT professionals
- Inward migration encouraged to fill gaps
- Difficulties in recruiting Masters and PhD students

Remarks
- Importance of careers advice and marketing to schools; increasing female participation; improving communication channels between industry and education

What's new from consultations?

- Understanding of the recession impact
- Increased risk of outsourcing

- Recognition of the potential lack of capacity to meet the skill needs (quantum, level etc) of large scale FDI
- Degree of mismatch between university offering and what companies need – courses seen as too general with not enough good solid programming elements (though this does not apply to all courses)
- Positive contribution of the Software Professional Course
- Placement years and international exposure making a positive difference to skill levels and employability
- Remarks – greater emphasis on the quality of the education output; importance of greater research collaboration and developing global partnerships with world-class universities

5 Tomorrow's ICT sector – quantified future demand for high-level ICT skills

The first part of the terms of reference asked for this research to assess the future demand for high-level ICT skills within the ICT industry from both a quantitative and qualitative perspective. To recap this was expected to cover:

- A quantification of the likely future demand, to the extent that is meaningful, for high-level ICT skills from within the ICT sector – building on the existing e-skills research which focused on all skill levels;

- A relative breakdown of high-level ICT skills by discipline, particularly computer science, software engineering and electronic engineering, based on enterprise needs and international best practice / experience; and

- An identification of qualitative changes in the nature of the future requirement for high-level skills.

The previous two chapters have covered the qualitative elements of high-level ICT skill demand which as said earlier, are difficult to quantify – e.g. experience, technical skill requirements, generic skills etc. **The focus of this chapter then is on forecasting the quantifiable elements of future high-level ICT skill needs – quantum, level and subject / discipline**.

It is worth repeating here the precise definition of high-level skills as set out at the start of report – 'advanced' and 'researcher skills' from NQF level 4 (foundation degree) to NQF level 8 (PhD), including accredited qualifications of a sufficiently high standard.

5.1 Economic backdrop

It is important in presenting forecasts for any industry to provide brief background economic context. This is particularly so for an export-led industry such as ICT which has undergone highs and lows in the recent past and given linkages to other sectors, could be said to be more cyclical than other sectors.

As described earlier, post dot-com crash and pre-recession the ICT industry in NI enjoyed a number of years of strong recovery in employment. Whilst not quite the same pace of growth of the 1990s (which is unlikely to be seen again in any generation for the industry), it was still sufficient to restore the industry to its peak level of employment. Notwithstanding the dot com blip, the last decade has been a 'golden era' for the local, national and global economies, and also for the ICT industry in NI.

The current recession, which is unprecedented in its global and sectoral reach, has however brought this 'golden era' to an abrupt end. Whilst recovery is predicted, and in initial years some sectors are expected to experience strong 'bounce back, there are still a number of downside risks which mean that recovery is not a foregone conclusion. Specifically for the ICT industry, examples of downside risks might include: a faltering global economy; strengthening of Sterling (which would affect ICT exports); a more risk averse FDI environment; and public expenditure cuts which might affect major ICT projects.

It is against this backdrop then which the baseline forecasts for Oxford Economics' NI ICT employment forecasts are set - clearly different conditions from the recent golden era and internet revolution years of the 1990s. Note while the focus of the initial part of this chapter is on the baseline 'policy neutral' outlook for the ICT industry, later in the chapter we consider more aspirational scenarios which are more akin to what Matrix, Invest NI and government aspire to.

5.2 Quantum of future high-level ICT skill needs (baseline)

The forecast quantum of future high-level skill needs required by the NI ICT industry under a baseline scenario is summarised next. This is the sum of expansion demand (change in the employment stock) and net replacement demand (leavers less joiners) to give a quantum of likely vacancies for joiners from education and in-migration.

The baseline refers to Oxford Economics' latest summer 2009 outlooks which factor in the very latest developments and outlooks for macroeconomic variables such as global trade, exchange rates etc, all of which direct and indirectly matter for prospects for the NI ICT industry.

As explained previously, the methodology employed is exactly the same as that used in wider economy skills forecasting work for DEL (see http://www.delni.gov.uk/forecastingfutureskills) with industry-specific assumptions from the LFS used (again based on the e-skills sector footprint definition).

The key messages from the baseline 'quantum' analysis are:

- **Expansion demand** – **short-term job losses** in the sector are predicted during the recession (Fig 5.1[10]) followed by steady employment growth (though slower than the previous decade). The long-term industry employment growth rate is similar to the e-skills 'likely' forecasts for the UK and NI long-term employment forecasts referred to in both the NI ICT Future Skills Action Plan and Matrix ICT Horizon Panel reports. However importantly **future growth is half the rate of the last decade**.

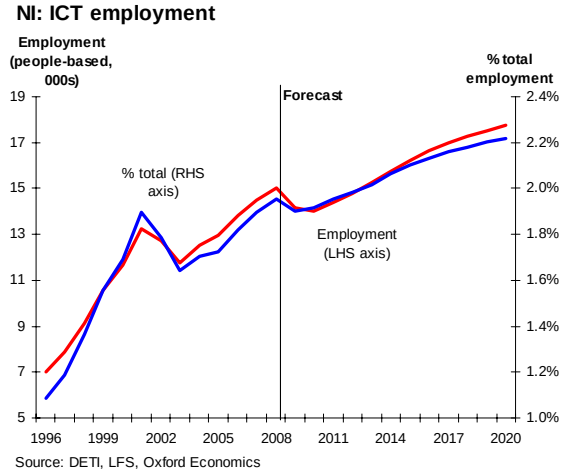
- **Leavers and joiners** – according to the LFS, and again consistent with e-skills' labour flows analysis at UK level and figures used by Momentum, 'churn' in the sector is relatively high with outflows from and inflows to the sector averaging 10-11% of the total workforce pa (excluding switchers within the ICT sector and joiners from education and in-migration). During consultations Matrix understandably questioned the scale of joiners for NI although the assumptions are consistent with e-skills assumptions for the UK and have not been adjusted[11].

[10] The red line in Fig 5.1 is the ICT employment level; the blue line is the ICT share of total employment.

[11] As always with this type of analysis there is a possibility that sectors have been misclassified (e.g. call centre jobs recorded under ICT with high joiner rates from unemployment etc) which cannot be fully discounted. However there is insufficient information available to make a reasonable adjustment to the data to take account of this.

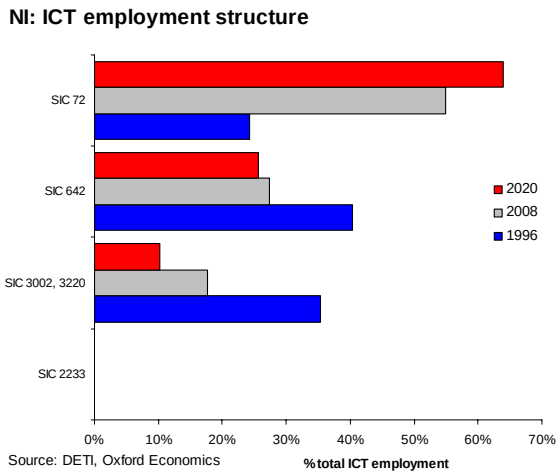
- **Gross opportunities and net requirement for education and in-migration** – although gross job opportunities are expected to exceed 1,000 pa on average in 2009 and 2010 (expansion demand + gross replacement demand), there is still estimated to be excess supply in the short-term from joiners from other sectors and non-employment (especially in 2009). Inevitably this will mean leavers from education will face intense competition for a more limited number of ICT job opportunities than in the past[12]. **As the industry recovers and starts to grow again post-recession, the expected annual net requirement from the industry for education leavers and migrants is 300 persons across all skill levels (Fig 5.6) – however this is still 500 lower than the net annual requirement of the last decade excluding the 'dot com' crash years. This may surprise some but it must be remembered, as explained above, that expansion demand growth is half the rate of the last decade**.

Fig 5.1: ICT employment forecast (baseline)



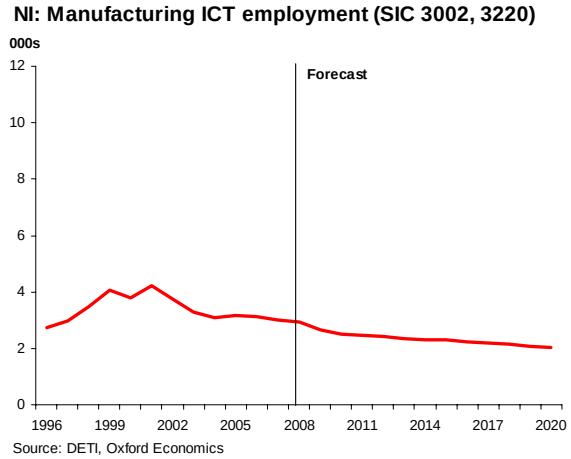
Source: DETI, LFS, Oxford Economics

Fig 5.2: ICT employment structure (baseline)



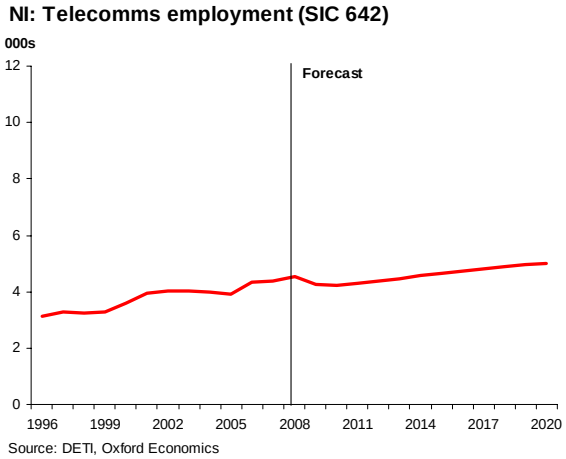
Source: DETI, Oxford Economics

Fig 5.3: ICT employment forecast – manufacturing sub-sectors (baseline)



Source: DETI, Oxford Economics

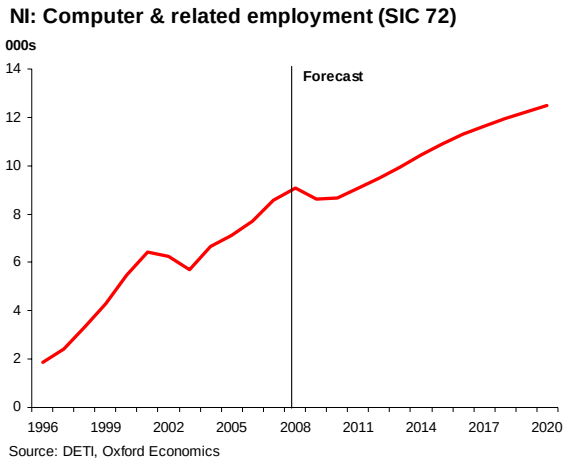
Fig 5.4: ICT employment forecast – telecoms (baseline)



Source: DETI, Oxford Economics

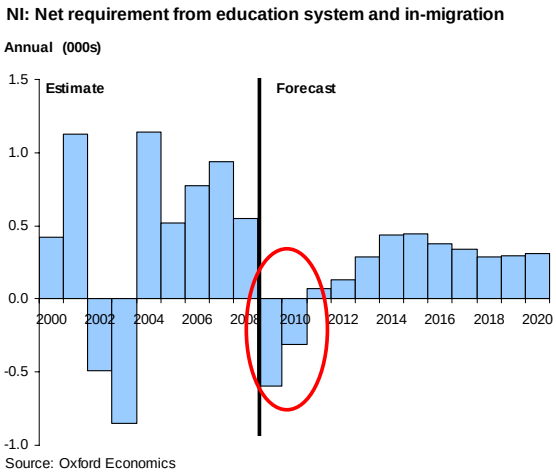
[12] This could dampen wage expectations with many people competing for few jobs. The recession may help to alleviate part of the skill shortage problem in ICT, although achieving this via demand and not improving supply is not the optimal route

Fig 5.5: ICT employment forecast – computer & relative services (baseline)



Source: DETI, Oxford Economics

Fig 5.6: ICT net requirement from education and in-migration (baseline)



Source: Oxford Economics

5.3 Level of future high-level ICT skill needs (baseline)

- **Net requirement for high-level skilled education leavers and in-migrants** – half of the net requirement for total education leavers and in-migrants will be for persons with high-level skills (NQF 4 and above). In the long-term (2010-2020) this translates to 110 foundation and undergraduate students, 30 masters students and 10 PhD students on an annual basis.

- **Caveat** – the skill assumption applied to the 'residual' net requirement from education and in-migration is based entirely on past data (with some skills 'creep' built into new entrant flows). This approach should therefore be considered skill demand if past actual skills trends and data are indicative of actual labour market desires and not just education and migrant skill outputs – i.e. it assumes the skill patterns in past data reflect the actual skill demand from employers. It may well be the case, particularly for ICT which has had well-documented skill shortage problems, that in recent years inflows into the labour market from education have not always had as high a level of formal qualification that employers would have liked or benefited from. For example the Matrix focus group session and wider consultations revealed a strong demand for higher level skills, including at masters and PhD level, but historically the sector has not been able to attract a large number of entrants qualified to this level. This caveat applies equally to the forecasts by subject discipline, which are based on past data with some subject 'creep'.

5.4 Discipline of future ICT high-level skill needs (baseline)

- **Net requirement for degree-level education leavers and in-migrants by subject** – the main degree discipline expected to be demanded from education leavers and in-migrants is computer science. This is based on historical HESA patterns (and reflecting the dominance of software as the main driver of growth in the ICT industry). Within computer science, pure computer science degrees will be the main degree demanded (software engineering is a relatively small proportion of overall degree demand – based on past trends which could also reflect available supply).

- **Caveat** – the same caveat for the 'level' analysis applies equally to the forecasts by subject discipline, which are based on past HESA data for NI with some subject 'creep'. More so than the 'level' analysis, an assessment of subject demand, given data limitations and possible past constraints (employers took what was available, including 'stop gap' conversion courses such as the Software Professional Course), needs to be informed by a wider evidence base than is possible through a quantitative skills forecasting model. This study has contributed partly to the qualitative evidence base, reporting a preference for highly technical disciplines, but also for courses with business modules as part of a joint or major-minor degree.

- **Demand for ICT graduates from other sectors** – using Oxford Economics' NI economy skills forecasting model (used to provide DEL with wider economy skill forecasts), it is possible to also quantify the demand for ICT graduates from other sectors. As presented below, the quantum of demand for computer science from non-ICT industries, for example, is 430, significantly higher than the demand from the ICT industry (70). This reflects the transferability of ICT qualifications to other sectors and level of challenge the ICT industry faces to attract ICT graduates, not to mention the problem of falling enrolment trends.

Table 5.1: Summary of baseline ICT high-level skill demand forecasts

Component	Short-term (2008-2010)	Long-term (2010-2020)
Expansion demand	**-500 jobs pa (people based)** -200 ICT manufacturing sub-sectors -100 telecoms -200 computer & related services	**400 jobs pa (people based)** (2.4% pa) (3.7% pa for IT / SIC 72) 90% expansion demand in computer & related services [Note 600 jobs (5.0%) pa last decade 1998-2008 so long-term growth half the growth rate of the past decade]
Gross replacement demand	**1,600 persons pa** (11% of total workforce)	**1,800 persons pa** (11% of total workforce) Includes leavers to retirement, death, unemployment, inactivity, other sectors and out-migration (other sectors roughly half of leavers) but does not include within ICT job switchers
Gross job opportunities	**1,100 persons pa** Possible over-estimate if fewer people retire early / leave for other sectors etc and actual job loss turns out to be higher	**2,100 persons pa**
Demand for entrants other than from education and migration	**1,600 persons pa** (11% of total workforce) 50% from other sectors 33% from unemployment / training schemes (this is surprisingly high given these entrants are likely low skilled although the share is broadly comparable to e-skills UK assumptions) 17% from inactivity excluding students	**1,800 persons pa** (11% of total workforce) 50% from other sectors 33% from unemployment / training schemes 17% from inactivity
Net requirement from education and in-migration	**-500 persons pa** Note this includes all skill levels from NQF 1 and below to 8 (see next for net requirement for high-level skills only)	**300 persons pa** (average net requirement last decade 800 persons pa excluding 'dot com' crash years) Note this includes all skill levels from NQF 1 and below to 8 (see next for net requirement for high-level skills only)
Net requirement from education and in-migration (high-level skill only)	**-200 persons pa** (46% of total net requirement) -165 sub-degree and degree, 30 masters, 5 PhD	**150 persons pa** (49% of total net requirement) 110 sub-degree and degree, 30 masters, 10 PhD
Net requirement from education and in-migration (degree level only)	**ICT industry (persons pa)** -90 Computer science, -20 Business & administration, -10 Engineering & technology, -40 Other disciplines (note all figures rounded to nearest 10)	**ICT industry (persons pa)** 70 Computer science, 10 Business & administration, 10 Engineering & technology, 20 Other disciplines (note all figures rounded to nearest 10) The sum of these figures, 135, is consistent with the figure of 150 above (the difference is an adjustment for the non-degree share of NQF 4-8 – subject analysis is only possible for university degrees) **Non-ICT industries (persons pa)** 430 Computer Science, 390 Engineering & technology (from Oxford Economics' wider NI economy skills forecasting research)

5.5 Aspirational scenario high-level ICT skill needs

The quantitative analysis thus far on future high-level skill needs in the ICT sector is based on Oxford Economics' summer 2009 baseline 'policy neutral' outlook for the global, national and NI economy and industries. These are the same underlying economic forecasts used by other government departments and the summer 2009 outlooks have also been used for an update of NI wider economy skill forecasts for DEL (see addendum report).

As explained above, for the ICT industry in NI this translates into an employment outlook with short-term average annual jobs losses of approximately 500 and longer-term expansion of roughly 400 jobs (people-based) pa. In growth rate terms, the long-term ICT employment outlook is half the rate of the past decade but broadly consistent with industry employment forecasts for NI from e-skills UK.

This baseline outlook is of course not the same as the aspirational vision for the industry or the outcome if the sector maximises its potential. Similarly the metrics of the future skill needs analysis is not what the industry would need if it achieved the aspiration.

It is therefore useful to look as well at skill needs under an aspirational scenario. Regardless of whether the aspiration is ever achieved in full, it is still important to know the skill requirements of the aspiration so that skills supply is not the constraint on its achievement if demand factors are in place (e.g. FDI, expansion of indigenous ICT companies etc). Having surplus ICT skills (which can be exported to other regions and later attracted back) is a better problem than having a shortage of ICT skills.

Development of an aspirational scenario is however often a complex process. Though there are published goals for the economy such as closing the productivity gap and a degree of consensus over 'moving up the value chain', 'focusing on exports' etc, there is no fully defined path or all encompassing accepted vision on 'how to get there'.

Fortunately for the ICT sector (unlike many other sectors of the economy bar the other Matrix sectors), thanks to the Matrix process, **the ICT industry has a well articulated vision of where it would like to be**. This was based on 18 months of work, drawing on research of NI ICT capabilities, the experience of leading ICT businesses in NI and foresight work on future industry growth areas. This culminated in the selection of three focus areas – package application software, near-shoring and high performance embedded systems. **Unfortunately, as for most visions, the underlying detail is not taken a step further and explicitly translated into additional jobs by sub-sector, which is needed to run a scenario through our and other quantitative skills forecasting models**. While the Matrix ICT Horizon Panel report does refer to a high base scenario of 1,000 jobs per year, equivalent to 5-6% growth pa (and most of these jobs requiring degree-minimum qualifications), this is not directly linked to the actual Matrix vision. The number comes from a report by OCO Consulting in 2006 (*NI ICT Sector Review*), i.e. pre-dates Matrix and the global recession. The figure of 1,000 was based on information from Invest NI at the time on the potential growth of existing ICT companies between 2007/08 and 2009/10.

Having discussed in some depth with Invest NI the level of expansion demand growth under an aspirational scenario, we have decided to maintain a long-term scenario of 1,000 net jobs growth pa

and term this the 'Matrix scenario' (we build in this expansion demand of 1,000 net new jobs from 2012 onwards[13]).

It is however worth caveating that the Invest NI job target relates to only new pipeline FDI or pipeline existing FDI (Invest NI clients setting up a new division). As an aggregate industry forecast is required, this does not factor in performance of indigenous, non-Invest NI clients. In addition the target is only available up to the end of the Invest NI corporate plan period (2011) and not to 2020 as required for this research so the expansion demand assumption post-2011 cannot be said to come directly from the Invest NI corporate plan.

In addition to this Matrix scenario, there is one other potential local aspirational scenario option which can be considered – a PSA 1 / Leitch scenario which is described below.

- **PSA 1 / Leitch scenario** – Oxford Economics' NI Future Skills Needs research for DEL articulated and quantified an aspirational outcome for the NI economy (this was the first attempt to do so in terms of underlying sectoral detail and magnitudes of employment and productivity uplift). Described in more detail in the full published report (http://www.delni.gov.uk/forecastingfutureskills), the aspiration was the employment and occupation trajectory the NI economy would need to follow to meet the PSA1 private sector productivity target by 2015, given (1) the unique characteristics and competitiveness strengths of the NI economy; (2) the ethos and direction of policy, including focus on key priority sectors, which ensures growth is export-led but with local multiplier impacts on secondary sectors; and (3) assuming productivity in the rest of the UK improves as envisaged by the Leitch Review. Under this scenario, which has now been updated consistent with the new summer 2009 baseline position, long-term ICT employment growth rises from 2.4% pa to 3.4% pa. Note this aspirational scenario, given its PSA1 focus, is less about job creation and more about significant productivity enhancements (although this does mean that new entrants are required to have higher skills and a higher rate of upskilling of the existing workforce is also implied). It incorporates faster employment growth but only as one element of the achievement of PSA 1.

For useful comparison we have also provided below some detail on e-skills UK and ROI aspirational / faster growth scenarios.

- **E-skills UK IT & Telecoms Insights: Employment forecasts (2008)** - three employment scenarios were evaluated, starting with the standard Experian baseline, supplemented by lower and upper case alternative scenarios. As the standard Experian scenario was considered relatively strong, this limited the potential for upside to 1.9% pa above the lower likely scenario adopted by e-skills. **While the experience of the late 1990s illustrated the potential for expansion within IT against a highly supportive background, that experience was not expected to be repeated over a long forecast period, not least because in its final stages the pace of strong historical growth became unsustainable and the dot com crash followed.**

[13] The short-term (2009-2011) expansion demand assumption is roughly 700 net additional jobs pa. This is lower than 1,000 because of more challenging inward investment conditions over the past 18 months which were not foreseen at the time the Programme for Government targets were set (including inward investment targets). Invest NI has advised that for the period 2008-2011, the overall economy inward investment target be adjusted downwards to 5,500 jobs, with ICT jobs assumed to be 40% of the total. This is close to the number of actual number of new jobs promoted in IT firms in year one of the current corporate plan (606).

- **ROI Future Requirement for High-Level ICT Skills in the ICT Sector (2008)** – three scenarios were considered in the ROI research: a base continuing recovery scenario (continuation of growth between 2005 and 2006), an accelerating recovery scenario (uplift in growth experienced between 2005 and 2006) and a loss of competitiveness scenario (gradual slowdown in employment growth with most sub-sectors eventually experiencing falling employment). For each scenario specific sub-sectoral employment growth rates were assumed. For example for the accelerating recovery scenario, software employment growth is set at 7% pa, semi-conductors at 2% pa etc.

Table 5.2 below summarises alternative upper scenario options. One of the first observations is the relative similar level of growth rates across the alternative scenarios, which makes the use of any credible.

However it is important to note that some consultees considered elements of the Matrix vision[14] over-ambitious. Views included: '*"the timeframe is unrealistic"* and '*"the three specific areas of focus identified by Matrix (package application software, near-shoring and high performance embedded systems) might not necessarily be the most appropriate"'*. Also an important view from employers at the time of publication of the *e-skills UK IT insights: Regional skills gap analysis NI* (2005) report was that 'inward investment can create skill shortages if not properly managed. The influx of a large employer without a matched supply of people can lead to wage inflation that ultimately damages the incumbent companies'. Matrix acknowledge the vision is ambitious (and a reversal in supply trends would be needed to deliver the ambition), however at the same time it is believed that the ICT sector needs to 'aim for something'.

Given the lack of complete consensus on the quantum and timing of the aspirational scenario, we decided it would be most appropriate to run two aspirational scenarios: (1) Oxford Economics summer 2009 PSA1 / Leitch upper scenario [slower employment growth than the Matrix projected growth but consistent with (a) DEL's wider economy aspirational skills forecasting work, and (b) roughly also what the Matrix focus group suggested for a realistic aspiration]; and (2) the Matrix scenario of 1,000 net new jobs pa (2012-2020) quoted in the high base scenario in the Matrix ICT Horizon Panel report (700 net new jobs 2009-2011 – to account for reduced inward investment in the short to medium-term).

[14] 'NI will transform the current ICT sector into a globally-recognised centre of higher value activities, achieving leadership across specific focus areas in Europe by 2010 and global recognition as a leading region by 2015'

Table 5.2: Alternative ICT employment upper scenario options

Source	Long-term ICT employment growth rate pa
Oxford Economics summer 2009 baseline	2.4% (2010-2020)
Matrix	Approximately 700 jobs per year 2009-2011 and 1,000 net jobs per year 2012-2020 (5% pa)
Oxford Economics summer 2009 PSA1 / Leitch upper scenario	3.4% (2010-2020)
e-skills UK IT & Telecoms Insights: Employment forecasts (2008)	3.9% (Oxford baseline plus upper case scenario uplift)
ROI Future Requirement for High-Level ICT Skills in the ICT Sector (2008)	5.0% (Oxford baseline plus approximate difference between ROI accelerating recovery and continuing recovery scenarios)

A full summary of future skill needs under the two aspirational scenarios (and baseline scenario for comparison) is provided in Table 5.3 below. **It is clear, as expected, that the quantum of high-level skill needs is significantly higher in the aspirational scenarios.** We compare later these skill demand forecasts with basic supply forecasts to project potential demand-supply imbalances. As a control check Table 5.3 also includes a projection for how large the ICT sector would grow as a share of private sector employment. The share in 2020 in the Matrix scenario, 4.4%, is not unrealistic (relative to the best performing UK ICT regions) provided ICT growth continues to be export focused.

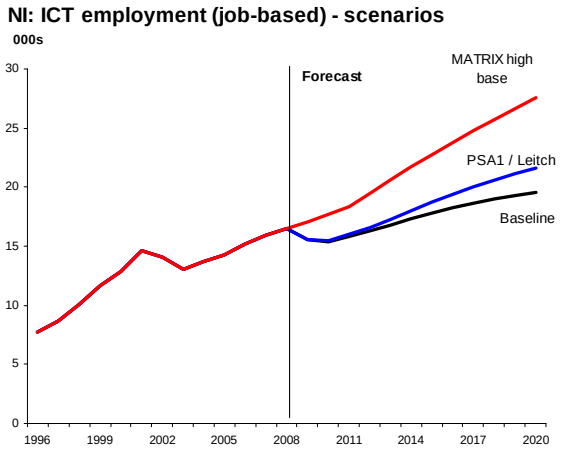
It is important to note that were NI to realise the Matrix growth scenario (which remember applies to the ICT industry), this could have a potentially large displacement effect on other NI industries employing ICT professionals, if they were attracted away by new opportunities. This would create a supply shortage of ICT professionals elsewhere in the economy, which would then arise as a key issue for other Sector Skill Councils.

Table 5.3: ICT aspirational scenario future skill needs (2010-2020 annual average)

	Oxford Economics summer 2009 baseline	Oxford Economics summer 2009 PSA1 / Leitch upper scenario	MATRIX high base
Expansion demand (people-based)	375	557	901
Gross replacement demand	1,759	1,847	2,232
Entrants other than from education and in-migration	1,836	1,824	2,044
Net requirement from education in-migration	298	580	1,089
o/w high-level skills (NQF 4-8)	145	301	597
o/w high-level skills (degrees only)	113	234	465
Computer science	67	143	284
Engineering & tecnhnology	8	19	37
Other	37	72	145
ICT % total private sector employment (2020)	3.1%	3.3%	4.4%

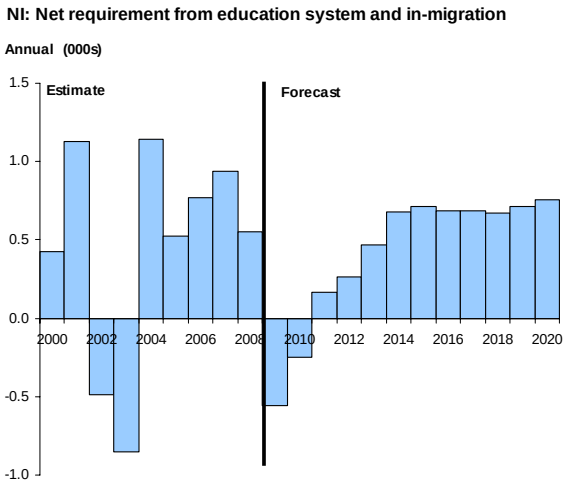
Source: Oxford Economics

Fig 5.7: ICT employment forecast – computer & relative services (baseline and upper scenarios)



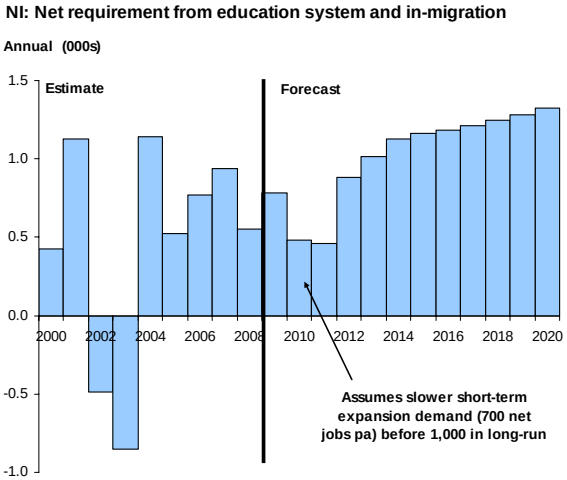
Source: DETI, LFS, Oxford Economics

Fig 5.8: ICT net requirement from education and in-migration (PSA 1 / Leitch scenario)



Source: Oxford Economics

Fig 5.8: ICT net requirement from education and in-migration (Matrix scenario)



Source: Oxford Economics

6 Supply of high-level ICT skills in NI

The second part of the terms of reference asked for an assessment of the adequacy of the current flow through the ICT skills supply pipeline, and the pool of ICT skills in the existing ICT workforce to satisfy the likely demand profile in the sector.

Note beyond the analysis here of supply trends and the supply stock of skills, Annex F in the report also presents a stock take of ICT courses offered at university and Further Education colleges in NI, including degree content and entry requirements, as well as an overview of the Software Professional Course. We have already discussed in the earlier literature and consultation chapters drivers of supply trends which are important when considering recommendations / actions.

6.1 ICT supply-side institutions and courses in NI

Table 6.1 below summarises the main providers of high-level ICT education in NI and individual courses offered. Further details on individual courses are provided in Annex F.

Table 6.1: NI ICT supply-side ICT institutions and course offering

	Higher education undergraduate courses
Queens University Belfast 4 Courses	Computer Science
	Electrical & Electronic Engineering
	Computing & Information Technology
	Business Information Technology
University of Ulster 8 Courses	Computer Science
	Computer Science (Software Systems Development)
	Computer Science (Foundation Course)
	Computing Science
	Electronic Engineering
	Electronics & Computing Systems
	Electronics & Computing Systems (Foundation Year)
	Electronics & Software
	Higher education postgraduate courses
Queens University Belfast 7 Courses	Postgraduate Diploma in Electronics
	Postgraduate Diploma in Telecommunications
	MSc in Computer and Electronic Security
	MSc in Telecommunications
	MSc in Electronics
	MEng in Computer Games Design and Development
	Postgraduate Diploma in Computer and Electronic Security
University of Ulster 3 Courses	Postgraduate Certificate/ Postgraduate Diploma/MSc in Computing
	Postgraduate Diploma/MSc Computing for Financial Services
	Postgraduate Diploma/MSc Engineering (Named Specialism)
	Further education courses
Belfast Metropolitan College 7 Courses	Foundation Degree – Software Engineering
	HND - Electronic Engineering
	HND – Computing (General)
	HNC – Electrical and Electronic Engineering (Electronics Bias)
	National Diploma in Electrical/Electronic Engineering
	Diploma – IT Practitioners (Software Development)
	First Diploma – Electronic Engineering

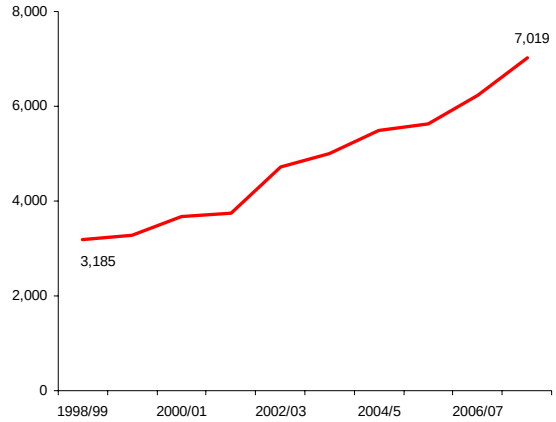
North West Regional College 7 Courses	CISCO Certified Network Associate/Professional (CCNA/CCNP)
	Higher National Certificate in Computing
	Higher National Certificate in Computer Networking
	Higher National Diploma in Computer Networking and Internet Technology
	National Diploma in Electrical and Electronic Engineering
	Higher National Certificate or Diploma in Electrical and Electronic Engineering
	Higher National Diploma in Manufacturing Engineering or Electrical and Electronic
Northern Regional College 6 Courses	HND in Computing General, ICT Systems Support, Software Development
	Foundation Degree Science, in Computing / Software Development
	First Diploma for IT Practitioners
	National Diploma for IT Practitioners
	National Diploma in Engineering
	HND in Electrical / Electronic Engineering
Southern Regional College 8 Courses	Advanced GCE in applied ICT (double award)
	BTEC Higher National Diploma in Computing (with E-business)
	BTEC First Certificate In Engineering
	BTEC National Diploma In Electrical / Electronic Engineering
	BTEC First Diploma In Computing
	Foundation Degree In Computing
	BTEC National Diploma In Computing
	BTEC Higher National Diploma In Computing (With Multimedia And Internet)
South-West College 4 Courses	BTEC National Diploma for IT Practitioners (Software Development)
	BTEC National Diploma in Engineering or National Diploma in Electrical/Electronic Engineering
	BTEC First Diploma for ICT Practitioners
	Diploma in Digital Applications for IT Users with Level 2 BTEC First Certificate in Business
South-Eastern Regional College 5 Courses	BTEC First Certificate In IT Practitioners
	EDEXCEL BTEC HND Electrical/Electronic Engineering
	EDEXCEL BTEC HNC Electrical/Electronic Engineering
	EDEXCEL BTEC National Certificate Electrical/Electronic Engineering
	EDEXCEL BTEC National Diploma Electrical/Electronic Engineering
	Conversion courses
4 of 6 FE colleges	Software Professional Course – 35 week course designed to take graduates from alternative disciplines and train them in software development. Students graduating from the Software Professional Course will awarded the Edexcel Level 5 Diploma in Professional Software Development.

The remainder of the chapter focuses on ICT supply trends across the various levels of education through to actual entrants to the ICT industry. As the charts / tables largely 'speak for themselves' commentary is kept brief.

6.2 Secondary education

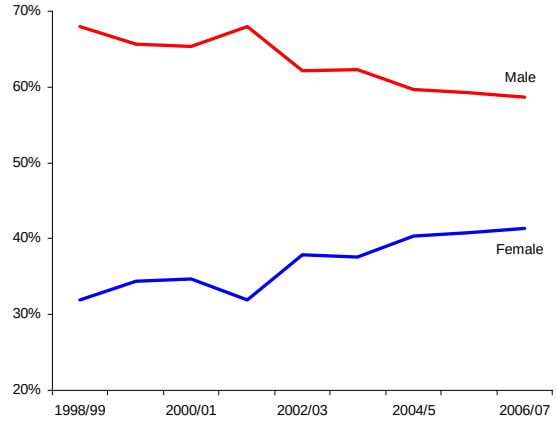
There have been positive recent supply trends at GCSE level with a strong rise in the IT GCSE intake (Fig 6.1) and partial closing of the gender gap (Fig 6.2)

Fig 6.1: NI IT GCSE intake



Source: DE

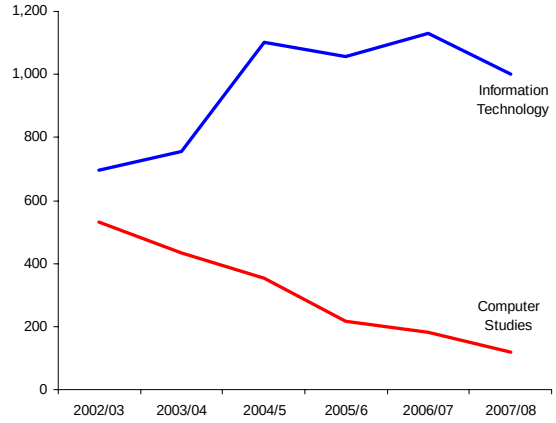
Fig 6.2: NI IT GCSE intake by gender



Source: DE

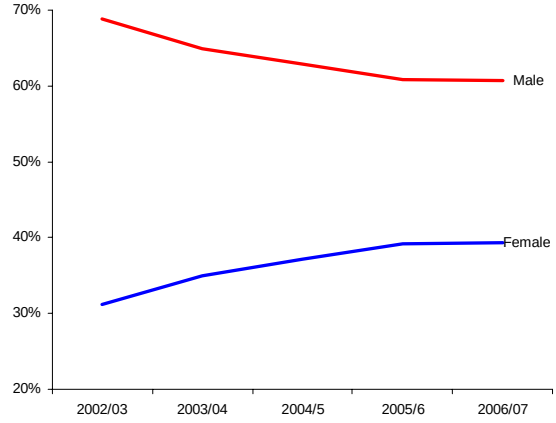
Evidence on intake trends at A-Level is more mixed. As for the UK, the computer studies intake has fallen sharply while the information technology intake has risen. However as for GCSEs, the gender intake gap is steadily closing.

Fig 6.3: NI IT A-Level intake



Source: DE

Fig 6.4: NI IT A-Level by gender



Source: DE

6.3 Further Education

There have been mixed enrolment trends across individual ICT subjects at FE level. There has been a large drop in enrolments for Information Technology (this is the opposite of the trend at GCSE and A-Level) and expansion in areas such as Computer Studies and Software. Similar trends are observed for FE achievements but with a lag (figures are not presented).

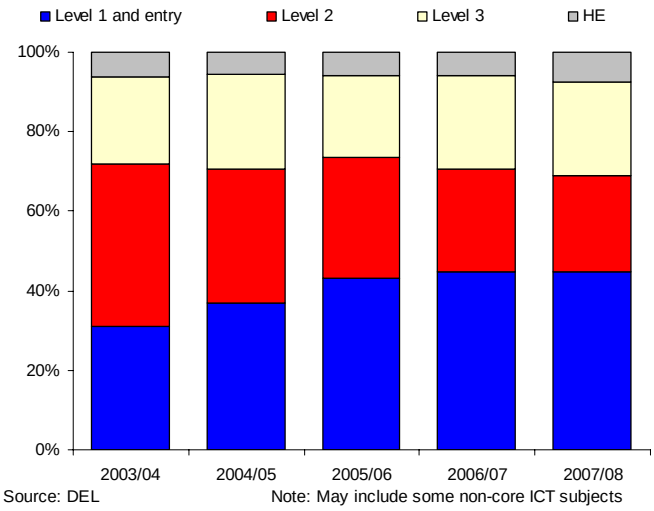
While the share of NVQ 3 and HE enrolments as a per cent of total ICT FE enrolments has remained stable (this matters most for high-level ICT skills supply), there has been a noticeable increase in share of NVQ level 1 and entry ICT enrolments (Fig 6.5) at the expense of level 2 enrolments (its share is now down to one-quarter).

Table 6.2: NI ICT selected FE course enrolments (all levels combined)

	2003/04	2007/08	Change	2003/04 % total	2007/08 % total	Change (pp)
Information Technology	11,417	6,637	-4,780	44%	41%	-3.1
Computer Education	8,271	1,965	-6,306	32%	12%	-19.7
Others in Computing	1,724	661	-1,063	7%	4%	-2.6
Computer Studies	1,025	1,659	634	4%	10%	6.2
Electrical & Electronic Engineering	792	584	-208	3%	4%	0.5
Others in Electrical Engineering	375	332	-43	1%	2%	0.6
Electrical & Systems Engineering	347	160	-187	1%	1%	-0.4
Applied Computing	334	311	-23	1%	2%	0.6
Electrical Engineering	317	768	451	1%	5%	3.5
Applied Information Technology	270	438	168	1%	3%	1.6
Information Systems	245	39	-206	1%	0%	-0.7
Softw are Engineering	177	457	280	1%	3%	2.1
Computer Aided Engineering	138	307	169	1%	2%	1.4
Electronic Engineering / Electronics	129	59	-70	0%	0%	-0.1
Electronics & Computer Technology	112	145	33	0%	1%	0.5
Programming	84	78	-6	0%	0%	0.2
Electronic Servicing	74	150	76	0%	1%	0.6
Computing Science	47	64	17	0%	0%	0.2
Softw are	1	591	590	0%	4%	3.6

Source: DEL

Fig 6.5: NI ICT FE enrolments by level



Source: DEL Note: May include some non-core ICT subjects

6.4 Higher Education

HESA data in Table 6.3 confirms the significant drop in ICT HE enrolments from NI Higher Education institutions. Both computing and telecoms first year enrolments are down by roughly 50% between 2002/03 and 2007/08. Only enrolments for Information Systems degrees have remained stable. This is not surprising given a large drop in the number of UCAS choice selections and acceptances for computing degrees.

Given the lag between enrolment and qualifying, the impact of this enrolment decline is not yet fully captured in qualifier data, which by 2007/08 had only declined by one-quarter (Table 6.3).

The decline in quality of students, a regularly quoted criticism across the entire education system, has perhaps some justification for ICT graduates. UCAS points data (Table 6.4) shows a fall between 2002 and 2008 in the share of students for both choices and acceptances for computer science and software engineering with the highest UCAS points (420+). In contrast for all subjects combined the share of applicants with higher tariff points has risen. In addition the actual UCAS points for accepted students for computer science and software engineering is lower than for choices (the opposite is true for all subjects) – this may reflect a higher proportion of ICT students being accepted through clearing than the all subjects average. Lower UCAS entry points may though reflect change in course entry requirements.

We do acknowledge however that QAA Audits, Professional Body accreditations and External Examiners all indicate that for both NI universities (Ulster and Queen's), the quality and standards of ICT courses are considered comparable with other UK institutions. Nevertheless if similar UCAS points trends are occurring for ICT courses in GB, this means that though NI ICT courses may be remaining of relatively similar standard to GB ICT courses, in absolute terms (or even compared to other subjects), the quality of student intake and course provision may genuinely be falling.

HESA data in Table 6.3 also helps to confirm why the Matrix ICT Horizon Panel report would highlight a shortage of postgraduate ICT students. The number of qualifiers with postgraduate computing degrees has fallen from over 500 in 2002/03 to just under 100 in 2007/08.

Table 6.3: NI ICT selected HE course UCAS choices and acceptances, enrolments and qualifiers from NI higher education institutions

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
UCAS choices						
Computing degrees	4,354	3,792	3,266	3,359	3,636	2,915
(G4) Computing	3,896	3,589	3,073	2,978	3,061	2,449
(G5) Information systems	219	1	0	226	446	399
(G6) Softw are engineering	239	202	193	155	129	67
UCAS acceptances						
Computing degrees	713	740	689	640	595	537
(G4) Computing	692	726	667	592	535	458
(G5) Information systems	2	0	0	29	53	66
(G6) Softw are engineering	19	14	22	19	7	13
First-year enrolments						
Computing degrees	1,705	1,380	1,250	1,095	970	905
(G4) Computing	1,465	1,205	1,050	850	765	695
(G5) Information systems	190	130	155	200	190	195
(G6) Softw are engineering	50	45	45	45	15	15
Telecoms degrees	40	20	30	30	15	20
(H640) Communications engineering	15	5	5	5	10	5
(H641) Telecoms engineering	25	15	25	25	5	15
Undergraduate qualifiers						
Computing degrees	730	800	720	705	625	540
(G4) Computing	650	660	540	575	535	425
(G5) Information systems	65	95	130	95	75	100
(G6) Softw are engineering	15	45	50	35	15	15
Telecoms degrees	0	0	0	0	5	5
(H640) Communications engineering	0	0	0	0	5	5
(H641) Telecoms engineering	0	0	0	0	0	0
Postgraduate qualifiers						
Computing degrees	520	280	185	205	60	90
(G4) Computing	365	210	145	165	55	75
(G5) Information systems	150	70	40	40	5	15
(G6) Softw are engineering	5	0	0	0	0	0
Telecoms degrees	30	25	20	25	20	5
(H640) Communications engineering	5	5	5	0	0	0
(H641) Telecoms engineering	25	20	15	25	20	5

Source: UCAS, HESA
Note: To prevent the identification of individuals, HESA figures are rounded to the nearest 5, w ith 0, 1, 2 rounded to 0

Table 6.4: NI ICT selected HE course UCAS point choices and acceptances

Tariff points	2002	2008	Change (pp)
Choices			
(G4) Computer science			
1-179	31%	17%	-14.1
180-299	44%	52%	7.6
300-419	21%	29%	7.8
420 plus	3%	2%	-1.3
(G6) Softw are engineering			
1-179	30%	7%	-23.5
180-299	37%	57%	19.7
300-419	26%	33%	6.2
420 plus	7%	4%	-2.4
All subjects			
1-179	18%	10%	-7.4
180-299	42%	37%	-4.9
300-419	34%	41%	7.9
420 plus	7%	11%	4.5
Acceptances			
(G4) Computer science			
1-179	22%	18%	-4.6
180-299	51%	56%	4.8
300-419	24%	25%	1.5
420 plus	3%	1%	-1.7
(G6) Softw are engineering			
1-179	20%	0%	-20.0
180-299	60%	82%	21.8
300-419	13%	18%	4.8
420 plus	7%	0%	-6.7
All subjects			
1-179	12%	7%	-5.2
180-299	42%	33%	-9.2
300-419	37%	46%	9.1
420 plus	8%	14%	5.4

Source: HESA
Note: NI universities only

6.5 Software professional course

The data below, provided by DEL, show recent enrolment and completer figures for the Software Professional Course. Enrolments for SPC 4 doubled compared to SPC 2 levels indicating the attractiveness of the course to graduates from other disciplines.

- SPC 2 (Oct 07-June 08): 51 enrolments, 38 successful completers
- SPC 3 (Feb 08-July 08): 10 enrolments, 5 successful completers
- SPC 4 (Oct 08 to June 09): 117 enrolments, 91 successful completers (note this may change in line with examination re-sits)

6.6 Qualified entrants to the ICT sector and ICT supply leakages

Analysis using HESA data (Table 6.5) helps to trace ICT graduates from NI Higher Education institutions to employment in the ICT industry in NI and in doing so identify skill leakages. Note this analysis relies on the HESA first destination survey which may not reflect final career destinations of ICT graduates (which ultimately is more important than first employment destination 6 months after graduation).

The starting point of this analysis is to look at economic activity status – according to HESA, 80% of NI ICT graduates are in full-time employment shortly after graduation. This is higher than the overall UK figure – the UK has a higher share entering further study only[15].

An important second leakage for the labour market (after economic activity leakages such as entering unemployment and further study – the latter is a leakage from an industry perspective), is the loss of NI ICT graduates to employment outside NI. However HESA data averaged between 2002/03 and 2005/06 shows this leakage is relatively small with only 15% of ICT graduates from NI Higher Education institutions taking up employment outside NI.

The major leakage for the industry is the loss of ICT graduates to other sectors – in both NI and the UK, only one third and one quarter of ICT graduates respectively who enter employment end up working in the ICT industry six months after graduation. (Note this is subject to the accuracy of HESA's SIC industry classification of employment destinations – there is a possibility of entrants to ICT firms being recorded in other industries outside the e-kills ICT footprint – Allstate is one example where this may arise).

A key research question is why this major leakage? Is it lack of demand from the ICT industry, lack of ambition / interest of graduates to work in the industry, better pay and conditions in other sectors etc? (Brief analysis of HESA first destination data for ICT graduate earnings suggests that entrants to the ICT industry are certainly not paid less than entrants to other industries) It is worth however caveating that this leakage analysis is based on the period 2002/03-2005/06 and may be affected by the dot com crash. Given the importance of this leakage analysis, we would strongly recommend that latest data is analysed and monitored on an ongoing basis.

[15] Note the figure of 0% of ICT graduates entering further study in NI suggests an error in the data source. DEL subsequently analysed HESA data from more recent years and found the share entering 'further study only' to be similar to the UK average.

Table 6.5: First destinations of IT graduates from higher education institutions

	Average (2002/03-2005/06)	
	NI	UK
Economic activity	**100%**	**100%**
Full-time paid work only (including self-employed)	81%	55%
Part-time paid work only	10%	7%
Voluntary / unpaid work only	0%	0%
Work and further study	8%	7%
Further study only	0%	15%
Assumed to be unemployed	0%	11%
Not available for employment	0%	4%
Other	0%	1%
Employment destination	**100%**	**100%**
NI	86%	4%
England	5%	83%
Wales	0%	3%
Scotland	1%	8%
Non-UK	8%	2%
Employment destination by industry	**100%**	**100%**
ICT	32%	27%
Retail & distribution	14%	13%
Non-ICT manufacturing	9%	7%
Non-IT business services	9%	11%
Education	8%	8%
Public administration & defence	7%	7%
Financial services	7%	10%
Other personal services	5%	4%
Health & social work	4%	4%
Hotels & restaurants	2%	3%
Construction	2%	1%
Non-ICT transport & communications	1%	3%
Mining & quarrying	0%	0%
Agriculture, forestry & fishing	0%	0%
Utilities	0%	1%

Source: HESA, Oxford Economics
Note: Based on computer science, information systems and software engineering graduates

The employment destination by industry analysis refers to employment in NI only for the NI column. The denominator for the economic activity share figures is the sum of all destinations (and not to be cinfused with only NI employment destinations)

6.7 Future supply of high-level ICT skills

The ROI *Future Requirement for High-Level ICT Skills in the ICT Sector* (2008) report makes projections for the short-term supply of ICT high-level skills based on current enrolments and CAO acceptances (CAO is the ROI equivalent of UCAS). Longer-term projections are not made for ROI.

The ROI research assumed that the decline in graduate enrolments in computing would bottom out in 2008 and undergo a modest recovery in 2009 and 2010, driven by mainly increased interest among college entrants in courses combining computing and business, and by the success of 'sexier' new courses in computer games development.

To project the supply of high-level ICT levels in NI going forward and actual numbers entering the ICT industry (in order to undertake demand-supply balance analysis) we adopt a similar approach to ROI. The key assumptions and caveats are outlined in Annex F. Note these supply-side forecasts are **'policy neutral'** and do not build in the impact of interventions such as introduction of STEM bursaries at HE level which is the subject of a separate study by DEL, or interventions earlier in the education life cycle.

As the charts below illustrate, we project a continued decline in ICT high-level skilled entrants for the next few years due to the lagged impact between enrolments (which have continued to fall until we assume this trend 'bottoms out') and qualifiers / entrants to industry. **Note the supply of high-level ICT skills are assumed to come from both HE and FE (level 4/5 FE ICT courses).**

Fig 6.6: ICT HE skills supply-side projections

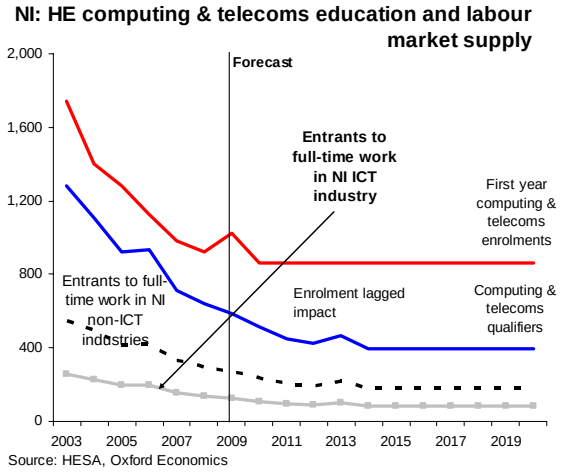


Fig 6.7: Projections for ICT high-level skill entrants to ICT industry in NI by source

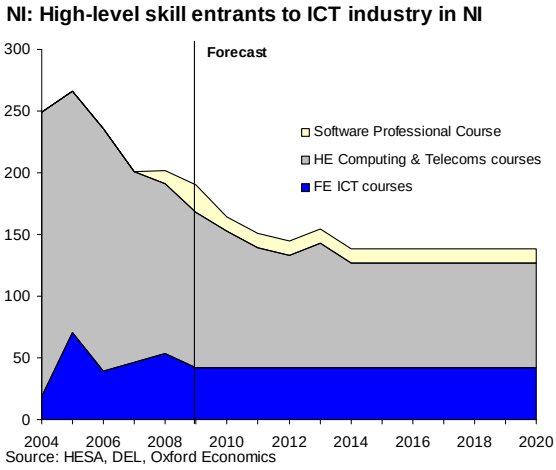
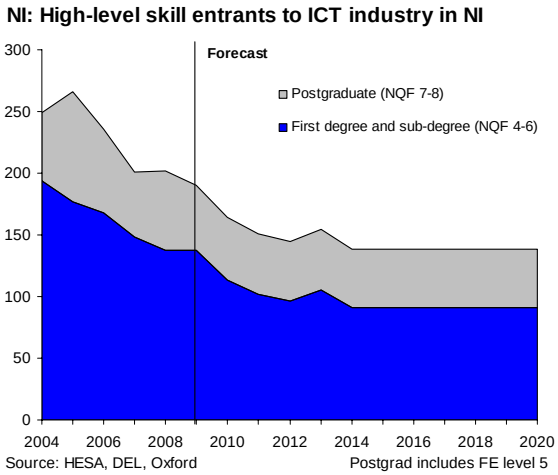


Fig 6.8: Projections for ICT high-level skill entrants to ICT industry in NI by level



7 Future high-level ICT skill demand and supply

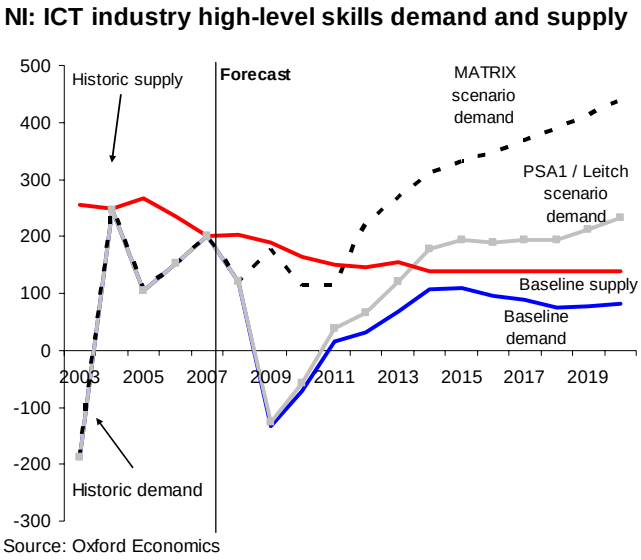
This chapter brings together quantified forecast demand and supply estimates for high-level ICT skills from the preceding two chapters to make an assessment of the likely balance between demand and supply (similar to the ROI analysis).

Note for absolute clarity demand here refers to high-level skills demand from the ICT industry for ICT courses and excludes demand from other sectors of the economy (or for non-ICT courses). Baseline supply, based on assumptions outlined in Annex F, refers to the projected number of education & training leavers with higher level qualifications in ICT subjects, from HE, FE and the SPC, actually taking up full-time employment in the ICT industry in NI (thereby excluding the various leakages to non-employment, outside NI and to other sectors).

The main observations from the quantified demand-supply balance analysis (Fig 7.1) can be summarised under four headings:

- Recent 'boom bust';
- Excess supply during recession;
- Sufficient supply in the long-run under the baseline scenario; and
- Long-run supply shortfall in aspirational scenarios.

Fig 7.1: Projections for high-levels skills demand by and supply into NI ICT industry



Recent 'boom bust'

- The volatile recent pattern of ICT high-level skills demand and supply, sometimes referred to as 'boom bust', is evident from Fig 7.1.
- Post-dot com crash the analysis suggests an excess supply, followed more recently by demand being closer but still less than supply (other evidence presented in this report would suggest there has been an under-supply of ICT skills coming through the education system, although an excess, as suggested by Fig 7.1, may help to explain the high numbers flowing into non-ICT sectors).

- A useful quote from consultations would also back up this analysis of recent demand-supply balance – *"some in the sector say that they cannot find skilled staff but maybe it's that they cannot find enough good ones"*. This may be related to trends in choices amongst ICT subjects – for example the shift away from more technical. In-demand (from industry) courses such as computer science.
- Note if the excess supply of skilled ICT labour after the dot-com crash remained in NI and available to work in the ICT industry, this should have limited any skills shortages (unfortunately supply-demand analysis is based on annual individual flows and not cumulative flows).
- However the more likely outcome was a leakage of some of these skills to other sectors and outside of NI (unfortunately, to the best of our knowledge, there are no tracker-type surveys or other data collection processes to monitor trends such as this).
- **As always, it is important to caveat this analysis. The relatively high ICT joiner rates assumed (both going forward and historically) partly explain the conclusions drawn here. While the assumptions are broadly consistent with those used by e-skills UK (also based on the LFS), it cannot be discounted that an over-estimation of joiners may be providing a misleading picture here of historic demand-supply imbalances.**
- Regardless of the nuances of assumptions, lessons from the past 'boom bust' in ICT skills supply and demand are important for the current recessionary and post-recovery period. What will be different this time however is that whereas before the 'dot com crash' was a fairly isolated sectoral downturn (other sectors were growing strong, creating jobs and presumably 'sucking up' leavers from the ICT industry), this recession is almost unprecedented in its sectoral and global reach as previously explained.
- This means that much of the pool of ICT talent made redundant in the recession / new ICT graduates not immediately finding employment should be available for when the economy recovers and the ICT sector starts to grow again (as other sectors and economies such as in London, Dublin or even Silicon Valley will not have large scale employment opportunities and competition for limited jobs will be intense).

Excess supply during recession

- Even with the quantum of ICT education outturns falling recently and the entire impact only being fully realised in the coming years (due to the lag between enrolments and qualifiers), an excess supply of high-level ICT skills is predicted over the next few years (as it is for most sectors of the economy)[16].
- Admittedly some of this excess could be tapped to fill perceived shortages built up from previous years but with the economy still fragile and firms nervous about recruitment, an excess supply of ICT skills seems inevitable in the short-term.
- This will directly affect graduate recruitment from ICT courses as it will do across the whole economy and the majority of courses.
- Given the harm caused by the dot com crash to the image and attractiveness of the industry, there is a risk enrolment trends could continue to decline rather than flatten out as assumed in our baseline. With actual annual numbers of highly skilled education & training leavers entering the industry already quite small (about 200), a further decline could constrain future growth in ICT employment, never mind the more aspirational trajectory that Matrix is aiming for.

Sufficient supply in the long-run under the baseline

- In the long-run as the economy recovers and the ICT industry in NI starts to grow again, the projections for both baseline demand and supply suggest the supply of high skilled ICT persons from the education system will be sufficient (Fig 7.1).

[16] Although a 'quick win' inward FDI expansion in the short-term could limit the extent of over-supply of ICT skills

- There may be some relative supply pressures in the early recovery phase (as the lagged effect of falling enrolments starts to be felt and the economy is in pick-up mode), but assuming high-skilled persons made redundant during recession or graduates not finding employment can still be recruited, the forward-looking analysis does not suggest a major shortage of high-skilled labour.
- Of course this outcome depends crucially on the quantum of recruitment in competing sectors, the assumption on the end in enrolment decline, how and when the economy recovers and the validity of replacement demand assumptions.
- It would be a risky strategy to allow supply to be just sufficiently high enough to meet demand. This strategy would almost rule out the capacity for the economy to absorb a major new ICT player (which is not part of a baseline demand scenario) and ensuing tightness in the labour market could drive up wages and reduce competitiveness.
- **In addition while demand may be sufficient at aggregate level, this is not to say there may not be a lack of supply for particular subjects, technical skill requirements or a particular level of study (e.g. PhD students). This point is picked up in the Matrix ICT Horizon Panel report which talks about the risk of "over-simplifying macro analysis" of skill needs.**

It should be noted that in the ROI *Future Requirement for High-Level ICT Skills in the ICT Sector* (2008) report, demand and supply remain in balance under the 'loss of competitiveness' scenario (though this is not the same as the baseline described here for NI). Also the Matrix ICT Horizon Panel report refers to NI graduate supply falling short of demand by a factor of 6 – this however fails to account for flows of labour into the industry other than from education.

Supply shortfall in aspirational scenarios

- While the Matrix scenario of 1,000 net new ICT jobs in the long-run (2012-2020) may be considered over-ambitious (and also possibly the short-run assumption of 700 net new jobs pa), even in the PSA1 / Leitch upper scenario which assumes a lesser uplift in employment growth, **high-level ICT skill shortages are predicted to emerge over the next decade**.
- As Table 7.1 shows (which is consistent with Fig 7.1), the projected supply-demand imbalance for the PSA 1 / Leitch upper scenario over the period 2015-2020 is 60 persons on average pa[17] and even higher for the Matrix scenario (250 persons pa).
- Note there are alternative ways to close this supply gap – increasing enrolments (but remember the increase in enrolments would need to be greater than the gap given leakages to other sectors), reducing numbers finding employment outside NI (though this loss is small) and perhaps most importantly, stemming the loss of ICT graduates to other sectors. An alternative option is of course attracting migrant ICT professionals. **In 2008 DEL explored this option by offering companies the chance to participate in skills missions to Eastern Europe to source ICT migrant labour. There was however insufficient demand from local ICT companies.**

[17] The shortfalls quoted in the ROI *Future Requirement for High-Level ICT Skills in the ICT Sector* (2008) report are much higher – 2,000-3,000 honours bachelor computer graduates pa in the accelerating recovery scenario.

Table 7.1: Projections for high-levels skills demand by and supply into NI ICT industry

	Annual average (2010-2020, roundest nearest 10)			Annual average (2015-2020, roundest nearest 10)		
	Demand ICT high-level skills	Supply high-level ICT skills to labour market (baseline)	Balance (supply less demand)	Demand ICT high-level skills	Supply high-level ICT skills to labour market (baseline)	Balance (supply less demand)
Baseline						
Postgraduate (NQF 7-8)	20	50	30	20	50	30
First degree and sub-degree (NQF 4-6)	60	90	30	70	90	20
Total high-level skills	80	140	60	80	140	60
OE PSA1 / Leitch upper scenario						
Postgraduate (NQF 7-8)	40	50	10	50	50	0
First degree and sub-degree (NQF 4-6)	130	90	-40	160	90	-70
Total high-level skills	160	140	-20	200	140	-60
MATRIX upper scenario						
Postgraduate (NQF 7-8)	70	50	-20	90	50	-40
First degree and sub-degree (NQF 4-6)	250	90	-160	300	90	-210
Total high-level skills	320	140	-180	390	140	-250

Source: Oxford Economics
Note: Figures may not add due to rounding

8 Securing the high-level skills future of ICT in NI

8.1 Existing NI policy actions

Since 2005 there have been a number of published reports focused on skills issues facing the NI ICT sector. These reports, including those published by e-skills UK, Invest NI (OCO report) and Matrix, have also provided a set of actionable recommendations to help address and overcome some of the skills issues identified throughout the research.

As a recap, four of the main skills issues highlighted in these reports were;

1. Shortage of ICT graduates and professionals;
2. Falling number of ICT graduates, in particular female students studying ICT related subjects;
3. Lack of international exposure and experience of the existing workforce; and
4. Lack of ICT graduates and professionals with industry-relevant skills.

Annex H provides an overview of recommendations from the NI SSA, the Invest NI (OCO report) and the Matrix report. As a brief overview some of the key recommendations identified in these three reports included:

- Increasing the number of ICT graduates, masters and PhD students;
- Improving the attractiveness of ICT as a career;
- Increasing collaboration between education providers and industry; and
- Raising university ICT course entry requirements to improve the quality of the ICT graduate intake and output.

As part of an overall policy recommendation strategy, an **ICT Future Skills Action Group** (FSAG) was established in 2007 to bring together education providers, government bodies and ICT businesses facing immediate skills challenges. Its role was to develop a set of short-term actions to address the skill needs of the sector. These actions have provided the foundation for a number of programmes which have been implemented to address skills issues in the industry.

The **ICT Future Skills Action Plan** (FSAP) was devised to act as a starting point to begin to address the downward trend in ICT enrolments at university and to complement and build on the actions already established by the NI SSA. It was also an opportunity to co-ordinate activity across all of the key organisations including e-skills UK, Momentum and industry players. While the actions are mainly short-term, the key objective of the plan is to build a 'pipeline' of appropriately qualified software professionals for the future development and growth of the sector. **Therefore the action plan is specifically aimed at the software part of the ICT sector, which as this report has highlighted, has been and is expected to continue to be the fastest growing and most important sub-sector within the overall industry**.

The FSAP published in 2008 is designed around three thematic areas of action:

1. Skills provision
2. Career attractiveness
3. Additional sources of talent

Key actions for each of these themes and recorded outcomes since 2008 are summarised below. This information has been provided by DEL.

Theme 1: Skills Provision – relevance, quality and accessibility

Action	Outcome
Deliver a higher education-industry workshop to address issues such as the suitability of current provision, retention issues and financial support for students	A workshop was held on 21st October 2008 to examine how providers and industry representatives could work together to meet student and industry needs. A report of the recommendations was produced and circulated to attendees
Develop a marketing plan to support future recruitment to the Software Professional Course	A marketing plan was developed and delivered through the Association of Northern Ireland Colleges (ANIC) for the September 2008 intake
Provide support for higher level skills development in IT companies through the Business Improvement Training Programme (BiTP)	Invest NI continues to provide on-going training support to clients in the ICT sector through the BiTP
Progress development work on the IT Professional Pathways	This is a work-based degree framework for IT professionals specific to the needs of employers in NI. Development of IT Professional Pathways was further investigated and e-skills UK will continue to engage with employers to explore their professional needs
Explore the feasibility of introducing 'The Guide' Business IT Guide to NI	The feasibility of introducing the Business IT Guide (website) to NI was examined. It was however established that the existing nibusinessinfo website, provided by Invest NI, already met the needs of industry in NI

Theme 2: Career Attractiveness – information and promotion

Action	Outcome
Provide careers advisers with engaging, current and sufficient information on career opportunities within the IT sector	Information sessions were delivered to DEL career advisers and teachers through a range of events
Develop a comprehensive media / marketing campaign to encourage more young people to choose a career in IT	A co-ordinated creative campaign, which included a series of high profile television, billboard and press advertisements, ran from Jan 2009 – April 2009. The brand developed for use in this campaign – Bring-IT-On – has been used consistently throughout all supporting and front-facing activity. The www.bringitonni.info website was also launched in Jan 2009 to coincide with the media campaign
Engage in appropriate careers outreach activities	An extensive programme of outreach activity was delivered to promote ICT careers to the 14+ age

Action	Outcome
	group. These included a variety of events - school visits to companies, Bring-IT-On 14-16 events, teacher placements, school visits, CCEA Employability Fest, Business Education Partnerships, UCAS and university open days. A substantial number of pupils were 'reached' by these activities
Identify ambassadors for the NI IT industry	Local companies have provided 20 ambassadors to support the delivery of the outreach events and to act as case studies for the www.bringitonni.info website

Theme 3: Additional Sources of Talent – national and international outreach

Action	Outcome
Increase the number of IT professionals and IT students from target countries coming to work / study in NI	A number of ICT companies participated in the C'MON Over campaign events held at university campuses in the UK and ROI. The "thinkni" website was developed and the information on it subsequently incorporated into DEL's C'MON Over `Northern Ireland' Facebook page. The message that ICT is one of NI's key economic strengths has been communicated to an international audience through broader initiatives such as "Choose NI", a DEL funded British Council project to promote NI as a desirable location for third level study
	Local ICT companies were offered the opportunity to participate in a skills mission to Hungary, facilitated by the European Employment Service – there was however insufficient demand from local employers

It is evident from this comprehensive list of actions and outcomes that significant effort has been made since the development of the FSAP to address skill issues in the NI ICT sector. However whilst some of the actions did receive positive feedback during the consultation process, particularly with regards to careers attractiveness campaigns and the calibre of students graduating from the SPC course, **there is no real measurement at this stage as the level of success of each of these policies. It should also be noted that none of these activities have targeted the 'quality' issue which has been identified in this research, through consultations, literature and UCAS points' analysis, as an emerging skills issue of concern to the industry.**

8.2 International evidence

The ICT industry is a high-value and growing sector both locally and internationally. As explained already ICT also plays an important catalytic role supporting development of other sectors.

Following the dot com crash which affected the ICT industry worldwide, the sector has since recovered and experienced a period of strong growth during which many countries have experienced skills shortages and gaps similar to those experienced in NI. This led to a requirement for education providers and governments to provide a stimulus to the supply of skills in these countries.

As part of this research we also examined and evaluated programmes and initiatives implemented by countries facing similar difficulties as Northern Ireland (UK, ROI and Australia) and international best practice countries with rapidly developing and world-class ICT sectors (Finland, Korea and Israel).

Chapter four of this research provides a detailed overview of some of the skills issues facing the **UK** and **ROI** and given the influence which both of these economies has on NI, in terms of governance and geography, it is important that these skills issues are closely monitored and taken into consideration.

Australia, a country geographically remote from NI, has also experienced some of the same skills shortages which have been reported in NI, the UK and ROI. In 2008, the Centre for Innovative Industry and Economic Research (CIIER), undertook a study to quantify the current and forecast employment in the ICT sector in Australia. The research concluded that the ICT industry in Australia does not have sufficient skills to meet the demands of industry today and will suffer a shortfall of ICT professionals and graduates up to 2020. Given the importance of the ICT sector to Australia's GVA, employment and productivity, the Australian government as well as education providers have introduced several key policies and recommendations to address these identified skills shortages.

The international best-practice countries researched for this study include Finland, Korea and Israel. Each of these countries have supported rapidly growing ICT sectors over the previous decade through the development of specialist ICT hubs, particularly within areas requiring niche or high value added skills.

- **Israel**, or the new 'Silicon Valley', has become a leading powerhouse in ICT developments, particularly software development. The Israeli government has found 'unique' ways to develop and nurture its workforce. In particular, the educational process in Israel has a significant catalytic role influenced by the military. With compulsory military service for both sexes, the military can select and train the brightest young people in elite computing units, giving young persons considerable responsibility for ICT project management at an early age. This helps to create innovative networks of young programmers so that when they return to civilian life, there are strong links between military research and industry. Whilst obviously not a direct transferable policy action for NI, it does highlight the importance of educating and training high quality, bright students.

- **Finland** has developed a strong telecommunications industry which has largely been built around the emergence and growth of a prestigious national champion – Nokia - and other major telecommunications companies which the most talented young persons aspire to work for.

- **South Korea** has been hugely successful in the ICT sector, primarily in the manufacture and export of key hardware such as consumer electronics, mobile handsets and telecommunications. South Korea is also a leader in developing new ideas and technology-related products such as the introduction of digital textbooks in a number of secondary schools in 2008.

8.3 Existing international policy actions

ROI, Australia and the international best practice country examples listed above have implemented a series of initiatives to help address skills issues in the ICT industry. These are summarised in this section.

For ease of read-across, we have categorised these skill interventions under the same headings as the NI ICT FSAP.

The first initiatives presented below are those that are **similar to interventions in the NI ICT FSAP**. These are then followed by interventions which to the best of our understanding would be new to NI but in our view complimentary and appropriate given the skill issues identified by this research.

Skills provision

Country	Action
Australia	• The Australian government has recently allocated $AU 2.2billion of funding to contribute sustainable and meaningful changes to teaching and learning in Australian schools that will prepare students for further education, training and to live and work in a digital world. The NI government has provided funding for 44 specialist schools in NI of which a number specialise in STEM related subjects
Israel	• Israel offers ICT conversion courses or re-training specifically for top graduates from alternative disciplines other than computer science or engineering. NI has introduced the SPC to turn non-ICT graduates into ICT professionals

Careers attractiveness programmes

Country	Action
ROI	• A science curriculum has been introduced at primary level and a Junior Certificate which awards points for practical work in science
Australia	• PR campaigns, marketing programmes and promotional DVDs have been designed for universities to encourage secondary students to study ICT. NI has a significant outreach programme aimed at 14+ students to promote ICT careers

Additional sources of talent

Country	Action
Australia	• Australia has encouraged in-migration of ICT professionals, by developing advertising campaigns to bring experienced professionals home from London and the US. The C'mon over campaign, whilst not ICT specific was developed to encourage in-migration to NI

As said above we also identify interventions which are **not currently being implemented in NI** but would in our view be **complimentary** to existing actions and be **appropriate** given the skill issues facing the NI ICT industry identified by this research.

Skills provision

Country	Action
ROI	• The ROI government has increased the level of funding to universities to help improve retention of students • Broad ICT courses have been introduced in ROI. Universities such as Trinity College Dublin have also introduced specialist courses such as ICT and finance to meet emerging specific industry needs. While there are no undergraduate courses in NI specialising in finance and IT, the University of Ulster does offer a postgraduate course combining computing and financial services
Australia	• Australia, in particular QUT (Queensland University of Technology) in Brisbane, introduced a bursary aimed specifically at female students • The government developed apprenticeship programmes placing ICT graduates across a number of public sector organisations (this is in its second year of delivering this policy) • The Australian government has also provided funding for institutions to improve retention on ICT courses
Israel	• The recognition of degrees granted by technical schools and accreditation by the Ministry for Education has helped to increase the supply of ICT professionals in Israel
South Korea	• Teacher training courses have been implemented in South Korea to help improve the quality and relevance of ICT teaching

Careers attractiveness programmes

Country	Action
ROI	• ROI has created 'Discover Science and Engineering' programmes to promote interest in science and engineering (which covers ICT) among students at primary and secondary school
Finland	• Finland increased university ICT entry level requirements to improve the quality of ICT graduates and attract the best and brightest students

Additional sources of talent

Country	Action
Israel	• Israel has provided incentives for returning Israelis from Silicon Valley to either set up R&D centres for the ICT companies they worked for or to establish their own high tech start-ups • Israel also took advantage of the almost one million Jewish migrants from Eastern Europe arriving in Israel in the decade between 1989 and 1999 to fill positions in ICT. Many possessed advanced degrees and technical training which could be transferred into ICT skills. As well as high-level skills they also brought ambition, innovative approaches to problem solving and a strong academic tradition

8.4 Reassessing ICT skills policy actions in NI - still fit for purpose?

In reassessing existing ICT skill policy actions in NI it is important to consider the plethora of existing research and new / validated findings from this research (from consultations, international research and quantitative analysis - including the high-level ICT skills demand-supply balance forecast analysis).

The key skill issues from this research are best summarised as follows – these issues are split separately into demand and supply for clarity:

Demand	Supply
▪ **High-level skill demand elements** – experience; technical knowledge (e.g. as outlined in Matrix ICT Horizon Panel report); domain knowledge ▪ **Demand-supply imbalance examples** – perceived shortage of Masters and PhD ICT graduates; experienced ICT professionals; and ICT professionals with marketing / strategy / selling skills ▪ **Difficulty predicting demand with accuracy** – due to a number of factors - uncertain economic environment (impact on quantum), the evolving nature of the sector and the relative small size of the NI ICT sector (the closure or arrival of a large ICT firm from a particular niche has the potential to have a disproportionately large impact on overall skill demand in the industry) ▪ **Dealing with the recession** – managing a predicted excess short-term supply of ICT skills (which has potential for another 'boom bust' in ICT skills demand and supply) – this is likely to mean some ICT graduates not finding employment and some difficulty finding ICT work placements	▪ **Supply shortage in the aspirational scenario** - this study projects an under-supply (quantum) of high-level ICT skills in the two aspirational scenarios (though not in the baseline). Also a lack of supply capacity in general to service large scale FDI opportunities (without displacement impacts on other NI ICT companies). There is a need for 'layering' of supply capacity and more flexible supply solutions for alternative growth trajectories / FDI options (especially as NI is a small, peripheral economy) ▪ **Supply: quality** – falling quality of ICT graduate intake and output based on a range of evidence - high proportion of entrants to ICT courses from clearing system; UCAS points analysis; and consultation views. Lack of a 'top tier' / world-class local ICT course offering – though local universities would argue that some course offerings are 'top tier' such as the integrated MEng programmes – see Annex F (most policy emphasis has been on reversing enrolment trends) ▪ **Supply: quantity** – falling enrolment trends from A-Level to HE; lack of non-NI domiciled students enrolled on undergraduate ICT courses in NI; large leakage of ICT graduates to other sectors; and though there is little robust evidence, it would appear migrants have been an under-utilised source of labour for the ICT industry in NI, especially relative to ROI (However this may also reflect demand trends) ▪ **Re-skilling** – despite its importance given the rapid changes which occur within the ICT sector, re-skilling is a significantly under-researched area. In particular, there is little reference to the nature and quantum of re-skilling requirements in existing literature ▪ **Other supply challenges** – negative

Demand	Supply
	perception of the industry in the eyes of pupils and parents; gender participation gap; mismatch between IT curriculum at secondary level and course content of undergraduate ICT courses (computing / IT / technology is specified as a subject requirement for only 4% of higher education IT-related courses in UK); some ICT HE courses seen as too general by industry with not enough good solid programming elements ▪ **Addressing industry needs** - mainstreaming a standard programming language in ICT courses (C++); core ICT modules combined with industry-specific domain knowledge (as well as possibly wider roll out of employability courses such as those already in place at the University of Ulster) ▪ **Other issues** – importance of a vibrant research community to build a global reputation and attract high-level ICT researcher skills

In addition to the above review of emerging key research issues, it is also important to assess the success of current policy actions to date. Though as said previously, given that several of the existing policy actions have been implemented only within the last three years (e.g. Bring-IT-On campaign, ICT Ambassadors Initiative etc), it is difficult at this stage to measure their level of success. Nevertheless broadly these programmes have been supported by the consultation process. When prompted consultees recognised the contribution of the ICT FSAG and its work with regards to careers attractiveness and advice, course provision and increased collaboration between key players (although consultations did reveal that more needs to be done with regards to collaboration). Building on some of these policy actions consultees also identified some additional recommendations. These included:

- Careers advice and marketing to schools – continuing and expanding the Bring-IT-On campaign.

- Providing incentives such as bursaries and scholarships for ICT students. It was suggested that this could include 'no fees' for ICT students as well as bursaries or scholarships specifically for female participants. (It is worth noting that DEL is currently undertaking a study to determine the potential impact of STEM bursaries on student participation, the findings of which should be of particular interest to the ICT industry).

- Increasing entry requirements at university to help improve the quality of ICT student intake and output. However it was accepted that this may also pose a short-term risk given the backdrop of falling ICT enrolments so some form of course differentiation may be necessary (e.g. differentiated by entry requirements).

- Providing government funding for higher-end skills development and the continuous re-skilling of the existing workforce. This recommendation will need to be industry-lead to ensure that education and training programmes reflect specific industry needs.

- Increasing research capabilities and collaboration between research centres such as SAP and universities. This could also include closer matching of PhD research with industry needs.

- Improving communication channels between industry and education as well as between companies to address common problems.

- A possible rethink of ICT education from primary school through to higher education.

- Establishing global partnerships with international universities such as MIT.

- Encouraging and promoting ICT study or work abroad programmes (provided students return). Universities currently offer several study abroad programmes which students can access. However participation within these programmes (outside of the ROI) has been limited, highlighting the need to promote the benefits of living, working and studying overseas for future career development.

  These programmes include;
  - IASTE (International Association for the Exchange of Students for Technical Experience) – an international work experience programme for students prior to graduation. IASTE is a 12 week summer programme offered in over 80 countries;
  - ERASMUS (European Region Action Scheme for the Mobility of University Students) – an international higher education program to enable students to study and live abroad for a period of three months; and
  - BEI (Business Education Initiative) – an undergraduate programme for NI students to study business for one year in a college in the US.

In reassessing whether current policy recommendations are 'fit for purpose', it is evident from section 8.1 that NI is already making in-roads by addressing several of the key ICT skills issues identified by this and previous research. In this way therefore this research validates several of the actions already being implemented.

8.5 Additional policy remarks

There are a number of remarks highlighted in this chapter, both from local consultations and international evidence, which suggest that it may be possible to build upon the existing ICT policy actions in NI whilst still exploring some additional remarks which could be suitable for NI to build and develop a world class ICT sector.

Rather than 'reinventing the wheel' we have summarised new recommendations under similar headings as identified in the original FSAG report (Skills Provision, Careers Attractiveness and Additional Sources of Talent).

Though given what we have learnt, we have decided to modify the third theme from Additional Sources of Talent to Internationalisation. The original heading more specifically referred to the increasing in-migration of ICT professionals from countries such as India and Eastern Europe (Poland). The new heading however extends the emphasis to the need for international collaboration and both in and out migration which have been indentified throughout the research as very important for a successful ICT sector. Recall out migration refers to gaining international ICT exposure but importantly bringing this experience back to NI.

It must also be highlighted that the most important aspect of delivering a set of recommendations is that clutter is avoided and policymakers 'get the basics right'. This is a particular danger for ICT in which there are many players and strategy documents.

As a reminder then the three recommendation themes relate to the following:

1. **Skills provision** – ensuring that the skills delivered by educational institutions (HE, FE and private training courses) meet the needs of industry today and tomorrow;

2. **Career attractiveness** – increasing the demand for ICT related subjects by informing primary and secondary students of the benefits of studying ICT and the potential career opportunities which are available; and

3. **Internationalisation** – encouraging international and domestic in-migration to boost supply, as well as providing international exposure for graduates and skilled professionals to increase the level of specialist skills in the market (provided they return to NI).

For each recommendation theme we categorise the key skill issues associated with that theme and then set out the additional policy remarks which could potentially assist in overcoming these problems. We also, where relevant, highlight whether a policy remark is more / less relevant under the alternative demand scenarios.

Theme 1: Skills provision

Key skill issues

- Dealing with the recession
- Addressing the perceived falling quality of ICT graduates from local universities
- Addressing the drop in enrolments in ICT HE and FE courses, and in particular postgraduate students
- Ensuring the FE and HE course offering and module contents meet market demand and sufficiently address Matrix focus area skill requirements
- Tackling the shortage of commercial and business skills amongst ICT graduates
- Up-skilling and re-skilling the existing workforce

New policy remarks to consider

- Ensuring that both during and after the recession that lessons from the 'dot com crash' are applied and the image of the ICT industry as a rewarding career remains a high priority, for example by continuing and expanding upon the FSAG 'Bring-IT-ON' campaign (this is important across all demand scenarios to avoid a continued decline in high-level ICT skills supply, but even more so for the aspirational higher-growth scenarios where large high-level ICT skill shortages could occur).

- Encouraging more students to extend ICT education for longer than otherwise may have been the case, e.g. FE progression to undergraduate, undergraduate progression to postgraduate etc. This will help students to partly 'ride out' the recession and for the supply-side to emerge stronger (i.e. exploit the recession as an opportunity).
- Exploiting the recession as a time to re-skill the existing workforce, including 'bridging the gap' between technical and non-technical skills such as sales, marketing and business skills.
- Undertake research to better understand the nature and quantum of up-skilling and re-skilling requirements in the ICT industry in NI, how it is delivered and what is the most effective support to ICT businesses to promote up-skilling and re-skilling.
- Undertake an exercise to translate the Matrix ICT focus area technical skill requirements into 'ideal' discipline offerings and module contents and compare to current provision and international best practice (this should include exploring major: minor or joint ICT & business disciplines – look to ROI experience, Trinity College specialist course in ICT & finance). This should be followed by making recommendations to universities and FE colleges on the basis of findings. This, in our view, is especially important for the aspirational demand scenario.
- Develop some agreement on what a 'consensus' programming language should be to incorporate into ICT courses which addresses the needs of the majority of today and tomorrow's ICT industry in NI (or whether different institutions should specialise in different languages). Although note universities consider this something of a 'red herring'.
- Encourage and institutionalise closer links between industry and ICT education & training providers to ensure maximum discipline and technical skill alignment. This could also help to enhance the responsiveness of education and training capacity to industry needs. This is important across each of the demand scenarios.
- **Introduce a 'top tier' ICT course in one of the local universities with the highest possible entry requirements (we suggest looking to the Finnish experience and BSc actuarial studies at QUB which is over-subscribed even with 4 As entry requirement), including introducing entry requirements for more specific A-level IT-related courses** (this would include mathematics)**.** This type of policy however will require some careful consideration given initially places may be difficult to fill (and the financial sustainability of university courses is based on a 'bums in seats' rule). Also it is worth caveating that high entry requirements do not always provide a direct read across for quality – sometimes high entry requirements simply represent high demand – therefore making this policy work requires significant efforts to motivate the brightest young students to apply. We do however strongly believe that ambition is required on the ICT supply-side to do something different given the level of ambition inherent in the Matrix demand-side vision.
- **Introducing a good maths A-level as a pre-requisite for entry to Computer Science programmes (as opposed to the current ICT A-level).** Once again this type of policy will require some consideration given the impact it may have on course applications and enrolment numbers if entry requirements are tightened against a backdrop of already falling supply.
- Knowing the market for ICT skills supply - develop networks / databases of high-skilled ICT professionals outside NI (and within NI, especially outside the ICT industry) and provide access to recruiting ICT companies / new FDI firms. While Invest NI have already explored the option of introducing the 'Business IT Guide' website to identify businesses operating within the sector, a database of individuals and companies from outside NI should be considered. This could help to provide access to experienced ICT professionals which the NI market currently, according to consultations, cannot fully provide. We believe implementation of this recommendation would be especially important for the more aspirational demand scenarios.

Theme 2: Career attractiveness

Key skill issues

- Changing the negative perception of the ICT industry
- Supporting the industry's growth aspirations by taking into account Invest NI's vision for future FDI opportunities as well as the under-supply of high-level ICT skills under the two aspirational scenarios investigated in this report
- Addressing the perceived shortage of masters and PhD graduates

New policy remarks to consider

- Continuing and expanding upon the FSAG 'Bring-IT-ON' campaign to increase the number of ICT graduates, masters and PhD students as well as those interested in studying ICT (and agreeing where long-term responsibility for this should sit). This will be crucially important for a higher growth scenario where otherwise significant skill shortages could emerge.
- Undertake research to better understand the demand for and benefits of recruiting PhD ICT graduates (and masters versus undergraduate), as well as the likelihood of PhD graduates actually entering employment into the ICT industry (many could remain in academia).
- Explore options to closer align the current IT curriculum at secondary level with the potential future course content of more market-driven undergraduate ICT courses. This is important across all employment growth scenarios for the ICT industry.
- Identification of potential ICT talent at an early age and encourage the ICT career route.
- Consider lessons from digital schools in Australia and Korea to develop ICT capacity and promote interest from an early age.
- **Research why the high leakage of ICT graduates to other sectors – lack of demand from ICT industry ('push' factor), pay and conditions in competing sectors ('pull' factors'), ambition of graduates (less challenging career outside ICT), who is being lost to other sectors (the stronger or weaker ICT performers?). In addition undertake analysis of employment destinations beyond six months using the HESA longitudinal leaver survey (or it may require a more tailored survey)**. This research is especially crucial for the aspirational scenario as the demand-supply forecasting analysis predicts large imbalances in a higher demand growth scenario (but relative balance for the baseline).

Theme 3: Internationalisation

Key skill issues

- Addressing the perceived shortage of experienced ICT professionals
- Lack of foreign (or even ROI / GB) students enrolling on undergraduate ICT courses in NI
- Funding eligibility constraints for non-EU applicants to ICT postgraduate courses
- Under-utilisation of migrant labour
- Enhancing international exposure

New policy remarks to consider

- Learning lessons from ROI on how to attract and retain high-skilled ICT migrants (who are the most flexible source of labour and their international experience is seen as a major positive). This initiative is of critical importance to the more aspirational scenarios. According to the Matrix focus group, attracting a large ICT multinational to NI could directly bring international ICT professionals and act as a catalyst to further inflows.
- Attracting back NI ICT talent to NI (look to campaigns in Australia and Israel), building upon the 'C'mon Over' campaign.

- Assist education & training providers and ICT businesses to maintain work placements (overseas placements would be particularly attractive to give international exposure to students). This is important across all scenarios.
- Market NI ICT university undergraduate course offerings to students outside NI
- DEL to consider the possibility of extending the eligibility of postgraduate grants to include non-EU applicants.

While each of these policy recommendations has a part to play in the development of a robust, well-developed and secure ICT workforce, **there are three fundamental elements which must be considered ongoing pre-requisite activities**. These three elements include:

1. **Reviewing new literature, data and forecasts** – this research will fill a gap for now and allow policymakers to make an informed decision with regards to policy remarks based on the most up-to-date evidence on the supply and demand of ICT skills in NI. However this should be constantly reviewed to ensure the evidence is up-to-date. One option could be to significantly expand the coverage of analysis in the NI ICT Snapshot.

2. **Tracking and monitoring the sector** – the ICT sector in NI has been targeted as a key priority sector (DETI, Invest NI) with the potential for global recognition (Matrix). It is important that the sector is continually tracked to ensure that its development is in keeping with policy targets and ambitions (for example updating the analysis in this report – employment trends, LFS analysis, enrolment and qualifier trends, UCAS points analysis, graduate sector destinations etc). Tracking and monitoring is also important to keep a close eye on the potential for skills shortages and gaps which have been identified in the past as key inhibitors to the sectors development. This type of service may also help to send out an 'early warning sign' which may help to inform education providers of the demand for specific ICT skills. A number of areas should be tracked – evaluation studies on the success of ICT policy remarks; employment trends; enrolment trends; UCAS points analysis; new issues from e-skills UK research etc.

3. **Updating and collaborating with key stakeholders** – ensuring that all key players, including local businesses, government bodies, trade associations and local education providers are continually engaged in the sector and updated on any issues, challenges or developments which may affect the sector. We recognise this is likely to occur already via Momentum and the ICT FSAG.

8.6 Summary

In summary this research has validated much of the existing approach to addressing skills challenges in the NI ICT sector. Indeed one of the greatest challenges remains ensuring the policy space and direction does not become cluttered and unclear for businesses, education providers, Matrix and students alike.

The growth prospects for the ICT industry remain strong across the global economy, albeit not as strong as the 1990s and post-dot com crash recovery phase. The dynamic nature of the sector however means that precision over the quantum and specific skills required in 2, 5 or ten years time is not easy to deduce. Clearly the industry will have strong demand as its products and services become commonplace in modern society and the modern economy, and with a relatively high skills profile, it is not a sector which developing countries can easily compete effectively for at the highest level (this should not allow complacency to set in – progress in India, China and elsewhere in Asia such as South Korea shows that ICT skills capacity globally is increasing rapidly).

The skills required in the ICT industry in NI are complex. One only has to look at the Matrix ICT Horizon Panel range of technical skill requirements for the various focus areas to realise this. In many cases skill requirements are very specialised / firm-specific as the sector itself has a wide reach (R&D functions, software design, software implementation, sales and marketing activities and system and process development to name just a few examples, never mind the new Matrix focus areas) The relative small size of the NI ICT sector also means that FDI in a particular niche has the potential to have a disproportionately large impact on overall skill demand in the industry, yet it is difficult for the local education system to cover all potential skill requirement areas (as niche provision is expensive and not particularly compatible with the higher education 'bums on seats' funding environment). Taken together these all make the policy challenge complex.

This research has confirmed, based on latest data, falling numbers of ICT enrolments from A-Level to postgraduate higher education as suggested in other reports and for other jurisdictions. It has also highlighted a key pattern, which perhaps does not get the attention it deserves, of a high leakage of NI ICT graduates to other sectors of the economy – this reflects the transferability of ICT skills but also raises potential questions over the mis-match between graduate outturns and industry demand. Similarly an issue of increasing prominence flagged by consultees is the issue of quality of courses and the quality of the ICT graduate intake and output. The evidence on reduced UCAS points of people entering ICT courses (especially compared to other disciplines such as finance) supports this view from industry.

Baseline demand and supply projections for high-level ICT skills developed for this research do not at first suggest that the projected supply (which assumes a bottoming-out in enrolment declines) will be insufficient for NI. This is not least because the recession will (a) reduce the short-term requirement considerably; (b) provide a pool of ICT labour available in the years ahead; and (c) future growth, in a policy-neutral scenario, is predicted to be significantly slower than both the 1990s and recent years.

However the baseline outlook for the NI ICT industry is well below what might be considered optimal from a policy point of view and below what Matrix aspires to. In the NI economy-wide baseline, not only would the PSA1 productivity target remain unmet, but in the aftermath of the recession unemployment rates are likely to remain high. Looking at a credible aspirational scenario for the ICT industry, as this research has, suggests that the supply of high-level ICT skills would fall significantly short of what would be required unless enrolment trends not only stop declining but reverse. This would either lead to a failure to achieve the potential of the ICT industry or an import of high-level ICT skills (which NI does not have a particular tradition in doing well unlike ROI).

The implication is that to realise the vision of the Northern Ireland economy aspired to in the Programme for Government and Matrix, this is likely to require an increased supply of high-level ICT skills from current levels but perhaps more crucially, an increase in the quality of supply not just in terms of the new intake / output from education but in the current workforce as well.

Taking the evidence collectively and reflecting on previous published research, our final policy remarks are as follows:

- **Career attractiveness** – the research justifies continuing and expanding upon existing career attractiveness campaigns (such as Bring-IT-ON), remembering that for young people choosing a subject the key factors are long-term career prospects, parental guidance, likeability and earnings potential. Though the recession will have a less ICT-specific impact in the way the dot com crash

had, it is important to be mindful of the impact ICT redundancies could have on future supply and career choices. Publicising "good news" from the ICT industry in NI during the recession could be a potentially powerful tool.

- **Re-train and re-skill** – skill providers and industry should use the opportunity of the recession to retrain and re-skill the current workforce. This can include taking existing students unable to find work through onto more advanced courses (for example Software Professional Course) or adding perhaps business skills and top-up technical skills / new programming languages to the existing ICT workforce (for example through Invest NI's Business Improvement Training Programme).

- **Work placements** – encouraging work placements to help provide business readiness skills to young people and in helping business struggling to fund full-time posts. However placements can be expensive for business, especially during quieter periods, and consideration of government support for work placement schemes could be considered.

- **Closer links between education and industry** – much like the meeting in October 2008, the meeting of industry with education providers is important to ensure skills outturns are appropriate. This means dealing in precise terms about the languages, packages and techniques required by current firms and new types of firms envisaged by Matrix (in other words the choice of modules cannot be entirely led by the NI stock of ICT businesses who attend skills workshops – other industry representatives should also be represented at this type of workshop).

- **Introduction of a top tier course** – it is important to retain provision of an elite cadre of students to maintain both NI's reputation but also to attract the brightest young people into a career in ICT. A course with a lower entry requirement is rarely taken by students with the highest level of skills. A 'triple A' rate course (or higher like actuarial studies at QUB), perhaps with a very high profile prize or placement job offer, could significantly raise the image and calibre of the ICT training output.

- **Closer alignment of secondary IT curriculum with university curriculum** – it is important to ensure the input to universities is appropriately geared towards the requirements of university study to avoid teaching of more basic modules. That said it is also important to remember the distinction between what might be considered computer literacy and what might be a more advanced set of skills with respect to ICT.

- **Limited uptake amongst females** – though it is difficult to offset gender differentials where ,there is no unequal practices in place (in other word it is market choice), consideration should be given to promoting ICT courses to females, perhaps even by means of financial incentives (if feasible).

- **ICT high-level skills supply chain study** – any efforts to boost ICT course enrolments and increase female ICT course intakes etc will have limited impact if a high proportion of ICT graduates continue to leak into other sectors. It is imperative that the full reasons for this leakage are better understood as measures to address different factors could be very different.

- **Attracting and retaining high-skilled migrants** – to be successful on a global ICT stage and to develop a 'layering' of ICT skills supply capacity (to provide flexibility for unpredictable FDI), NI will require a flow of skills from outside the region to enlarge, broaden and deepen the skills base. This will necessitate cultivating and promoting an image of an ICT hub or ICT culture and ensuring jobs are promoted widely.

Annex A: Bibliography

Northern Ireland

DEL (2008) *NI ICT Future Skills Action Plan* Department for Employment and Learning, e-Skills UK, Invest NI and Momentum, June 2008

e-Skills UK (2009) *Northern Ireland IT Snapshot: ICT Labour Market in Northern Ireland* e-Skills UK, January 2009

e-Skills UK (2007) *Sector Skills Agreement for IT: 2007-2010 Action Plan Northern Ireland* e-Skills UK

e-Skills UK (2005) *IT Insights: Regional Skills Gap Analysis Northern Ireland* e-Skills UK, August 2005

Invest NI (2006) *Northern Ireland ICT Sector Review* OCO Consulting, December 2006

Matrix (2008) *ICT Horizon Panel Report* Northern Ireland Science Industry Panel Matrix, PA Consulting Group, October 2008

Peer Consulting (2007) *Economic Appraisal of the Software Professional Course* Peer Consulting

United Kingdom

e-Skills UK (2008) IT *and Telecoms Insights 2008: Profiles of the Industry and Workforce* e-Skills UK

e-Skills UK (2008) *IT and Telecoms Insights 2008: Trends and UK Skill Implications* e-Skills UK, Gartner Executive Programs

e-Skills UK (2008) *IT and Telecoms Insights 2008: Trends and Skills in the UK Telecoms Industry* e-Skills UK, Auridian

e-Skills UK (2008) *IT and Telecoms Insights 2008: Employment Forecast* e-Skills UK, Experian

e-Skills UK (2008) *IT and Telecoms Insights 2008: The Impact of ICT on UK Productivity* e-Skills UK, Adroit Economics and Regeneris Consulting

e-Skills UK (2008) *IT and Telecoms Insights 2008: Employer Skills Needs Survey* e-Skills UK

e-Skills UK (2008) IT *and Telecoms Insights 2008: Staff Training in the UK* e-Skills UK

e-Skills UK (2008) *IT and Telecoms Insights 2008: Assessment of Current Provision* e-Skills UK

e-Skills UK (2008) *IT and Telecoms Insights 2008: Employer Skills Needs Survey* e-Skills UK

Republic of Ireland

Ipsos Mori (2009) *Career Opportunities in Computing & Technology in Ireland* Higher Education Authority, Discover Science and Engineering

Expert Group on Future Skill Needs (2008) *Future Requirements for High-Level ICT Skills in the ICT Sector* EGFSN

Annex B: Overview of ICT skills literature

Northern Ireland

DEL (2008) *NI ICT Future Skills Action Plan* (e-Skills UK, Momentum)
The NI ICT Future Skills Action Plan is designed to identify additional actions to specific skills issues as a complement to those already in the Sector Skills Agreement (SSA). These actions aim to contribute to the overall objective of building a pipeline of appropriately qualified software professionals in NI. The actions are specifically aimed at the software part of ICT and whilst they are mainly short term their benefits may not be recognised for some period of years.

e-Skills UK (2009) *Northern Ireland IT Snapshot: ICT Labour Market in Northern Ireland* (e-Skills UK)
The Northern Ireland IT Snapshot for ICT outlines the changes in the demand/supply of ICT labour and skills in Northern Ireland. This summary report presents labour market data and the results from a survey of 300 employers of IT professionals in Northern Ireland.

Chapter Outline
- Introduction
- Summary of findings
- The NI IT snapshot and future skills action plan
- NI IT Snapshot: Sector profile
- NI IT Snapshot: Recruitment and demand
- NI IT Snapshot: Business outlook
- NI IT Snapshot: Data sources
- NI IT Snapshot: Future skills action group

e-Skills UK (2007) *Sector Skills Agreement for IT: 2007-2010 Action Plan Northern Ireland* (e-Skills UK, Momentum)
The Sector Skills Agreement for IT for Northern Ireland is a ten year vision and three year action plan for IT skills development in Northern Ireland. It follows extensive research which revealed that, over the next 15 years, the IT industry in Northern Ireland is forecast to grow at more than three times the rate of overall employment growth in Northern Ireland.

The SSA for IT strategy and action plan consider the skills needs of the 14,600 people in the IT workforce in Northern Ireland, the 76,200 business managers and leaders who need to understand how to realise the potential of IT, and up to 501,000 people who use IT in their day to day work.

Chapter Outline
- Foreword
- Executive summary
- Context
- IT Skills Strategy for Northern Ireland
- Action Plan for Northern Ireland
- The Future

e-Skills UK (2005) *IT Insights: Regional Skills Gap Analysis Northern Ireland* (e-Skills UK)

This report brings together primary research in Northern Ireland from an employer survey, face to face employer interviews and contributions from a conference of employers and stakeholders. It also contains commentary, foresight and forecasting data from the IT Insights suite of publications including an analysis of IT education and training provision.

Chapter Outline

- Executive summary
- Introduction
- The economic environment
- IT in Northern Ireland
- Future IT skills demand
- Training infrastructure and delivery in Northern Ireland
- Action planning
- Glossary

Invest NI (2006) *Northern Ireland ICT Sector Review* (OCO Consulting)

This report provides a detailed audit of the Northern Ireland ICT sector. It identifies the main ICT technology clusters in NI and quantifies the NI IT skills base.

Chapter Outline

- Introduction
- ICT Supply-Side Analysis
    - Industry development and segmentation
    - Labour supply and skills
    - Centres of excellence
    - Conclusions
- ICT Demand-Side Analysis
    - Industry trends in ICT
    - Growth technologies
    - Conclusions
- Competitive Position of Northern Ireland
    - Benchmarking design
    - Competitive positioning
    - Comparative location factor analysis
    - Conclusions

Matrix (2008) *ICT Horizon Panel Report* (PA Consulting Group)

Matrix has been established in NI to articulate the views of industry to government. The Matrix ICT Panel Report delivers a number of recommendations for accelerating future growth of the ICT sector in NI for the Minister for Enterprise, Trade and Investment. The ICT panel of experts draws upon the experience of leading ICT sector businesses such as Allstate, Asidua, Citi, Singularity, Meridio and Polaris. The recommendations contained in this research provide government with a blueprint for the development and growth of the ICT sector.

Chapter outline

- Executive summary
- This foresight report
- A definition and scope of ICT

- The global environment of ICT and the key challenges that impact any future direction in Northern Ireland
- ICT capabilities and skills within Northern Ireland
- The focus for Northern Ireland ICT
- Focus area 1 – Application software and packaged software
- Focus area 2 – The near shoring industry
- Focus area 3 – High performance computing systems and high performance signal and networking systems
- Developing the 10 year ICT focus in Northern Ireland – the Northern Ireland cluster
- Skills
- Framework conditions

United Kingdom

IT and Telecoms Insights 2008: *Profiles of the Industry and Workforce* (e-skills UK)
Based on current and time series data from national and international sources, this report provides key metrics for business, workforce, key demographic issues and relevant international comparisons

Chapter Outline
- Introduction, background and scope
- Executive summary
- Business profile of the IT and Telecoms industry
- IT and Telecoms demographics
- International comparisons
- IT users

IT and Telecoms Insights 2008: *Trends and UK Skills Implications* (e-skills UK/Gartner Executive Programs)
This report provides a vision of the future based on the predictions of leading global industry analysts.

Chapter Outline
- Introduction, background and scope
- Executive summary
- Key trends
- Leaders identify the need for action

IT & Telecoms Insights 2008: *Trends and Skills in the UK Telecoms Industry* (e-skills UK/Auridian)
This report, which includes input from leading Telecoms employers, provides insights into future trends specific to the Telecoms sector and identifies the potential impacts and likely skills implications for the workforce.

Chapter Outline
- Introduction, background and scope
- Key trends and observations
- Background
- The trends
- Conclusions

IT and Telecoms Insights 2008: *Employment Forecasts* (e-skills UK/Experian)
e-skills UK commissioned Experian to undertake detailed econometric forecasts for future employment in the IT and Telecoms industry and in IT and Telecoms occupations to 2016. Replacement demand is combined with growth data to provide estimates of entrants for IT and Telecoms professionals to 2012. The report also provides a detailed analysis of the demand for IT & Telecoms skills in the shorter term (2007-2010), by bringing together employment forecasts with the results of the Employer Skills Needs Survey (see below)

Chapter Outline
- Introduction and scope
- Executive summary
- IT and Telecoms forecasting

- The forecast scenarios
- Forecasts for IT and Telecoms industry
- IT and Telecoms occupations
- Replacement demand
- IT skills models

IT and Telecoms Insights 2008: *Competitiveness of the UK IT & Telecoms Sector* (e-skills UK)
This report provides an evaluation of the competitiveness and performance of the IT & Telecoms sector regionally, nationally and internationally. It provides key comparative data including information on productivity, growth and the competitive environment and includes an investigation into the links between competitiveness and IT strategic management and leadership skills.

Chapter Outline

- Introduction, background and scope
- Part 1: UK IT and Telecoms industry competitiveness
- Part 2: UK ICT utilisation and competitiveness

IT and Telecoms Insights 2008 : *The Impact of ICT on UK Productivity* (e-skills UK/Adroit Economics and Regeneris Consulting)
This report considers the extent to which Information and Communication Technologies (ICT) impact the UK's national and regional economies, and the implications for increasing productivity and GVA both for the UK as whole and within each nation / region. It also identifies possible interventions to optimise future productivity through ICT adoption.

Chapter Outline

- Introduction
- Executive summary
- The impact of ICT on productivity
- The wider impact of ICT on the regions
- Firms and broadband have key roles to play
- Constraints and barriers
- The solutions and policy interventions

IT and Telecoms Insights 2008: *Employer Skills Needs Survey* (e-skills UK)
This report is based on a survey of 3,026 employers. Considering both IT & Telecoms professionals (within IT & Telecoms companies and across all other sectors) and IT users, the survey assesses current and future skills needs; recruitment, vacancies and skills shortages; and the proficiency and skills gaps of the existing workforce.

Chapter Outline

- Introduction, background and scope
- Key findings and data points
- Methodology and notes
- Sourcing ICT skills
- ICT recruitment: sourcing staff with IT user skills
- ICT in the workplace: meeting the future requirement for ICT professional skills
- ICT in the workplace: ICT professional skills gaps
- ICT in the workplace: matching IT user skills to company needs
- ICT skills in the workplace: IT user skills gaps

IT and Telecoms Insights 2008: *Staff Training in the UK* (e-skills UK)
This report is based on a further survey of 1,000 representatives from UK businesses identified as holding responsibility for the training and development of IT and Telecoms staff at their place of work. It investigates the incidence and nature of training and development amongst the IT & Telecoms workforce.

Chapter Outline
- Key findings and data points
- Methodology and notes
- ICT staff development
- Technical training
- Business/management training
- Interpersonal skills training
- General company/employment training

IT and Telecoms Insights 2008: *Assessment of Current Provision* (e-skills UK)
This report provides an overview of IT & Telecoms-related education and training at Higher, Further and Secondary Education levels, which is either publicly funded and / or leads to nationally recognised qualifications.

Chapter Outline
- Introduction, background and scope
- Key findings and data points
- Secondary education
- Further education
- Higher education

Republic of Ireland

Ipsos Mori (2009) Career Opportunities in Computing & Technology in Ireland Higher Education Authority, Discover Science and Engineering

This research investigates the key drivers amongst young people and their key influencers that encourage them to consider or dismiss a career in computing and technology.

Chapter Outline

- Executive summary
- Background and research context
- Perceptions of science and maths
- Influences and influencers on subject and career decisions
- Perceptions of careers in computing and technology
- Understanding of existing initiatives to develop an interest in science and technology
- Summary conclusions and recommendations

Expert Group on Future Skill Needs (2008) *Future Requirements for High-Level ICT Skills in the ICT Sector* EGFSN

This report investigates the future requirement for high-level ICT skills in the ICT sector in Ireland and any proactive actions which need to be taken to ensure that the supply of these skills is sufficient for the sector.

Chapter Outline

- Executive summary
- Introduction
- Employment trends in ICT sector
- Economic drivers of Irish ICT sector
- The market for high-level ICT skills in Ireland
- Demand for high-level ICT skills
- Supply of ICT skills
- Comparison of domestic supply and demand
- Conclusions and recommendations

Annex C: Overview of consultations

Evidence from consultations

Whilst acknowledging the importance of a sound empirical base, Oxford Economics and FGS McClure Watters, viewed the consultation phase of the research as particularly important in building upon current research and providing up-to-date information and insights into the need for high-level ICT skills in Northern Ireland.

It has been widely documented both within NI, the UK, ROI and other international countries that the supply of ICT skills in the marketplace has become scarce. In Northern Ireland, high levels of growth in the ICT sector combined with a decreasing number of school leavers studying computer science or engineering subjects has become highly publicised. And while the dot com crash can potentially be cited as a key driver of this phenomenon there is also a need to explore other issues which may be contributing to the problem and recommendations for overcoming these obstacles.

The consultation stage of the research intends to answer some of the questions that cannot be accounted for by the data and provide information such as;

- Up to date information with regards to the current supply of ICT skills in the Northern Ireland market, the likely demand for these skills by local companies, and key issues which may be preventing school leavers from studying ICT or ICT related subjects;
- The overall effect of the credit crunch on the sector as a whole and individual ICT companies;
- The type, quantum and level of skills required in the marketplace given the current recession;
- The future skills needs and occupation requirements of the sector;
- The role of the supply side in driving and encouraging the growth of ICT skills;
- The role of education and training in delivering high quality graduates in sufficient quantities to fill any shortages or gaps in the sector; and
- A better understanding of key skill issues and challenges which the sector is facing and likely to face in the future.

Most recently the e-skills NI Sector Skills Council (SSC) produced a skills monitoring document (e-Skills NI Skills Snapshot) based on a survey of approximately 300 ICT companies in NI. This document covers some of the key issues required for this piece of research. Whilst e-skills research has provided a good definition and foundation for our study, given the dramatic change in economic conditions, there is a need to revisit research conclusions. The e-skills SSC is an important link between business and government and therefore meeting with both the NI and UK e-skills representatives was the first step to delivering this element of the research and establishing key contacts within the NI ICT sector.

Consultation aims

In order to bring focus to the consultations and research, three main outcomes were agreed with the project steering group for this element of the research.

1. Receive guidance from consultees on the current structure and likely changes to high-level ICT employment in Northern Ireland and what the drivers of growth will be
2. Receive guidance from consultees on specific skill demand issues and future skill trends within the ICT sector
3. Receive guidance from consultees on recommendations for interventions which would be necessary to assist the sector in overcoming any identified skills gaps

As an overview this annex is intended to fully document the consultation process in detail while the main messages, which are covered here, are also integrated into the main report. This section of the research highlights all of the key demand and supply issues pertinent to the ICT sector and the high-level skills needs of those working within the industry. This section will also highlight key recommendations from the marketplace for the future growth and longevity of the ICT sector in NI.

Consultation programme

The consultations were carried out between February and April 2009 and included interviews with key stakeholders including both NI and UK e-skills SSCs, local businesses, government, trade and education bodies (see table A1).

The consultations focussed specifically on a number of key themes, including:

1. ICT growth trends, key drivers and prospects
2. The demand for high-level skills, occupations and experience
3. Supply of ICT skills and the role of education and training
4. Demand and supply gaps
5. Securing the future for high-level ICT skills

The list of organisations selected provides a good overview of the sector as a whole, including commentators on key literature and recommendations available (Matrix, e-skills UK/NI), as well as input from local businesses and the main supply side providers within NI.

The initial agreement with DEL was to carry out a total of 10 to 15 consultations (see table 1), with a mix of face-to-face and telephone interviews. For various reasons it was not possible to interview all of the organisations identified in our initial list via face-to-face or telephone interview however all organisations were contacted three times either by telephone or email. The actual consultation phase consisted of a total of 13 face-to-face interviews, 2 telephone interviews and 2 written responses. The reasons for non participation or for submitting written responses included limited time to participate in consultancy services or unavailability of key personnel.

Table one provides an overview of the initial consultation list as well as those contacted, interviewed and method of consultation.

Table A.1: Consultation list

Industry	Contacted	Type of interview
First Derivatives	Yes	Telephone
Allstate	Yes	Face to Face
Singularity	Yes	Telephone
Asidua	Yes	Face to face
Liberty IT	Yes	Written response
ICS Computing	Yes	-

Industry	Contacted	Type of interview
SAP	Yes	Face to face
Kainos	Yes	Telephone
Latens Technology	Yes	Unavailable
Supply side	**Contacted**	**Type of interview**
University of Ulster	Yes	Face to face
Queen's University	Yes	Face to face/written response
Belfast Metropolitan College	Yes	Face to face
South East Regional College	Yes	Face to face
Southern Regional College	Yes	Telephone
North West Regional College	Yes	Telephone
South West Regional College	Yes	Telephone
IT Professional Academy	Yes	Face to Face
Other	**Contacted**	**Type of interview**
e-skills NI	Yes	Face to face
e-skills UK	Yes	Telephone
Matrix	Yes	Face to face
Momentum	Yes	Face to face
Invest NI	Yes	Face to face
Bond Recruitment	Yes	Face to face
Workforce Development Forum	Yes	Face to face
Forfas	Yes	Telephone

Source: Oxford Economics

Key Results

Theme 1: ICT growth trends, key drivers and prospects

Growth trends

- ICT companies are perceived to be stable and 'weathering the storm well' – many firms are adopting a wait and see approach to staffing while there are several firms actively recruiting.

- ICT is seen as an 'enabler' and 'key input' for industry so most consultees did not believe that there would be a downturn in global growth now or in the near future.

  'Growth opportunities seem to exist in helping firms become more efficient by offering ICT solutions (business transformation processes). We are still seeing growth in broadband penetration and mobile data sharing and firms. ICT spend does not appear to have been cut to the same extent as marketing spend'

- There was a general consensus across the consultations that the sector in NI can be summed up as 'fairly fledgling, not really mature' with a few large employers such as Allstate, Liberty and Citi driving the sectoral trends.

- Education providers (HE and FE) agreed with the view that there were opportunities in the sector for new qualifiers but raised some concern for the prospects of this year's graduate cohort.

Drivers of change

- The continued reform agenda and 'e-government' efforts from the Civil Service were seen as a potential opportunity for the sector, as was ICT in healthcare and security

- The type of roles which may develop in Northern Ireland was a little to early to say given the current economic situation however companies did believe that there would be a shift to more high skilled roles

- Outsourcing and the potential for cost savings were identified as critical factors driving the prospects for growth, particularly from global firms or firms undergoing rapid expansion.

- NI was seen as a 'middle player' between the likes of London on one side and India on the other and has the potential to attract investment from the US or UK.

  'A key driver of change will be firms revisiting their global footprint strategies to ensure maximum cost efficiency from all their operations. This might involve lower value jobs moving to India and could involve higher/mid value jobs moving to Belfast from higher cost locations such as New York and London'

  'Northern Ireland does have a competitive advantage in the sector. It is below the mid-point on costs and quite capable of getting new products to market quite quickly'

- It was evident that some local NI companies have outsourced some of their operations outside of NI in order to save on cost and fill skills gaps and shortages. These firms have experienced both positive (increased production, lower costs, availability of skills) and negative outcomes (language barriers, management difficulties) as a result. More specifically firms noted that it takes a certain type of project or skill to be able to outsource work and not everyone has the capacity or type of business to do it.

  'Only specific pieces of work can be outsourced successfully. There is a need to keep a very close eye on what is happening over there – as if the operation were next door. We have found that the employees can work very hard, but very hard on the wrong thing'

  In 1997 Singularity lost a contract due to offshoring and competition from low cost competitors. Singularity outsourced in the mid to late 90's to save on input costs, generate profits and grow their company. Now they have increased what they can deliver from India within the same budget e.g. half of their marketing is now done in India to become more competitive and generate higher levels of profit. While the company has been expanding in India, both their NI offices and UK offices have also been expanding.

- Some companies believed outsourcing was not a threat to local business or operations in NI but rather a chance to lower input costs and increase production. All firms currently outsourcing also reported expansion in their domestic operations particularly toward the higher skill end

- In particular, Kainos believed that outsourcing would only be a threat to ICT jobs in NI if suitably skilled professionals were unavailable. While Kainos expect growth over the next 6 years they expect most of this growth (in terms of numbers) to occur in Poland due to skills shortages at the high end. This is purely due to the availability of ICT professionals with the right technical skills.

  Kainos have outsourced some of their operations to Gdansk in Poland due to the unavailability of labour in NI with the right technical skills. Although there are still opportunities for growth in NI, in terms of numbers the greatest growth over the next 6 years will occur in Poland.

  'If the skills were available in NI the jobs would be done from here but I really don't know where we will find them over the next 6 years. There is no real cost saving in Poland but the skills are there'

- When discussing the potential threats to the growth of ICT in NI, outsourcing however was only viewed as the third most significant threat behind macroeconomic factors (the state of the economy) and the availability of skilled labour.

- Innovation was identified as key to developing new products and services. It was suggested that the environment for innovation in Northern Ireland is well defined with strong support for innovation provided by government.

- High numbers of graduates from India and China are seen as a possible threat to future large-scale investment coming to NI. The opinion was expressed that if a large company were looking for 100+ graduates it would be difficult to find them in NI.

  'India and China are producing serious levels of graduates – possibly with better maths skills than NI. NI needs to move up the value chain. To do this, it needs to become a world class research region (something that china and India are already gearing up for)'

Prospects

- The views on prospects for the sector broadly agreed that there was little evidence of redundancy yet. There is also some evidence of growth opportunities for ICT services within other sectors particularly within health, e-government and finance.

- While most companies were in a 'holding phase' in relation to staff levels – 'neither hiring or firing' many companies also continue to see opportunity in the current economic environment as firms seek to reduce costs and new financial services regulations are put in place all of which need software to drive them.

  'I'm optimistic we can grow ICT sector faster than the rest of the economy – its a better sector to invest in than most and I see increasing demand for ICT services'

- Education providers have expressed concern over the prospects for employment of the 2009 cohort of graduates.

- Consultees were presented with the Matrix aspirational scenario and asked to comment on how realistic it is.

Matrix Scenario
'NI will transform the current ICT sector into a globally-recognised centre of higher value activities, achieving leadership across specific focus areas in Europe by 2010 and global recognition as a leading region by 2015. The three specific focus areas are package application software, near shoring and high performance embedded systems' Matrix report

- Whilst there were mixed reviews, the consensus view offered was that;
  - the timeframe was unrealistic; and
  - the three specific areas of focus identified by Matrix (package application software, near shoring and high performance embedded systems) might not necessarily be the most appropriate
  - Some suggested alternatives to Matrix's areas of focus were: connected health, security software, e-government and business to business support

- First Derivatives however mentioned that near shoring was a very successful component of their business, providing back office functions to companies outside of NI and which could be developed further in NI

- In relation to high performance embedded systems, this was viewed as a very different field to what the NI sector currently offers. In order to develop and grow this industry a whole different set of skills will be required – a skills set that NI is not churning out in sufficient levels.

  'We need to be careful about what sectors we choose, pick winning sub sectors, support them, promote them and have the universities geared towards servicing them'

Theme 2: Demand for high-level skills, occupations and experience

High-level skills needs

- Consultees recognised there was a need to shift to high-level skills which could be defined as PHD students or those with 2 to 5 years experience.

  'Northern Ireland can no longer compete at the lower end of the market. In order for our ICT sector to grow we really need to develop our higher level skills and create a niche in the market – something that we are good at and renowned for'

- There was no consensus view as to what the 'specific' skills needs were for the sector, which related to the fact that there was really no standard career path or progression within ICT. It was however cited that high-level skills or niche skills were in higher demand than entry level skills such as graduates.

Occupation requirements

- Software development is the key sub sector in the NI market.

- There is an undersupply of high quality C++ programmers graduating from university which is the industry standard. There were two strands to note from this point. Firstly, the sector needs to promote itself to school aged people to boost enrolments. Secondly, the high quality point is important. The consultee believed that it was only going to be from high quality programmers that innovation would come.

- Companies suggest they need good programmers with team skills and good communication skills. The point around 'business ready' skills was raised consistently across all consultations.

- One business in particular cited the need for good marketing and sales people to help drive the business rather than purely ICT skills.

  'Without a good sales and marketing team we can't sell our products and hence our business will fail. To grow we need to think about competing with companies outside of NI which means writing tenders and selling our name and expertise'

- It was highlighted that there is no capacity in the labour market to accommodate a significant increase in demand for experienced programmers, software developers and technical web developers which are currently in short supply.

Demand for Experience

- Consultations with business suggest that their typical requirements were either at experienced or graduate level. However at the moment employers tend to be looking for more experienced (2 – 5 years) professionals rather than graduates.

- Whilst companies are looking for more experienced professionals they cannot find them in sufficient quantities in the market and are prepared to take on qualified migrant labour to fill the gaps. The best example of this situation is Kainos who are currently expanding operations in Gdansk, Poland due to the unavailability of skilled labour in NI.

- This was a surprising outcome given that in the past DEL have been prepared to provide skills missions to other countries to fill gaps and shortages in NI. These missions were confronted by a lack of interest from employers. Two companies responded to this comment stating that 'they would prefer to do their own skills missions in line with their company expansion policies rather than do what everyone else is doing'

- The message that the Universities have picked up from business through their own engagement processes[18] is that if they can get people with solid programming, team work and communication skills, businesses can mould them into what they need over 2/3 years.

Theme 3: Supply of ICT skills and the role of education and training

[18] The universities have advisory panels for course design which include sectoral representatives. This provides the sector with an opportunity to influence the content of courses and help ensure the universities are delivering the required skills.

Supply of ICT skills

- The major issue with the supply of ICT skills in the NI marketplace related to quality issues rather than quantity issues. So while companies are saying there is an undersupply of graduates in the market this may be more related to an undersupply of 'quality' graduates.

- Whilst there has been a downward trend in the number of students studying ICT related subjects. The number of students studying Computer Science was not as worrying as the lack of students taking up Software Engineering.

- Some consultees also suggested that there are too many generalist 'business' degrees and not enough specialised degrees such as Software Engineering.

- Increasing university enrolments needs to ensure that they are good quality students. The crux of the issue goes back to school level. The question was thus posed, how can STEM subjects be made more attractive?

  'Enough time has passed since the dot com bust to reduce its impact on career decisions but parents have a big influence over course choices and ICT is seen as a cyclical sector and not held in high regard. Traditional jobs such as doctor, pharmacist, lawyer, and accountant still hold large status in NI.'

The role of education and training

- Some companies stated a desire to move towards a standard learning language for ICT courses, specifically .NET as this was becoming the industry standard. The University of Ulster offered the view that graduates with a solid grounding in C++ could quickly learn the .NET language but C++ was a better 'all round' language', the principles of which can be applied to many other languages.

- The University of Ulster also noted that pupils coming from school have to start with Java and progress to C++ as there is somewhat of a mis-match between ICT teaching at school and university.

- A mismatch between what schools teach as computer science and what they teach at university was identified by the university. It was highlighted that this needs to be addressed to ensure that people that do come through from school to university are clear as to what they will be learning at University.

- Although companies were sympathetic with the plight of universities they did however agree that courses could provide specific modules which offered training in programmes which are more relevant for their company. For example, Microsoft Sharepoint was a specific collaboration tool used by Kainos however this was a not a primary tool taught at Universities in NI

- The software professional conversion course for non IT graduates was cited as providing a quick and valuable boost to supply. Companies whom have employed graduates from the course noted that the calibre coming out was 'very good'.

The Software Professional Course is a 35 week conversion course designed to take graduates from non-IT disciplines and give them the skills they need to work in software development roles in Northern Ireland. The course is designed to meet the needs of local ICT businesses both quickly and efficiently and is developed in consultation with industry.

- Education providers were keen to note that there is a high level of input from businesses in course design. Businesses noted that the flexibility of the Software Professional Course is a significant benefit – the last 5 weeks of the 35 week course are specifically related to industry needs at that time.

- Placement years within degrees are cited as making a significant difference to performance – anecdotally, a good placement can boost a degree by one level as students realise 'how it all fits together'.

- It became clear from the consultations that business appreciate the ability of the FE sector to respond relatively quickly to training requirements. Whilst liaison with the Universities is also appreciated and clearly defined, businesses did note a significant lag between identifying a need for skills and approval through the university system.

- It was however noted that the role of universities is not to train the individual in specific skills but rather to teach the student approaches and the ability to solve problems.

Theme 4: Demand and supply gaps

- C sharp (also known as dot net) was identified as the industry standard which should be taught as the standard language across NI. Currently the education system is not churning out enough high quality C++ programmers. The education providers offered the view however that a good C++ programmer could pick up other languages quickly.

  'There are too few top quality programmers coming through the education system here. University starts with Java code as C++ is too difficult for new undergraduates. C++ is progressed to'

- Some businesses consulted suggested that it would be challenging for the labour market to service large scale recruitment of more than 100 graduates and experienced professionals.

- There is a shortage of ICT professionals with 2-5 years experience. Re skilling or higher level training programmes tailored to this level was seen as imperative to building up a steady high-level skills base.

- In terms of NI's ICT research capacity University of Ulster cited difficulties in recruiting high quality programmers with a genuine interest in the subject. A vibrant research community was cited as important for the sector as it 'creates a buzz' and can attract global attention. QUB also reported a particular difficulty in recruiting PhD students locally. This is principally because graduates can get a well paid job in industry and see no benefit in spending a further 3 years studying. However, this situation may be reversed because of the current credit crunch.

  'Some in the sector say that they cannot find skilled staff but maybe it's that they cannot find enough good ones'

Theme 5: Securing the future of high-level ICT skills

- Consultees were unanimous in their belief that the sector needs to market itself better to students at Year 10 in school. The perception of the sector is problematic with people seeing it as 'dull' or in the case of the engineering side of the profession 'men in boiler suits' which discourages students from studying ICT related disciplines. And while the dot com bust is a distant memory in comparison to the current economic challenges ICT was still seen as a risky sector to pursue a career.

  'The profession fails to market itself – look what CIPD has done for HR as a profession. Maybe a practitioner body is part of the solution. Industry needs to be in schools convincing students that STEM subjects are worthwhile.'

- Whilst companies did mention the current activities going on in schools (Bring IT on campaign) and universities (open nights) and believed they had the potential to address the issues but the real results from these programs would not be available for 5 to 10 years

- Increasing STEM enrolment was cited as particularly important amongst females whom have a lower participation rate than males within ICT

  'There is a need to educate young females on the benefits of working in the ICT sector'

- In order to increase enrolments in STEM subjects (typically required for high-level ICT jobs) many consultees posed the suggestion of whether STEM subjects could be incentivised through the A Level points system or fees abolished for those studying STEM at university.

- Understandably, all consultees noted that if enrolments and graduate levels increase, quality levels need to (at a minimum) remain the same. So while consultees were supportive of attracting more enrolments, quality is absolutely paramount.

- Re skilling and continuous training were also cited as extremely important within the ICT sector to keep up with ever changing new techniques and trends and develop higher level skills and new ideas. Companies believed there was a role for government to not only provide training or funding for new starts but also for those already working within in the sector. More specifically this may take the form of training in a new technology or programme

- Whilst FDI was seen as an important driver of the ICT sector, local, established companies expressed concern that the increased wage levels had resulted in some staff movements to incoming companies. These companies believed that it was extremely important to ensure a 'level playing field' particularly with regards to wage levels

- Education providers highlighted a need to invest in research, suggesting that this is an area where India and China are becoming increasingly strong (in addition to the low cost competition). This is an issue that might have a longer term impact on the sectors growth prospects

Annex D: Overview of Matrix Focus Group Session

In response to information gathered from the initial consultation process (Annex C) the Matrix group focus group session was designed to gather feedback from Matrix horizon panel members with regards to the aspirations and key focus areas in the Matrix report and the subsequent skills needs of the ICT sector in NI. In co-operation with Eoin McFadden from Matrix, a focus group session was delivered on the 17th of June which included Matrix horizon panel members such as industry providers, Momentum as well as participation from DEL.

As part of our research, Oxford Economics and FGS McClure Watters were commissioned to consult with approximately 10 – 15 industry, education and government representatives on the future skills needs of the ICT sector. The consultations investigated issues such as –

- The quantum, level and type of skills needed in the ICT sector;
- The current structure and likely changes to high-level ICT employment in Northern Ireland and what the drivers of growth will be;
- The future skill trends within the ICT sector; and
- Recommendations for interventions which would be necessary to assist the sector in overcoming any identified skills shortages or gaps.

Given the importance of the Matrix report (vol 3) to the future of market development and future skills needs in the ICT sector, the initial consultations asked consultees to provide an insight into the practicality and reality of reaching the Matrix vision (see Box 1).

Specifying the Matrix vision below stage one of the consultations, including face-to-face and telephone consultations, revealed that consultees believed;

Box 1: Matrix Scenario

'NI will transform the current ICT sector into a globally-recognised centre of higher value activities, achieving leadership across specific focus areas in Europe by 2010 and global recognition as a leading region by 2015. The three specific focus areas include package application software, near shoring and high performance embedded systems' Matrix report

- The timeframe is unrealistic;
- The three specific areas of focus identified by MATRIX (package application software, near shoring and high performance embedded systems) might not necessarily be the most appropriate;
- Near shoring however was a very successful component of some businesses interviewed particularly in relation to providing back office financial services functions; and
- Some suggested alternatives to Matrix's areas of focus were: connected health, security software, e-government and business to business support.

Whilst these comments will be reflected in the final report, it is important that as part of this research we 'hear both sides of the story'. This focus group aimed to provide an opportunity for Matrix panel members as well as Momentum, DEL and Oxford Economics to debate some of the skills issues facing NI and the 'best' way forward for the sector.

Key messages

The key messages from the focus group have been summarised under a number of headings;

- Demand for skills;

- Supply of skills;
- Issues identified;
- Recommendations;
- NI ICT sector moving forward; and
- Other key factors

Demand for skills

Quantum of skills

- How much will the sector grow? Respondents agreed that 500 new entrants per year was reasonable
- Respondents agreed that FDI would increase this figure above 500
- Recession has not had a profound impact on the ICT sector in terms of employment numbers

Type of skills

- Graduates need to demonstrate a combination of both technical and non-technical skills such as sales and marketing skills
- No specific reference to particular programming languages such as C++, Java etc. Companies really looking for good, clever people with a degree which contains a solid programming element
- Organisations need a combination of “doers” and “innovators”

“Doers”

- “Doers” are the catalyst to “innovators” i.e. Graduates/software engineers

“Innovators”

- Higher level specialist skills providing value added to business i.e. masters/PhD (currently NI experiences a shortage of people within this space)

Level of skills

- ICT/IT degree students too general. It is essential that degrees contain a component of programming
- Shift in demand to high-level skills with particular emphasise on masters and PhD students
- It was felt by the group that to produce real innovation in this field a very high level of technical knowledge and expertise was required

Supply of skills

- Not enough “innovators” or high-level / specialist people available (masters/PhD/work experience)
- Quality and quantity of graduates falling
- Declining quality of graduates may be a result of a drop in entry requirements at university. Respondents however acknowledged the need for universities to get ‘bums on seats’

- Universities producing too many generalist graduates. Hybrid degrees such as IT with management viewed as weak by industry professionals
- IT degrees contain very little or no programming element therefore students are graduating with qualifications not industry relevant
- Some of our best companies rely on workforces largely trained by Nortel and BT (i.e. network technicians) and there may be a gap in our supply of such skilled engineers in the medium term
- Organisations struggling to fill FPGA (Field-programmable gate array) and software areas
- Mismatch between what is taught as ICT at secondary school and what is taught as ICT at University

Issues identified

- SMEs have difficulty providing time to collaborate with Universities and FE colleges with regards to skills needs and subsequently course content
- ICT sector not seen as an attractive or "sexy" industry for young people
- Northern Ireland population too risk averse, may hinder a proactive approach to development
- Increased competition particularly in relation to the lower end of the skills spectrum suggesting that low level job roles will dissipate overtime, losing jobs to China and Brazil

Recommendations

Skills Provision

- Linking a proportion of PhD's with industry needs
- More consultation and industry buy-in with regards to course content and modules at the University of Ulster and QUB. If NI wants to create a niche, higher value added ICT sector, there needs to be full alignment between industry and university
- The NI Universities and ICT organisations should be more proactive rather than reactive to market conditions
- Encouraging innovation communities (rather than purely University) to spin out research and undertake R & D. This could help to deliver a higher proportion of "innovators" with specialist skills to the ICT sector, generate new ideas and help in the skills agenda
- A Professional Certification of Skills (in the Matrix report) – roadmap of skills

Careers Attractiveness

- A rethink of the ICT skills taught throughout all levels of education
- Continuing to improve career attractiveness, including the ICT ambassador's initiative
- Identification of talent at a young age and encourage ICT route

International Reach

- Creation of global partnerships with universities specialising in ICT, for example MIT as well as better co-ordination with institutions in ROI
- Internationalising the workforce by encouraging graduates and those already working within the industry to work or study overseas for a period of time
- ECIT – links with international companies and industry, an example to follow?

NI ICT sector moving forward

- The Matrix vision – ambitious, however it was agreed that the ICT sector needs to aim for something. There is an opportunity for Matrix to provide strategic intelligence/vision for the industry and also to 'bridge the gap' between Universities, industry and schools
- In keeping with the findings of Matrix NI should pick a market, specialise in that market and encourage a large anchor tenant such as Microsoft or Oracle to set up in NI
- Some respondents agreed that increasing FDI and attracting a large MNE to set up in NI could create many opportunities and encourage migration of international ICT professionals into NI. This could also be established by a large international MNE making an acquisition of an existing NI firm
- Other respondents did not agree so wholeheartedly and stated firstly that while such an approach had worked in ROI, market conditions i.e. higher corporation tax would not produce the same effect in NI. Secondly such an inward investment, although welcome, would displace existing jobs within the industry creating a short term skills shortage
- Prerequisite for moving forward will be to increase the numbers of "innovators" including masters and PhD students. A particular emphasise on high end, specialist skills
- Great opportunities within the sector for IP innovation. Universities need to recognise and relate to the growth and potential of IP and the benefits of building up an exploitable pool of world class IP.
- Need for increased collaboration between education institutions and industry. This may include provision for ICT organisations to contribute to or create their own modules in QUB, University of Ulster, FE colleges
- Average age and experience of ICT professionals in NI was high, flagging difficulties in the medium and long term for replacing these skills

Other key factors

- The telecommunications and advanced engineering industries were cited as areas for potential long term growth with the right kind of high-level skills
- Comparison with India and China. China producing high-level skills at every age, children in early teens learning Java programmes and required to meet a very high pass rate
- Northern Ireland is no longer at the forefront of low cost
- Two types of software engineering were identified in NI i.e. Enterprise Software Engineers and Network Technicians. View that the real added value in global markets tends to come from the latter
- Respondents did not disagree with the 3 areas of growth identified in the Matrix report and of the three areas there seemed to be a greater emphasis placed on embedded systems

Annex E: Comparative statistics on NI ICT sector

Indicator	Oxford Economics	Other sources
Total employment (level)	**16,500 jobs** (2008) (o/w 1,500 self-employed) Definition: e-skills UK sector footprint definition; employee jobs and self-employed, job-based Source: DETI Census of Employment, NI Census Office, LFS and Oxford Economics	7,840 IT employee jobs (Q4 2008) Source: *e-skills UK NI IT snapshot* (March 2009) / DETI Quarterly Employment Survey 8,000 people in all roles in companies whose primary business purpose is IT (2004) Source: *e-skills UK IT insights: Regional skills gap analysis NI (2005)* / Labour Force Survey 11,000 employees (2008) Source: Matrix *ICT Horizon Panel* report (2008)
Total employment (share of total NI employment)	**1.9%** (2008)	-
Total GVA (effectively wages and profits)	**£938m ICT GVA** (2003 prices) 3.6% NI total GVA (2008) Source: Regional Accounts, ABI, Oxford Economics	£224m IT nominal GVA (current prices) 1.6% NI total GVA (2006) Source: *e-skills UK NI IT snapshot* (March 2009) / DETI ABI £500m GVA (year not specified) Source: Matrix *ICT Horizon Panel* report (2008) / DETI
Productivity	**£57,000 GVA (2003 prices) per job** 90% above economy average, 70% above economy private sector average (2008) Source: Regional Accounts, ABI, Oxford Economics	£39,745 GVA per employee 2.5 times economy average (2006) Source: *e-skills UK NI IT snapshot* (March 2009)
Wages	**One-third above economy private sector average** (2008) Definition: Median full-time basic pay (SIC 72 computer & related). Public sector assumed to be SIC L, M and N Source: DETI ASHE	-
Exports	**£103m** (2007) (provisional)	-

Indicator	Oxford Economics	Other sources
	60% of NI total high export potential service exports Definition: Export earnings (sales outside UK) by high export potential companies (SIC 72 computer & related) Source: DETI Exporting NI Services Study	
Investment	**£98m** (2007/08) 37% of NI total service sector Invest NI assistance and planned investment by indigenous and external client companies (13% of NI total including manufacturing) Definition: Invest NI assistance and planned investment by indigenous and external client companies (software and computer services) Source: Invest NI	-

Annex F: Supply of ICT skills

Supply-side institutions

There are three sources of supply which currently provide entry into the ICT sector, including higher education, further education and participation in an ICT conversion course. A detailed summary of the courses offered at university and further education colleges are provided below including degree content and entry requirements. An overview of the key fundamentals of the Software Professional Course is also included.

Higher Education

Queens University Belfast		
Degrees Offered and Length of Degree	**Degree Content**	**Entry Requirements**
Computer Science BEng/BSc – 4 – 5 years (sandwich) MEng/MSc – 4 - 5 years (sandwich)	Fundamentals of computer science, various forms of programming and software engineering projects. MEng also move into areas such as innovation and entrepreneurship.	BEng /BSc – BBC at A-Level MEng/MSc – BBB at A-Level
Electrical & Electronic Engineering BEng– 3 years MEng– 4 years	Computer Games Design and Development (including an optional placement year) will involve development of the necessary programming, content management and architectural design skills and provide students with a full development experience from concept through design and development to final implementation in preparation for a development-oriented career in the industry.	MEng – BBB at A-Level (including maths and physics)
Computer Games Design and Development MEng – 4 years	Fundamentals of both software and electronic engineering. Advanced C Programming, Embedded Software are all studied at the BEng level. The MEng level provides students with appropriate blend of engineering knowledge and business practice and management.	BEng – BCC at A-Level BTEC National Diploma and HND MEng – BBB at A-Level
Computing and Information Technology BSc Hons – 3 – 5 years	IT Architecture design and integration, IT system Administration, Programming and Professionalism are all undertaken in this degree course	BCC – at A-Level
Business Information Technology BSc Hons – 3 years	The main themes of this course are Business Practice, computer architecture, Management IT, Management Principles and Information Technology and Entrepreneurship within an IT environment	BBC- at A-Level

Courses offered at Q.U.B offer students the opportunity to spend a year in industry or to study abroad in another institution. Placement is compulsory on all courses.

In Q.U.B the entry requirements do give specific A-Levels which must be taken before acceptance into first year, these subjects vary from degree to degree but typically include subjects such as

Mathematics, Computer Science, Physics, Chemistry, Latin, ICT, Technology, Applied Double Award ICT all courses do require GCSE Mathematics. The minimum requirement for a Computing and Information Technology degree is two C's and a B at A-Level.

University of Ulster		
Degrees Offered and Length of Degree	**Degree Content**	**Entry Requirement**
Computer Science BSc Hons – 3 years	Areas studied include Computer Software Design, programming, systems analysis and design, computer architectures, algorithms and data structures and object-oriented programming	BCC – at A-Level BTEC National Diploma in a relevant area
Computer Science (Software Systems Development) BSc Hons – 3 years	Course content follows a similar path to the pure computer science degree, in their final year students complete a project involving the analysis, design, implementation, testing and evaluation of a substantial software system	BCC – at A-Level BTEC National Diploma in A relevant area Successful completion of HND
Computer Science (Foundation Year) Leading into Computer Science or Electronic Engineering Degree BSc Hons – 4 years	Introductory modules in internet and multimedia technology, programming, mathematics for computing, electronics, and business information systems.	EEE – at A-Level Successful completion of BTEC National Diploma
Computing Science BSc Hons – 3 years	Areas studied include Programming, professional software engineering, artificial intelligence, enterprise technologies, healthcare technologies, mathematical applications, major project in substantial software-related problem.	BBC – at A-Level BTEC National Diploma in a relevant area HND in a relevant area
Electronic Engineering MEng – 5 years BEng – 4 years	Areas studied include electronic circuit design, design and industrial applications, communications and software engineering. MEng studies include telecommunications systems and nanotechnology	BEng – BCC at A-Level MEng – BBB at A-Level BTEC National Diploma in a relevant area HND in a relevant area
Electronics & Computer Systems BEng Hons – 3 years	Areas studied include Programming, electronics, computer hardware, communication systems and mathematics, basic electronic and computer systems. Students in final year also undertake a major project to further advance and integrate technical and academic skills.	BCC – at A-Level BTEC National Diploma in a relevant area HND in a relevant area
Electronics & Computer Systems (Foundation Year) Leading into Electronics & Computer Systems Degree BEng Hons – 4 years	Introductory modules in internet and multimedia technology, programming, mathematics for computing, electronics, and business information systems.	DEE – at A-Level Successful completion of BTEC National Diploma
Electronics and Software BEng – 3 years	Areas studied include The use of information technology, digital electronics, systems, basic electronics, electronic	BEng – DDD at A-Level BEng Hons CCD at A-

BEng Hons – 3 years	engineering, micro-controller systems, software programming, communication engineering, operating systems and networks, object orientated programming, automation and control, nanotechnology and advanced medical sensors	Level BTEC National Diploma in a relevant area HND in a relevant area

Placement at the University of Ulster is compulsory with many of the courses either offering students the opportunity to spend a year in industry or studying abroad in another institution.

The entry requirements do give specific A-Levels which must be taken before acceptance into first year, these subjects vary but typically include subjects such as Mathematics, Physics, Chemistry, Biology, Technology, Engineering and Technology and Design. All courses do require GCSE Mathematics and English or equivalent. The minimum requirement for a Computer Science degree is two Cs and a B at A-Level however, students willing to undertake a foundation year can gain a place within the university with grades EEE at A-Level.

Post Graduate – Queen's University Belfast		
Postgraduate Diploma in Electronics 1 Year	Areas studied include Computer Architecture and Organisation, Computer Graphics, Custom Integrated Circuit Design, Digital Signal Processing, Digital System Design, Electronics of Solid State Devices, High Frequency Communication Design Techniques, Microelectronic Technology, Programming in C and C++ and Telecommunication Systems	MSc: second class honours degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronics content. Postgraduate Diploma: Pass degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronics content.
Postgraduate Diploma in Telecommunications	Areas studied include Programming in C and C++, Digital System Design, Telecommunication systems, Optional modules, Computer Architecture and Organisation, Computer Graphics, Digital Signal Processing, Embedded Software Systems, High Frequency Communication Design Techniques, Mobile Communications, Teletraffic Engineering and Switching Systems	MSc: second class honours degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronic communications content. Postgraduate Diploma: pass degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronic communications content.
MSc in Computer and Electronic Security 1 Year	Areas studied include Computer and System Security: Security Mechanisms and Network Security, Cryptography, Forensics, Internet Privacy, Media Security: Advanced Cryptography and Security Architectures, Digital Rights Management, Data Hiding, Watermarking Video Analytics and Biometrics	Entry to the course requires a minimum of a second class honours degree in Computer Science, Electrical and/or Electronic Engineering, or equivalent degree with a significant electronics or computing content.
MSc in	Areas studied include Programming in C	MSc: second class

Telecommunications	and C++, Digital System Design, Telecommunication systems, Computer Architecture and Organisation, Computer Graphics Digital Signal Processing, Embedded Software Systems, High Frequency Communication Design Techniques, Mobile Communications and Teletraffic Engineering and Switching Systems	honours degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronic communications content. Postgraduate Diploma: pass degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronic communications content.
MSc in Electronics	Areas studied include Computer Architecture and Organisation, Computer Graphics, Custom Integrated Circuit Design, Digital Signal Processing, Digital System Design, Electronics of Solid State Devices, High Frequency Communication Design Techniques, Microelectronic Technology, Programming in C and C++, Telecommunication Systems	MSc: second class honours degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronics content. Postgraduate Diploma: Pass degree in Electrical and/or Electronic Engineering, or equivalent degree with significant electronics content.
Postgraduate Diploma in Computer and Electronic Security	Areas studied include Computer and System Security, Media Security, Video Analytics and Biometrics	Entry to the course requires a minimum of a second class honours degree in Computer Science, Electrical and/or Electronic Engineering, or equivalent degree with a significant electronics or computing content.
Post Graduate – University of Ulster		
Postgraduate Certificate/ Postgraduate Diploma/MSc in Computing	Areas studied include Engineering Process Improvement, Distributed Computing, Reliable Software Development, Databases for Structured and Semi-structured Data, Communications, Web Technology, Artificial Intelligence and Health Informatics.	The essential requirement is an Honours or non-Honours degree in Computer Science or in a related discipline from a University of the United Kingdom or the Republic of Ireland
Postgraduate Diploma/MSc Computing for Financial Services	Areas studied include Database Technologies, Financial Services Information Systems, Advanced Human Computer Interaction, Artificial Intelligence / Knowledge Based Systems, Mobile & Pervasive Computing, Network Management, Object-Oriented Information Systems, Interoperability & Legacy System	Applicants must hold a degree or equivalent in Computing/Business or a related discipline or demonstrate their ability to undertake the course through the accreditation of prior experiential learning.

Postgraduate Diploma/MSc Engineering (Named Specialism)	Areas studied include Biomedical Engineering, Electronics, Manufacturing Management, Micro- and Nano-Technology, Polymers and Advanced Composites.	PGDip -a degree in a relevant engineering or technology course or an HNC/HND in a relevant engineering or technology course together with at least three years relevant industrial experience at an appropriate level. MSc - a minimum of a second class honours degree in a relevant engineering or technology course.

Postgraduate courses are offered on both a full-time and part-time basis. Therefore the duration of the course can vary from 1 year up to 3 years. These courses are quite specialised and lead into specific areas of industry.

Further Education

Belfast Metropolitan College		
Courses Offered and Length of Course	**Course Content**	**Entry Requirements**
Foundation Degree – Software Engineering 1 Year	The aim is to provide students with the vocational knowledge and skills necessary for progression to employment in the Software Engineering industry or to an honours degree.	EE – at A-Level and Five GCSEs, including English and Mathematics at grade C or above
HND – Electronic Engineering 2 Years	Areas Studied include Programming Concepts, Digital and Analogue Devices, Programmable Logic Controllers, Application of Power Electronics, Microelectronic Systems, Business Management Techniques, Telecommunication Principles, Operating Systems and Networks, Project Based Learning.	One A-Level in an appropriate subject area plus four GCSEs at grades A-C (including English Language) A BTEC National Diploma/Certificate/Award in a relevant area A GNVQ Advanced Award
HND – Computing (General) 2 Years	Areas studied include information systems and project management, understanding computer systems and computer networks, understanding and programming computing systems, multimedia and website design, understanding e-business and Internet technology, creating and accessing databases in e-business projects	One A-Level in an appropriate subject area plus four GCSEs at grades A-C (including English Language) A BTEC National Diploma/Certificate/Award in a relevant area A GNVQ Advanced Award
HNC – Electrical and Electronic Engineering (Electronics Bias) 1 Year	Areas studied include electrical and electronic Principles, Project, Analytical Methods for Engineering, Engineering Design, Business Management Techniques, Engineering Science, Microprocessor Systems, Digital and Analogue Devices and Circuits, Combinational and Sequential Logic.	A BTEC National Certificate/Diploma in Engineering One 'A' level Science or Mathematics or one AVCE in Engineering plus
National Diploma in Electrical/Electronic Engineering 2 Years	Communications for technicians, electrical and electronic principles, health and safety and welfare, event driven programming, communications technology, maths for technicians, selection and application programmable logic, computer architecture, principles and applications of electronics, construction of digital systems	Four GCSE passes at grades A-C, including Mathematics, English, and a Science based subject. BTEC First Certificate/Diploma GNVQ Intermediate Award
Diploma – IT Practitioners (Software Development) 1 Year	Areas studied include Website design and management (Server and Client side), Advanced Spreadsheets, Computer Operating Systems and Hardware, Graphics and Animation, Business Systems and the work of a Systems Analyst, Programming in Visual Basic.Net	Four GCSE passes at grades A–C; or
First Diploma – Electronic Engineering	Areas studied include Maths for engineering, working practises in	four GCSEs at grades A - C (including English and

	engineering, science for technicians, electronic maintenance, communication principles	Mathematics and Science) A Foundation GNVQ in Engineering

Applicants may also be accepted into courses by demonstrating that they are capable of coping with the demands of the course, this may be through the applicant's previous experience or by other studies they may have undertaken. A number of the courses offered by BMC offer students the opportunity to take a year in industry. Many of the courses are aimed at giving students the right qualifications to further their studies either within the college or in university.

Northern Regional College		
Courses Offered and Length of Course	**Course Content**	**Entry Requirements**
CISCO Certified Network Associate/Professional (CCNA/CCNP) 1 Year	Areas studied include Networking from Home and Small Businesses, Working at a Small-to-Medium Business or ISP, Introducing Routing and Switching in the Enterprise	There are no prerequisite qualifications required for this course.
Higher National Certificate in Computing 3 Years	Course content includes: Web Development, ASP.NET, VB.NET, Dreamweaver, Flash, Programming, VB.NET, Project Management, Software installations.	2 points at A-Level or equivalent, or National Diploma.
Higher National Certificate in Computer Networking 2 years	Core Units include: Hardware Concepts, Operating System, Concepts Networking, Technology Security, Concepts.	Applicants must have a BTEC Award in Computer Hardware/Networking
Higher National Diploma in Computer Networking and Internet Technology 4 years (potential to complete within a shorter period	Areas studied include Hardware Concepts, Client Operating System, Networking Technology, Routing & Switching Technologies.	Applicants must have a BTEC Award in Computer Hardware/Networking or one A-Level or a BTEC Certificate/Diploma
National Diploma in Electrical and Electronic Engineering 2 years	Areas studied include Mathematics for Technicians, Business Systems for Technicians, Communications for Technicians, Electrical and Electronic Principles	Applicants should have at least 4 GCSEs at Grade C or above. (including Maths and English)
Higher National Certificate or Diploma in Electrical and Electronic Engineering 1-3 years	Areas studied include Electrical and Electronic Engineering, Business Management Techniques, Project Electrical & Electronic Principles.	A BTEC National Certificate or Diploma in an appropriate area. At Least 2 AS Level in subjects Mathematics Physics or Technology, together with 5 grades at Levels A-C at GCSE level.

Higher National Diploma in Manufacturing Engineering or Electrical and Electronic 2 years	Core Units include Design Business Management Techniques Project Planning and Scheduling Principles Health and Safety and Risk Assessment Electrical and Electronic Engineering Analytical Business Management Techniques Project Electrical and Electronic Principles	A BTEC National Certificate or Diploma in an appropriate area. At Least 2 AS Level in subjects Mathematics Physics or Technology, together with 5 grades at Levels A-C at GCSE level.

Northern Regional College follows the same procedure as other colleges in that, if an applicant can demonstrate that they are capable of coping with the demands of the course, through previous experience or by other studies they may have undertaken they may be accepted to study in the college.

North-West Regional College		
Courses Offered and Length of Course	**Course Content**	**Entry Requirements**
HND in Computing General, ICT Systems Support, Software Development 2 years	Areas studied include Computer Platforms, System Analysis, Programming Concepts, Networking Concepts, Project Management, , Quality Systems, Management in IT, End-User Support, Internet Server Management, e-Business Strategy, Software Development, Software Testing	1 A Level (at least Grade D) & 4 GCSE passes (Grade C or above) including Mathematics
Foundation Degree Science, in Computing / Software Development 2 Years	Areas Studied Introduction to Programming, Software Applications, Object-oriented Programming, Project Implementation, Networking & Architecture, Visual Programming & Data Structures	1 A Level & 3 GCSEs (both Grade C or above) including Mathematics & English
First Diploma for IT Practitioners 1 Year	Areas studied include Using ICT to Present Information, Computer Systems, Website Development, Applications Software, Hardware Components, ICT graphics	GCSE Grade D in English & Mathematics
National Diploma for IT Practitioners 2 years	Areas studied include Computer Systems, Advanced Database Skills, System Analysis & Design, Principles of Software Design & Development, Event Driven Programming, Communications Technology, Computer Architecture, Object Oriented Programming	4 GCSE passes (Grade C or above) including English & Mathematics
National Diploma in Engineering 2 years	Areas studied include Mathematics for Technicians, Electronics, Computer Aided Design, Engineering Materials, Microelectronics, Analogue Electronics, Communication for Technicians	4 GCSE passes (Grade C or above) including Mathematics

HND in Electrical / Electronic Engineering 2 Years	Areas studied include Mathematics for Engineers, Electrical / Electronic Principles, Electronics, Digital & Analogue Devices & Circuits, Programming Concepts, Microprocessor Systems, Business Management Techniques, Electronic Computer-Aided Design, Programmable Logic Controllers	1 A Level pass & 4 GCSE passes including an appropriate science or technology subject (Grade C or above)

North-West Regional College follows a similar procedure to BMC in terms of acceptance criteria, if an applicant can demonstrate that they are capable of coping with the demands of the course, through the applicant's previous experience or by other studies they may have undertaken they may be accepted to study in the college.

Southern Regional College		
Courses Offered and Length of Course	**Course Content**	**Entry Requirements**
Advanced GCE in applied ICT (double award) 2 Years	Students will study a range of subjects including: program design, software development, developing and creating websites, networking and system installation	Four GCSE passes at grade c or above Or equivalent
BTEC Higher National Diploma in Computing (with E-business) 2 years	Units which students must complete cover hardware, software, networking, systems analysis and databases, e-Business Technology, e-Business Development, e-Business Strategy, Professional Development.	National Diploma 2 A levels (good to have ICT background) 80 UCAS Tariff Points
BTEC First Certificate In Engineering	Areas studied include Working Practices and Engineering Information, Mathematics, Science, CAD and Electronic Systems.	No previous qualification required
BTEC National Diploma In Electrical / Electronic Engineering	Areas studied include Electronics, Microelectronics, Digital Electronics, Mechanical/Electronic, Computer Aided Design, Electronic Circuit Manufacture, Programmable Controllers, Manufacturing Systems, Engineering Materials and Information and Communication Technology.	4 GCSEs/First Cert Or equivalent
BTEC First Diploma In Computing	Core units can include: Website Development, Installing Hardware Components, ICT Graphics, Using ICT to Present Information, Introduction to Computer Systems, Database Software.	Students must be well motivated and have completed a programme of general education which would enable the student to benefit from and succeed on the course.
Foundation Degree In Computing	Subjects studied include Systems Analysis and Design, Programming and Problem Solving, Computer Platforms, Database Development, Object Oriented Programming, Computing Mathematics, Visual Programming	Level 3 qualification

BTEC National Diploma In Computing	Areas studied include Communication and Employability Skills for IT Computer Systems, Information Systems, Organisational Systems Security, e-Commerce, Communication Technologies, Principles of Software Design and Development, Event Driven Programming, Installing and Upgrading Software.	Four GCSE passes at a grade C or above
BTEC Higher National Diploma In Computing (With Multimedia And Internet)	Units which students must complete cover hardware, software, networking, systems analysis and database as well as e-Business Technology, e-Business Development, e-Business Strategy, Professional Development, Multimedia Design & Authoring, Website Design, Human Computer Interface and e-Business Strategy.	National Diploma 2 A levels (good to have ICT background) 80 UCAS Tariff Points

The entry requirements for Southern Regional College were not readily available but the assumption can be made that they would mirror the requirements of similar courses offered at Colleges throughout the rest of NI. Once again the college will accept applicants that show they are capable of coping with the demands of the course, through previous experience or by other studies they may have undertaken.

South-West College		
Courses Offered and Length of Course	**Course Content**	**Entry Requirements**
BTEC National Diploma for IT Practitioners (Software Development)	Areas studied include Communication and Employability Skills for IT Computer Systems, Event Driven Programming, IT Systems Analysis and Design, Principles of Software Design and Development.	Minimum 4 GCSEs Grades A*-C or First Diploma
BTEC National Diploma in Engineering or National Diploma in Electrical/Electronic Engineering	Business Systems for Technicians Communications for Technicians Engineering Project Mathematics for Technicians Electrical and Electronic Principles Mechanical Principles and Applications	Minimum 4 GCSEs Grades A*-C or First Diploma
BTEC First Diploma for ICT Practitioners	Using ICT to Present Information and an Introduction to Computer Systems	6 GCSE Passes Grades A-G
Diploma in Digital Applications for IT Users with Level 2 BTEC First Certificate in Business	Areas studied include Digital Applications, Using ICT, Graphics, ICT in Enterprise, Exploring Business Purposes, Business Communication, Investigating Financial Control	6 GCSE Passes Grades A-G

South-Eastern Regional College		
Courses Offered and Length of Course	**Course Content**	**Entry Requirements**
BTEC First Certificate In IT Practitioners	Areas studied include Introduction to computer systems, Networking essentials, Installing hardware components, Software installation and upgrade, Technical fault diagnosis and remedy Exploring business purposes	Students should be 16 years of age and have a good standard of education.
EDEXCEL BTEC HND Electrical/Electronic Engineering 1 Year	Students undertake modules including Business Management Techniques, Electrical/Electronic Principles, Electronics, Microprocessor Systems, Computer Aided Machining, Digital and Analogue Devices and Circuits, Electronic Computer Aided Design, Programmable Logic Controllers, CAD/CAM and Data Communications and Networks	At least 18 yrs of age 1xA'level 5 GCSEs grade C or above incl English & Maths
EDEXCEL BTEC HNC Electrical/Electronic Engineering	Students undertake modules including Business Management Techniques, Electronics, Digital and Analogue Devices and Circuits, Operational Amplifiers, Electronic Computer Aided Design, Programmable Logic Controllers, Data Communications and Networks.	You will need an ONC in Engineering or equivalent qualification.
EDEXCEL BTEC National Certificate Electrical/Electronic Engineering	Electrical and electronic principles, Business systems for technicians, Mathematics for technicians, Communications for technicians, Electronics, Digital electronics, Electronic fault-finding, Electronic Computer-Aided Design (CAD) Introduction to software development Programmable controllers	4 GCSEs at grade C or above, preferably with Maths, English, and 1 science-based subject plus 1 technology-based subject BTEC First Diploma/Intermediate VCE in IT, Science or Engineering BTEC First Diploma/Intermediate VCE in another vocational area with GCSE Mathematics Grade C or above.
EDEXCEL BTEC National Diploma Electrical/Electronic Engineering 1 Year	Students undertake modules including Business systems for technicians, Electronics, Electronic faultfinding, ECAD, Electronic circuit manufacture, Electronic measurement and testing, PC spec and maintenance, Introduction to software development, Introduction to robot technology, Programmable controllers and Computer hardware	4 GCSEs at grade C or above, preferably with Maths, English, one science-based subject plus one technology based subject, or Art or BTEC First Diploma/GNVQ Intermediate in Engineering, IT or Science.

As with afore mentioned colleges both the South-Eastern Regional College and South-West College applicants that show accept they are capable of coping with the demands of the course, through previous experience or by other studies they may have undertaken.

Conversion Courses		
IT Professionals Academy (BMC) or the Software Professional Course	The IT Professional Academy is run in collaboration with industry, further education and Momentum, Northern Ireland's professional body for ICT. It teaches the fundamentals of computer systems and software development to graduates from non-IT disciplines.	Need to be a graduate or equivalent in a non-ICT discipline. Applicants will also undertake an aptitude test to qualify for acceptance

Supply forecasting assumptions

Supply element	Supply sub-element	Assumption	Caveat / comment
Education & training	FE ICT courses - Level 4	▪ Number of passes to stop declining in 2009 and remain constant at 109 pa (109 = 2007/08 number of level 4 achievements on ICT courses at FE institutions in NI) ▪ Economic activity - % entering full-time employment after qualification held constant at 15% (15%=2007/08 full-time level 4 achievements on ICT courses at FE institutions in NI as % total achievements. Assume part-time achievers are already in employment) ▪ Location of employment - % entering employment in NI held constant at 91% (5% higher than the HE HESA ICT share entering employment in NI - higher as assume FE graduates are moderately less mobile than HE graduates) ▪ Sector of employment in NI - % entering employment in NI ICT sector held constant at 32% (equivalent to HE HESA share of ICT graduates entering employment in the ICT industry)	Share of graduates remaining in NI and entering employment, including by industry, are unlikely to remain constant over time (also lack of an FE leaver survey means utilising HESA assumptions may not be entirely appropriate for FE leavers). Also the assumption on whether part-time achievers are already in employment is important and there is a possibility that part-time achievers currently working outside the ICT industry could transfer to jobs in the industry (although this is not directly assumed)
Education & training	FE ICT courses - Level 5	▪ Number of passes to stop declining in 2009 and remain constant at around 250 pa (322 = 2007/08 number of level 5 achievements on ICT courses at FE institutions in NI) ▪ Economic activity - % entering full-time employment after qualification held constant at 55% (55%=2007/08 full-time level 5 achievements on ICT courses at FE institutions in NI as % total achievements. Assume part-time achievers are already in employment) ▪ Location of employment - % entering employment in NI held constant at 86% (equivalent to the HE HESA ICT share entering employment in NI - higher than for level 4 passers as assume level 5 FE graduates are moderately more mobile) ▪ Sector of employment in NI - % entering employment in NI ICT sector held constant at 32% (equivalent to HE HESA share of ICT graduates entering employment in the ICT industry)	Share of graduates remaining in NI and entering employment, including by industry, are unlikely to remain constant over time (also lack of an FE leaver survey means utilising HESA assumptions may not be entirely appropriate for FE leavers). Also the assumption on whether part-time achievers are already in employment is important and there is a possibility that part-time achievers currently working outside the ICT industry could transfer to jobs in the industry (although this is not directly assumed)

Supply element	Supply sub-element	Assumption	Caveat / comment
Education & training	HE Computing & Telecoms courses (undergraduate and postgraduate)	▪ UCAS choices - number of UCAS choices to stop declining in 2010 (data is available for 2009) and remains constant at 2,300 pa (figures only available in sufficient detail for computing) ▪ UCAS acceptances - share of UCAS acceptances as a per cent of total choices held constant at 22% (slightly higher than the historical average but in keeping with the recent trend) ▪ First year enrolments - first year Computing and Telecoms enrolments calculated as UCAS acceptances multiplied by a constant ratio of first year enrolments to UCAS acceptances ▪ Qualifiers - Computing and Telecoms qualifiers extrapolated based on a 3-year lag of first-year enrolments trends ▪ Economic activity - % entering full-time employment after qualification held constant at 81% (HE HESA share entering full-time employment from ICT courses). Postgraduate share lower (three-quarters of undergraduate share) as a proportion of graduates are assumed to remain in university research ▪ Location of employment - % entering employment in NI held constant at 86% (HE HESA share entering employment in NI from ICT courses) ▪ Sector of employment in NI - % entering employment in NI ICT sector held constant at 32% (HE HESA share of ICT graduates entering employment in the ICT industry)	HESA shares of graduates remaining in NI and entering employment, including by industry, are unlikely to remain constant over time. In reality they will not be independent of demand and wage factors

Supply element	Supply sub-element	Assumption	Caveat / comment
Education & training	Software Professional Course	▪ Number of enrolments held constant at 61 pa (full year annual enrolment figure in 2008 – this is a more conservative assumption than a two-year average of 2008 and 2009 but in our view more realistic given the recruitment difficulties currently being experienced by the latest SPC graduates) ▪ Share of completers as a per cent of enrolments held constant at 70% (2008 value) ▪ Economic activity - % entering full-time employment after qualification held constant at 61% (three-quarters of the HE HESA share entering full-time employment from ICT courses - lower as assume some of the completers are already in full-time employment or for replacement demand analysis, will be entrants other than from education and in-migration) ▪ Location of employment - % entering employment in NI held constant at 86% (HE HESA share entering employment in NI from ICT courses) ▪ Sector of employment in Ni - % entering employment in NI ICT sector held constant at 50% (assume share of SPC completers entering employment in the ICT industry is higher than for HE ICT courses)	All qualifiers are assumed to fall within NQF 4-6 category (sub-degree and degree), i.e. high skill level. Note also it is not straightforward to identify the Software Professional Course within FE data - there are no courses identified as SPC in the FE database. However this is not to say SPC may be included under a different course title (in which case there is a risk of double-counting which would over-estimate the supply of high-level ICT skills)
Education & training	HE Computing & Telecoms courses (undergraduate and postgraduates) from outside NI	-	Not quantified – would require a further interrogation of the HESA full UK dataset which DEL does not have access to
Up-skilling and re-skilling	Existing ICT workforce and new entrants other than from education and in-migration	-	Not quantified due to a lack of data but an important research area

Supply element	Supply sub-element	Assumption	Caveat / comment
In-migration	In-migration to ICT industry (could include attracting back NI talent from GB, ROI and further afield)	-	Not quantified due to a lack of data Flows likely to be small but could become more important in an aspirational demand scenario

Annex G: International policy action references

Australia

Centre for Innovative Industry Economic Research (2008) *The ICT Skills Forecast Project First Report: Quantifying Current and Forecast ICT Employment* Australian Computer Society, August 2008

Department of Innovation, Industry and Regional Development (2008) *University IT graduates for ICT occupations in Victoria 2008 to 2022* Multimedia Victoria, June 2008

Department of Innovation, Industry and Regional Development (2007) *ICT Skills Research: Attitudes to ICT Careers and Study among14-19 year old Victorians (Years 9-12)* Multimedia Victoria, April 2007

Department of Innovation, Industry and Regional Development (2009) *Victorian Government ICT Industry Plan 2005-2010: progress report* Multimedia Victoria, February 2009

Australian Computer Society (www.acs.org.au)

Multimedia Victoria (www.mmv.vic.gov.au)

Skills information snapshot (www.mmv.vic.gov.au/ICTskillssnapshot)

VicIT database (www.mmv.vic.gov.au/VicIT)

Finland

E Business Articles (2005) *Finland – An ICT-Driven Knowledge Economy* April, 2005

Global

World Economic Forum (2009) *The Global Information Technology Report 2008-2009* INSEAD 2009

Israel

Business Monitor International (2009) *The Israel Telecommunications Report* March, 2009

Ministry of Industry, Trade and Labour (2008) *Inspiration, Invention, Innovation: Communications in Israel* Invest in Israel

World Economic Forum (2006) Chapter 3 *Israel: Factors in the emergence of an ICT powerhouse* World Economic Forum

South Korea

Hangzhou, C (2005) *Technology Innovation and Economic Growth* May, 2005

Annex H: Existing policy recommendations in NI

Sector Skills Agreement

- Improving the attractiveness of ICT as a career
- Preparing the future workforce
- Improve industry / university dialogue to ensure the industry relevance of learning
- Developing adults and the existing workforce
- Addressing infrastructure matters
- Ensuring the IT qualifications structure and approach to recognising achievement in NI is fit for purpose and meets employers needs
- Underpinning policy and action with authoritative insight and market intelligence

Invest NI (OCO report)

- Increasing the number of graduates, particularly at Masters and PhD level
- Internationalisation of the workforce
- Strategic focus from government on specific technology areas
- Increased university / industry linkages

Note: Since this report was written, Invest NI has undertaken a number of actions, one of which is the creation of the Software Professional Course

Matrix ICT Horizon Panel

Short term

- Promotion of the ICT sector not only at university level but also at the pre-university secondary level
- Re-evaluation of course content at university. Ensuring that course content is up-to-date with industry trends and changes.
- Development and enhancement of Further Education courses. Ensuring that industry relevant material is delivered as well as higher end skills development to supplement any potential shortfall in graduates from university degree courses.
- Conversion course to address short to medium-term needs
- Improve graduate quality by ensuring high calibre students study ICT. This can be achieved through promotion as well as by tightening entry requirements for ICT courses.
- Improve the sector image
- Effective inward migration. Attracting overseas graduates from countries such as Poland, Romania and India to meet the immediate needs of the sector.

Medium term

- Quantity and quality needs to be verified and addressed

Long term

- Specific ICT skills strategy that spans from basic to specialist skills