

Guidance for higher education providers on current and future skills needs of enterprise

1. Current & Future Skills Needs - Executive Summary

The following is a summary of skills gaps/shortages identified in reports of the Expert Group on Future Skills Needs. *Even though some reports date back as far as 2007, the skills gaps identified still hold true.*

Future Requirement for High Level ICT Skills in the ICT Sector (June 2008)

Honours Bachelor Degree Level 8

- Core Computing
- Business Information Systems
- Multimedia/Gaming
- Electronic Engineering
- Computer Engineering
- Communications Engineering

To supply graduates to the following IT sectors: Software; Electronics hardware; Web-based Employment; Electronics/IC Design; Electronics hardware and Semiconductor Research Centres. Also opportunities within adjacent sectors that have high skills requirements for ICT personnel, particularly Business, Finance and Insurance.

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2008/title,2513,en.php>

Cloud Computing

With the cloud computing space taking shape, enterprises are finding it more difficult to find professionals with substantial relevant experience. A main demand is for system / software engineers with a firm understanding of the core technologies who can focus on how cloud computing technology can address client business needs. Requirements specified in advertised job vacancies include:

- Bachelors Degree in Computer Science /IT related discipline
- Excellent programming skills in Java or C++
- Web 2.0 technology skills - Window server 2008
- Experience scripting in Linux/Unix environments
- Generic competences including the need for business partnership and negotiation skills, technical writing, process design skills and strong integrative thinking.

For many positions, a numbers of years experience is specified a requirement.

See section 3.1 for further detail on Cloud Computing

Future Skills Needs of Enterprise within the Green Economy in Ireland (November 2010)

Current and emerging skills gaps in the following sub-sectors (n.b. see section 3.2 for full list and relevant NFQ levels).

- Renewable energy - e.g. power, hydraulic, marine engineers; IT systems; project managers; physicists
- Energy efficiency use and management - e.g. energy engineers; international sales; energy auditors; home energy consultants
- Water and Waste Water Treatment - e.g. process engineers; telemetry skills; hydrologists; laboratory technicians; polythene welders
- Waste Management and Recovery - e.g. anaerobic digester operatives; logistics managers and planners; mechanical engineers, waste recycler educators
- Environmental Consultancy - e.g. energy, environmental, electrical engineers; hydrology; product design;
- Green ICT Skills - e.g. business analysts; principal researchers; mathematicians; statisticians
- Cross disciplinary - e.g. organisation skills; personal skills; technical skills; core professional skills (business; engineering; sustainable building and design).

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,7063,en.php>

Future Skills Requirements of the Bio-Pharma -Pharmachem Sector (November 2010)

- **Chemistry** - analytical chemistry; organic chemistry; crystallisation; formulation; generic/soft skills (e.g. problem solving; IT systems; informatics).
- **Biological sciences** - formulation; stem cell research; vaccine development
- **Pharmacology** - drug/body interaction
- **Bio-analytics and Bio-informatics** - standardise modules within undergraduate programmes
- **Cross-disciplinary** - compliance and regulatory affairs; continuous manufacturing; green technologies including lean manufacturing; business and management skills.

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,6968,en.php>

Future Skills Requirements of the Food and Beverages Sector (November 2009)

Skills gaps identified in:

- **Internationalisation** - sales; account mgt; regulation; brand mgt.
- **Innovation** - product and services innovation
- **Lean Manufacturing** (inc. Six Sigma)
- **Supply Chain Management**, esp. need to include supply chain management on graduate programmes.

- **Commercial Acumen** - include financial / commercial modules on graduate programmes; Develop commercial skills for the non-finance functions

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2009/title,5016,en.php>

Future Skills and Research Needs of the International Financial Services Industry (December 2007)

Level 8

- Maths/Economics/Quantitative Modelling
- Accountancy with funds experience
- Risk Management
- Quantitative Financial Analysis
- Credit Analysis
- Hybrid technologists - business analysis with IT/systems skills

Level 6/7

- Business Development with detailed product knowledge/industry qualifications
- Middle management with financial services experience

Link to report: <http://www.egfsn.ie/publications/2007/title,2515,en.php>

Future Skills Needs of the Irish Medical Devices Sector (February 2008)

Engineers and Scientists (Level 8)

- Electronic Engineers
- Mechanical Engineering/Biomedical Engineering with strong practical engineering design skills
- Mechanical/Mechatronic and Production/Industrial/Manufacturing Engineers

Technicians and Trades (Level 6/7)

- General Level 6 or 7 Engineering or Science Courses
- Diagnostics - Level 6 or 7 Laboratory-based Courses
- Level 6 Biomedical Technician Courses

Medical Device Industry Skills (Management and Professionals)

- Regulatory Affairs Professionals
- Clinical Trials Management Professionals

Link to report: <http://www.egfsn.ie/publications/2008/title,2514,en.php>

Future Skills Needs of the Wholesale and Retail Sector (May 2010)

Need to ensure adequate provision in higher education in modules (see Section 3.7 for complete list and relevant NFQ levels):

- **Business Leadership** - e.g. strategy; finance; brand management; small business management
- **Professional Disciplines** - e.g. category management; purchasing; Customer Relationship Management; supply chain technology; data mining; online marketing
- **Retail Operations** - e.g. customer service; marketing; stock control; selling
- **Cross disciplinary** - e.g. product expertise; lean improvement; application of retail and distribution technology
- **Distribution centre and logistics** - e.g. back office and security operations
- **Personal skills** - e.g. technology; relationships; communication; personal effectiveness

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,6230,en.php>

Cross sectoral Enterprise/Generic Skills Needs

The following of skills gaps have emerged in EGFSN sectoral reports that are apparent across sectors. *The main objective is not to address these skills gaps individually but to embed them within programmes so that they can be practically applied and developed.* See Section 4 for further details):

- Mathematical proficiency
- Foreign language capabilities and understanding foreign markets
- Business acumen, management capabilities and entrepreneurship in addition to core expertise
- Skills for creativity, innovation and design
- Improving generic skills such as communication, project management and team working.

Current Occupational Skills Shortages

Current skills shortages (or 'difficult to fill' vacancies) identified in the 2010 EGFSN National Skills Bulletin are for a small number of highly skilled/experienced people in the following occupational fields:

- ICT - programmers, network and security experts
- Science professionals - research and development, clinical trials, regulation / compliance officers, laboratory technicians
- Engineering - particularly design, process, quality control, electrical and environmental engineers
- Sales - Marketing Managers; Technical and foreign language sales representatives
- Transport - Supply chain specialists; foreign management proficiency
- Financial services - claims handlers actuaries, risk management, quantitative specialists

These shortages complement the findings of the EGFSN sectoral reports as summarised above.

Link to report:

<http://www.skillsireland.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,6444,en.php>

2. Introduction

The following information is a synthesis of recent Expert Group on Future Skills Needs reports. It covers specific skills gaps (current and future) as reported by enterprises. The information covers:

- **Sectoral Skills Needs** - skills shortages identified in particular sectors (typically forecast over a 5-6 year period), based on various sectoral reports of the EGFSN (Section 3).
- **Enterprise/Generic Skills Needs** - skills deficits that are common across enterprises regardless of sectors (Section 4).
- **Current Occupational Skills Shortages** - the most recent information on vacancies reported by employers as 'difficult to fill' (Section 5).

Forfás believes that the optimal labour market outcomes for participants under the Labour Market Activation Fund will be delivered by:

- Ensuring programmes are **relevant to enterprise skills needs** as identified by the EGFSN or in conjunction with employers on a sectoral or regional basis.
- Ensuring there is **appropriate screening of candidates**, for example, that candidates are of sufficient calibre to cope with the demands of the course or that candidates with significant previous experience in the sector could proceed by advanced entry to programmes (recognition of prior learning) and will gain through enhanced specialism on top of their existing qualifications and experience.
- Given that many current skills shortages arise not only because of lack of suitably qualified graduates but also *suitably experienced* graduates, programmes should seek to offer a **structured work placement** focussed on enhancing the employability of the graduate (particularly with regard to enterprise/generic skills (see section 4 for further detail).

3.1 Future Requirement for High Level ICT Skills in the ICT Industry (June 2008)

- The ICT Sector is of strategic importance to Ireland in terms of sales, exports, jobs, inward investment etc. The aim of the report was to determine the future requirement for high-level ICT skills in the ICT sector in Ireland in terms of ensuring, a sufficient quantity; quality; and diversity of high-level ICT skills.
- A greater share of ICT sector employment is now accounted for by people with high-level skills- caused by a shift away from electronics hardware where many of the lower skilled jobs in the sector were located towards software which predominately employs people with high-level skills.
- High-Level ICT skills now account for approx 40% of total employment in the sector. These skills fall into the following main categories - Computing Engineering; Electronic Engineering; and Physical Scientists. The demand is overwhelmingly for graduates with an Honours Bachelor Degree or Masters.
- The domestic supply of Honours Bachelor Degree graduates in computing and electronic engineering had fallen steeply up to 2007 from a peak around 2002. The decrease in interest has been steeper for females than among males.). However over the two year period 2007-2009 , acceptances for ICT Computing Level 8 courses increased by 24% and for ICT Computing 6/7 courses by 45% . There was also an a 10% increase in Level 8 Electronic Engineering acceptances and 24% for Electronic Engineering 6 & 7 courses acceptances over this period.
- Under the two competitive demand scenarios modelled in the report a significant gap was apparent between the demand and the supply of computing and electronic engineering graduates when account is taken both of ICT sector demand and demand from other sectors of the economy .
- Inward migration (which then met a substantial part of total demand), was anticipated to continue to be an important source of supply into the future to help bridge the above projected high-level ICT skill gap. However, the priority for policy action should be on increasing the domestic supply of high-level skills as the most sustainable way forward.

Link to report:

<http://www.skillsireland.ie/publication/egfsnSearch.jsp?ft=/publications/2008/title,2513,en.php>

Cloud Computing

Cloud Computing Trends

Cloud Computing Services exist along a spectrum from open public to closed private. The next three years is expected to see the delivery of a range of cloud service approaches. Vendors will offer packaged private cloud implementations that deliver the vendor's public cloud service

technologies (software and/or hardware) and implement best practices to build and run the service, in a form that can be implemented inside the client enterprise. Many will offer management services to remotely manage the cloud service implementation. Large enterprises are expected to have a sourcing team in place that is responsible for ongoing cloud sourcing decisions and management.

To set the emergence of cloud computing services and skills into a broader context:

- Appendix 1 provides an outline of the top 10 technical skills in demand in 2010; and
- Appendix 2 provides an outline of the top 10 trends in technologies for 2011.

Skills Requirements within Enterprises

The major cloud service providers include Amazon, Microsoft, Google and Yahoo. Several of the larger IT companies are engaged in the provision of cloud computing including Hewlett Packard, IBM, Cisco, Fujitsu and Dell.

With the cloud computing space taking shape, enterprises are finding it more difficult to find professionals with substantial relevant experience. Instead companies are drawing expertise from a range of IT skill sets, including storage, network and desktop¹. A main requirement is an understanding of the core technologies involved.

In organisations that move towards utilising, private, public and hybrid cloud services, there is likely to be a split of the IT workforce between those involved in the building and operating the internal private cloud and those who manage their organisations use of cloud services.

- Those who build and operate private cloud services will be required to both design and implement an integrated approach to meet internal needs. There will be an increase in network architecture, development and management requirements as connectivity to the cloud increases in importance. Persons require process design skills and strong integrative thinking.
- Those which manage cloud services will require a new set of abilities. Their skills matrix will include understanding how to define how a business requirement can be addressed with cloud computing service technology. Skills involved include workload analysis and management, procurement and vendor management, analysing how software applications can meet the needs of business, minimising, and control of identified risks, IT Governance, and compliance with regulatory and auditor standards.

Skill Requirements within Cloud Computing Providers

With the cloud computing space taking shape, enterprises are finding it more difficult to find professionals with substantial relevant experience. A main demand is for system / software engineers with a firm understanding of the core technologies who can focus on how cloud computing technology can address client business needs. Requirements specified in advertised job vacancies include:

- Bachelors Degree in Computer Science /IT related discipline
- Excellent programming skills in Java or C++
- Web 2.0 technology skills - Window server 2008

¹ Source Network World Article

- Experience scripting in Linux/Unix environments
- Generic competences including the need for business partnership and negotiation skills, technical writing, process design skills and strong integrative thinking.

For many positions, a number of years experience is specified as a requirement.

Upskilling Topics

Skills requirements on the cloud computing affect in-house and cloud computer providers in different ways. The following topics could be tailored to specific needs. Topics are:

a) Cloud Computing Fundamentals

- Knowledge of the key drivers of the adoption of cloud computing including lower computational costs and higher performance. Understanding of characteristics of cloud computing in terms of its basic architecture and structure and the way it works. Differences between private, public and hybrid cloud services. Emerging cloud computing trends and innovations.

b) Benefits, Challenges and Risks of Cloud Computing Services

- How the application of cloud computing services can benefit an organisation including that the device and location independence mean that users can connect via the internet. The economics of various cloud computing service options - enhancing business value and rate of return. Potential cost savings arising from avoiding capital expenditure and use of shared infrastructure. Challenges and potential risks arising from use of cloud services.

c) Understanding of Cloud Computing Applications

- Understanding of the principles, architectural building blocks and techniques for the design, implementation and use of cloud technologies - and the challenges involved. Knowledge of software distribution model based on virtualisation, client-server architectures and high-bandwidth communications.

d) Cloud Computing Infrastructures

- Application of technologies which interact to provide successful cloud computing platforms including developments in computer architecture, networking and operating and system technologies. Choosing the right solution for the enterprise based on application requirements. Ensuring scalability of services to optimise user experience.

e) Commercial Offerings

- Meeting the quality of service requirements of customers including service level agreements. The economics of various cloud options- enhancing business value and rate of return. Methods of payment for utilised computer services. Risk Assessment and Management including contractual effects within licensing agreements

f) Network Security

- Knowledge of the critical security features and issues of new models of storage and delivery, from both a technical and commercial perspective. Availability of different tools and technologies available to assure performance and security.

3.2 Future Skills Needs within the Green Economy in Ireland (November 2010)

The main focus within initial education and training provision for this sector should be on the development of core business, engineering and ICT skills capability. Additional expertise in emerging areas such as wind, marine, solar, biomass, geothermal etc could best be acquired through the integrated provision of ‘add-on’ specialism modules within third and fourth year of undergraduate courses or through Master Degree/postgraduate diploma provision. Training programmes aimed at unemployed graduates should take account of the qualifications / competences individuals already possess and then provide upskilling in the specialism area required to obtain employment. Current skills gaps and emerging skills needs of relevance for the call are:

1. Renewable Energies

Current Skill Gaps by Work area

Occupation	Work Area
<ul style="list-style-type: none"> Power Engineers (Level 8) 	<ul style="list-style-type: none"> HV Power System Design; Grid connection; Wind Power Generation.
<ul style="list-style-type: none"> Electro Mechanical Technicians (Level 7) 	<ul style="list-style-type: none"> Operation and maintenance of renewable installations.
<ul style="list-style-type: none"> Marine Engineers (Level 8) 	<ul style="list-style-type: none"> Cable laying, lifting and installing, use of equipment like sub-ploughs and knowledge of marine legislation.
<ul style="list-style-type: none"> Hydraulic Engineers (Level 8) 	<ul style="list-style-type: none"> Concerned with the flow and conveyance of fluids
<ul style="list-style-type: none"> IT Systems Developer (Level 8) 	<ul style="list-style-type: none"> Smart Metering, Smart Networking
<ul style="list-style-type: none"> Project Managers (Level 8) 	<ul style="list-style-type: none"> Wind Energy.
<ul style="list-style-type: none"> Mechanical Engineers (Level 8) 	<ul style="list-style-type: none"> Biomass/ Thermal Energy.
<ul style="list-style-type: none"> Mechanical Engineering Technicians (Level 7) 	<ul style="list-style-type: none"> Operation and maintenance of biomass installations
<ul style="list-style-type: none"> Physicists (Level 8) 	<ul style="list-style-type: none"> Analysis of wind movement.
<ul style="list-style-type: none"> Systems Engineers (Level 8) 	<ul style="list-style-type: none"> Integrating systems comprising a range of technologies (mechanical, electrical, hydraulic, marine, instrumentation).
<ul style="list-style-type: none"> Nano Systems Engineers (Level 8/9) 	<ul style="list-style-type: none"> Design, develop, the production of materials, devices, and systems of unique molecular composition.

Emerging Skills

Occupation	Work Area
<ul style="list-style-type: none"> Wind Turbine Service Technicians (Level 7) 	<ul style="list-style-type: none"> Operation and maintenance of installed wind capacity
<ul style="list-style-type: none"> Electro Mechanical Engineering Technicians (Level 7) 	<ul style="list-style-type: none"> Operation and maintenance of renewable technologies systems including biomass
<ul style="list-style-type: none"> Smart Grid Technicians (Level 7) electrical technicians with enhanced ICT skills 	<ul style="list-style-type: none"> Providing consumers with access to more accurate data and knowledge about electricity pricing.

<ul style="list-style-type: none"> Technicians and Skilled Workers (Levels 6/7) 	<ul style="list-style-type: none"> Installation and maintenance of charging points for electric cars
--	---

2. Energy Efficiency Use & Management

Current Skill Gaps by Work area

Occupation	Work Area
<ul style="list-style-type: none"> Energy Engineers (Level 8) 	<ul style="list-style-type: none"> Design of energy efficiency installations. Identifying energy usage and efficiency improvements. Advising customers on ways to save energy.
<ul style="list-style-type: none"> International Sales (Level 7-8) 	<ul style="list-style-type: none"> Technical selling into international markets - with language skills.
<ul style="list-style-type: none"> Architects (Level 8) 	<ul style="list-style-type: none"> Understanding of sustainability - energy efficient design and retrofitting of buildings. Understanding of overseas construction techniques & regulations -UK method of building assessment (BREEAM) and the USA method (LEED)

New and Emerging Skills

Occupation	Work Area
<ul style="list-style-type: none"> Energy Auditors (Level 7) 	<ul style="list-style-type: none"> Assessing the scope for energy savings and the implementation of energy efficiency initiatives in the industrial and commercial sectors.
<ul style="list-style-type: none"> Home Energy Consultants (Level 6) 	<ul style="list-style-type: none"> Assessment of energy efficiency in dwellings and liaison with householder to specify and implement measures to improve efficiency.
<ul style="list-style-type: none"> Small Scale Installers & Technicians (Level 6) 	<ul style="list-style-type: none"> Installing and servicing small scale renewable technologies.

3. Water and Waste Water Treatment

Current Skill Gaps by Work area

Occupation	Work Area
<ul style="list-style-type: none"> Process Engineers (Level 8) 	<ul style="list-style-type: none"> For the design and construction of wastewater, water and sludge treatment plants - mechanical, electrical and instrumentation skills.
<ul style="list-style-type: none"> Telemetry Skills (Level 7/8) 	<ul style="list-style-type: none"> Maintains telemetry lines and related systems as well as applicable instrumentation used by water and sewerage departments.
<ul style="list-style-type: none"> Installers of Meters (Levels 6/7) 	<ul style="list-style-type: none"> Install, repair, and maintain regulating and controlling devices, such as electric meters, gas regulators, thermostats, safety and flow valves.
<ul style="list-style-type: none"> Hydrologists (Level 8) 	<ul style="list-style-type: none"> Research the distribution, circulation, and physical properties of underground and surface waters.
<ul style="list-style-type: none"> Geographic Information Systems (GIS) (Level 8) 	<ul style="list-style-type: none"> Presenting geological and hydrological data in three dimensions and transforming this into hard data to be imported into a computer model.
<ul style="list-style-type: none"> Laboratory Technicians (Level 7) 	<ul style="list-style-type: none"> For the testing of water and waste water.
<ul style="list-style-type: none"> Electrical and mechanical Technicians (Level 7) 	<ul style="list-style-type: none"> For the servicing and maintenance of treatment plants.
<ul style="list-style-type: none"> Specifiers for water metering solutions (Level 8) 	<ul style="list-style-type: none"> Persons (staff and consultants for local authorities) with responsibility to specify contracts for metering and related services.

New and emerging skills

Occupation	Work Area
<ul style="list-style-type: none"> Asset Manager of Water Meter Systems (Level 8) 	<ul style="list-style-type: none"> Following on from installation of domestic and commercial water meters, there will be a requirement to manage water assets.
<ul style="list-style-type: none"> SCADA Engineer (Level 8) 	<ul style="list-style-type: none"> Evaluate, design, maintain and support highly technical and complex aspects of Process Control Network/SCADA communications and security as well as existing and proposed data and voice telecommunication systems.
<ul style="list-style-type: none"> Plumbers (Level 6) 	<ul style="list-style-type: none"> Rainwater harvesting - diverting rainwater off roof to be used for toilet flushing, gardening and car cleaning.

4. Waste Management & Recovery

New and Emerging Skills

Occupation	Work Area
<ul style="list-style-type: none"> Anaerobic Digester Operatives (Electro Mechanical Technicians) (Level 6) 	<ul style="list-style-type: none"> Operation and maintenance of larger commercial anaerobic plants.
<ul style="list-style-type: none"> Anaerobic Digester Expert (Level 8) 	<ul style="list-style-type: none"> Support commercial anaerobic digester farms as well as smaller (50 kw) farm based plants.
<ul style="list-style-type: none"> Logistics Managers & Planners (Level 8) 	<ul style="list-style-type: none"> Including GPS route planning and logistics management to planning the safest, most cost efficient collection and delivery of waste.
<ul style="list-style-type: none"> GPS route planners and logistics management (Level 7) 	<ul style="list-style-type: none"> For the efficient and safe collection, transfer and delivery of waste by road.
<ul style="list-style-type: none"> Mechanical Electrical Engineer (Level 8) 	<ul style="list-style-type: none"> Managing all aspects of commercial biomass plants.

5. Environmental Consultancy

Current Skill Gaps by Work area

Occupation	Work Area
<ul style="list-style-type: none"> Energy Engineers (Level 8) 	<ul style="list-style-type: none"> UK method of building energy assessment (BREEAM) USA method of building assessment (LEED)
<ul style="list-style-type: none"> Environmental Engineers (Level 8) 	<ul style="list-style-type: none"> Prevention, control, and remediation of environmental health hazards utilizing various engineering disciplines
<ul style="list-style-type: none"> Electrical Engineers (Level 8) 	<ul style="list-style-type: none"> Consultancy in renewable energy (wind, tide and biogas)
<ul style="list-style-type: none"> Modelling Design & Planning (Level 8) 	<ul style="list-style-type: none"> Relating to drainage and river basins, the grid and traffic management
<ul style="list-style-type: none"> Hydrology (Level 8) 	<ul style="list-style-type: none"> Research the distribution, circulation, and physical properties of underground and surface waters.
<ul style="list-style-type: none"> Product Design (Level 7/8) 	<ul style="list-style-type: none"> Recycling and Recovery.

6. 'Green ICT' Skills

Current Skill Gaps by Work area

Occupation	Work Area
<ul style="list-style-type: none"> Business Analysts (Levels 8 & 9) 	<ul style="list-style-type: none"> Experienced in the solar, wind power, environmental business, smart

	buildings to work with software engineers
<ul style="list-style-type: none"> Specialists in Water Management, Energy Management, Smart Grids, Transport (Levels 8 & 9) 	<ul style="list-style-type: none"> Specialists (Professional Engineers & Scientist) with cross over skills in Professional Business
<ul style="list-style-type: none"> Product Manager- Mechanical Engineer with IT (Level 9) 	<ul style="list-style-type: none"> Product development and supporting infrastructure, hosting and managing for clients
<ul style="list-style-type: none"> Mathematicians (Levels 8 & 9) 	<ul style="list-style-type: none"> Solutions to problems in various fields by mathematical methods
<ul style="list-style-type: none"> Statistician (Level 9) 	<ul style="list-style-type: none"> Masters level to work as an analyst.
<ul style="list-style-type: none"> High-End IT Disciplines 	<ul style="list-style-type: none"> Storage management products

7. Key Skills Set Requirements across Sector

Summary of cross-sector skills requirements

<ul style="list-style-type: none"> Organisation Skills 	<ul style="list-style-type: none"> Initiative/Adaptability; Project Management; Planning & Coordination; Decision Making; Applying theory in practice; Team working
<ul style="list-style-type: none"> Personal Skills 	<ul style="list-style-type: none"> Entrepreneurship; Leadership; Critical thinking; Communications and Influencing; Foreign Languages; Team working; Creativity and Innovation
<ul style="list-style-type: none"> Technical Skills 	<ul style="list-style-type: none"> Sales and Marketing; Commercial Awareness; ICT proficiency; Maths proficiency; Systems Knowledge; Finance; Health and Safety
<ul style="list-style-type: none"> Core Professional Skills 	<ul style="list-style-type: none"> Business Skills - Finance/Business Development, Sales and Marketing High Level Engineering and ICT Skills - with 'add-on' specialism/expertise Sustainable Building - Eco-design and use of new materials and technologies

Occupational Groups - Summary of Emerging Skill Requirements

<ul style="list-style-type: none"> Managers - Leadership, corporate governance, access to finance / business planning , marketing skills particularly for export markets, entrepreneurial skills, Intellectual Property Engineers & Scientists: core mechanical/electrical skills; commercial awareness & product knowledge; multi-skilling re knowledge of converging technologies; language skills (for exporting); software development; 'green chemists'. Professionals - project management; finance, environmental & regulatory skills; Geographic Information Skills; Sustainable buildings materials & standards; Carbon Monitoring & Accounting - understanding of carbon market. Technicians - mechanical-electrical skills for the operation & maintenance of renewable energy generators (ocean and wind), high voltage IT skills, servicing and maintenance. Supervisors - IT Skills in new software and management of teams working in dispersed locations. Marketing & Sales -technical sales, language skills, knowledge of green public procurement opportunities; legal skills re procurement/contracts. Skilled Trades - multi-skilling re installation, operation & maintenance; integration of systems i.e. energy upgrading & retrofitting of buildings, electricians could be given specialist training in energy efficient lighting. Operatives - operation & maintenance skills; health and safety.
--

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,7063,en.php>

3.3 Future Skills Requirements of the Bio-Pharma / Pharmachem Sector (November 2010)

The EGFSN Bio-pharma/Pharmachem report highlights that the main focus within initial education and training provision for this sector should be on the core disciplines, however, additional expertise in could best be acquired through the integrated provision of ‘add-on’ specialism modules within undergraduate courses or through Master Degree/postgraduate diploma provision. The following table identifies the skills gap that need to be addressed in the sector.

Discipline	Skills Gaps
Chemistry	<p>Both undergraduate and postgraduate</p> <ul style="list-style-type: none"> ▪ Analytical Chemistry - including process analytical technologies (PAT), chemometrics, quality by design (QBD), and impurity identification. ▪ Organic Chemistry - high level skills required to underpin process development including synthesis, mechanism, understanding impurity formation and how this can be avoided, and polymer chemistry. ▪ Crystallisation - solid state properties of pharmaceuticals. ▪ Formulation - critical that chemistry and chemical engineering graduates are familiar with formulation in an industrial context linking active pharmaceutical ingredients (API) and finished dosage form (FDF), and physical properties of APIs. ▪ Problem solving competences, IT systems skills and informatics are becoming increasingly important and will also need to be embedded into HEI programmes. ▪ Undergraduate Chemistry programmes - Modules in physical characterisation and method development, formulation, innovation methodologies and polymer chemistry. Industrial formulation; industrial pharmacy programmes. ▪ Postgraduate Chemistry programmes - Structured industrial programmes at Masters/Phd Level; CPD programmes (e.g. organic chemistry)
Biological Sciences	<ul style="list-style-type: none"> ▪ Formulation, stem cell research and vaccine development are key areas and should be covered at some stage in the education process.
Pharmacology	<ul style="list-style-type: none"> ▪ Drug/body interaction; 1st and 2nd Year electives in biology for chemistry students and in chemistry for biology students
Bio-analytics and Bioinformatics skills gaps	<ul style="list-style-type: none"> ▪ Bio-analytics and Bioinformatics modules should be embedded in undergraduate programmes - especially in drug design, DNA sequencing.
Cross-Disciplinary	<p>Compliance and regulatory affairs</p> <ul style="list-style-type: none"> ▪ Postgraduate Compliance and Regulatory Affairs - postgraduate modules and CPD programmes. Technical compliance expertise combined with

	<p>leadership and influencing skills.</p> <p>Blended and converging skills</p> <ul style="list-style-type: none"> ▪ Deep core knowledge with soft skills embedded in undergraduate and postgraduate programmes, in particular, team-working and communications. ▪ Postgraduate level programmes in ‘Transition Skills’ for process development e.g. to enable engineers to become familiar with chemistry; or chemists to become more familiar with engineering. ▪ Continuous Manufacturing Modules (undergraduate engineering) ▪ Green Technologies - Include ‘Lean Manufacturing’ within green engineering programmes. Updated CPD programmes in green technologies. <p>Business skills</p> <ul style="list-style-type: none"> ▪ Business modules should be embedded in science, engineering and technology programmes focussed on Legal Tax and Finance Skills; Leadership and Entrepreneurship; Team working, Communications, Creativity; Problem Solving; Project Management; Lean Technologies and Six Sigma; Sales Marketing and Business Development; Intellectual Property Management; Information Technology.
--	--

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,6968,en.php>

3.4 Future Skills Requirements of the Food and Beverages Sector (November 2009)

Internationalisation

- Commercial sales/negotiation
- Key account management
- Economic and regulatory aspects of international trade and globally traded commodities
- Brand management

Innovation - Skills Gaps

- Portfolio management - ability to evaluate and prioritise multiple projects
- Awareness/understanding of regulatory environment
- Industrial design (products/packaging/process)
- Commercial/business case assessment
- Ability to identify deep consumer market insights
- Focus on incremental/existing product development at third level

Lean Manufacturing (Skills Gaps)

- Lean/World Class Manufacturing/Six Sigma with food sector experience
- Process diagnostics and control/super-skilled technicians/crafts

Supply Chain Management (Skills Gaps)

- Bespoke SCM in-service programmes encompassing financial and performance management
- Lack of awareness at undergraduate level

Financial and Commercial Acumen (Skills Gaps)

- Financial, Commercial and IT expertise to deliver insightful, financial information across the operations.
- Finance modules at third level with a food industry slant

Leadership (Skills Gaps)

- Leadership, Entrepreneurship and Communication skills

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2009/title,5016,en.php>

3.5 Future Skills and Research Needs of the International Financial Services Industry (December 2007)

Skill demand	Course topics/ contents	Course features (delivery, scale, etc)
<p>Graduate level</p> <p>Maths/Economics/ Quantitative Modelling</p>	<p>General Mathematics and Economics degree programmes with a focus on higher level quantitative skills. Modules might include:</p> <ul style="list-style-type: none"> • Econometrics; • Quantitative modelling in C++; • Product development; • Product modelling; • Asset pricing; and • Stochastic modelling. 	<ul style="list-style-type: none"> • Degree programme • Incorporating applied/case study elements from financial services • Work experience • Low volume (approx 20 per annum)
<p>Accountancy with funds experience</p> <p>Risk Management</p>	<p>Accounting courses with a focus on fund accounting (modular format)</p> <p>General Risk Management courses with modules covering</p> <ul style="list-style-type: none"> • Risk management in financial institutions; • International risk management; • Risk modelling; • Regulation; and • Compliance. <p>Reference course - BSc in Insurance and Risk Management offered by Penn State and BSc in Investment and Financial Risk Management offered by Cass.</p>	<ul style="list-style-type: none"> • Degree programme with professional exams • Incorporating applied/case study elements from funds servicing environments • Work experience • Medium volume (300+ per annum) • Degree programme • Specialised modules incorporated to existing degree programmes • Incorporating applied/case study elements from financial services • Work experience • Low volume (<50 per annum)
<p>Quantitative financial analysis</p>	<p>Quantitative finance/ Mathematics courses with modules in the following areas:</p> <ul style="list-style-type: none"> • Technical skills in quantitative financial analysis; • Quant asset management; • Financial engineering; • Quantitative strategic analysis; and • Quantitative strategy implementation. 	<ul style="list-style-type: none"> • Degree programme • Specialised modules incorporated to existing degree programmes • Incorporating applied/case study elements from financial services • Work experience • Low volume (approx 20 per annum)
<p>Credit analysis</p> <p>Hybrid technologists - business analysis with IT/systems skills</p>	<p>General Financial services degree programmes with modules in:</p> <ul style="list-style-type: none"> • Financial analysis technology; • Scenario modelling; • Credit analysis and rating interpretation; • Company research; and • Asset quality/ Forensic accounting. <p>IT Courses with a specific focus on financial services, including:</p> <ul style="list-style-type: none"> • Applying IT to financial services; • Financial products; • Financial modelling; • Product development; and • Business systems analysis. 	<ul style="list-style-type: none"> • Degree programme • Specialised modules incorporated to existing degree programmes • Incorporating applied/case study elements from financial services • Work experience • Low volume (approx 20 per annum) • Degree programme or 6 month/1 year graduate diploma programme/ conversion course to provide graduates from IT courses with basic financial services skills • Classroom based • Medium volume (approx 100 per annum)
<p>Business development with detailed product knowledge/ industry qualifications</p>	<p>Incorporation of financial services aspect into general Business/ Marketing courses: Topics might include:</p> <ul style="list-style-type: none"> • Introduction/ background to international financial services; • Products, services and markets; and • Financial products and markets. 	<ul style="list-style-type: none"> • Certificate course/module providing business and marketing graduates with an understanding of financial products and instruments • Medium volume (approx 80 per annum)

Skill demand	Course topics/ contents	Course features (delivery, scale, etc)
Middle-management with financial services experience	Incorporation of following skills into financial services related courses: <ul style="list-style-type: none"> • General business skills; • Marketing skills; • Business development skills; and • Effective communication skills. 	<ul style="list-style-type: none"> • Certificate course/ conversion course providing a basic understanding of financial products and instruments, the IFS sector and general management training • Medium volume (approx 80 per annum)

The full EGFSN report on International Financial Services skills requirements is available at:
<http://www.skillsireland.ie/publication/egfsnSearch.jsp?ft=/publications/2007/title,2515,en.php>

3.6 Future Skills Needs of the Irish Medical Devices Sector (February 2008)

Ireland is one of the leading global medical devices industry centres. Employment in the sector rose rapidly since the early 1990's. The sector is particularly focused on the manufacture of medical and surgical instruments and on surgical appliances and supplies. There is also a significant activity in the manufacture of ophthalmic goods and in diagnostic test kits.

Key Roles	Future Requirements
<ul style="list-style-type: none"> Assemblers 	<ul style="list-style-type: none"> Low skilled. Numbers likely to fall steeply with automation, or eventually migration overseas.
<ul style="list-style-type: none"> "Technicians" (sometimes "operators" at lower end) - wide range of types and levels of skill 	<ul style="list-style-type: none"> Numbers, and level of technical and team working skill required, to rise as automation increases
<ul style="list-style-type: none"> Biological Scientists and/or chemists in bioconvergence areas 	<ul style="list-style-type: none"> Numbers to increase from very low level, as bio-convergence progresses
<ul style="list-style-type: none"> Operations Managers & Supervisors 	<ul style="list-style-type: none"> To require more technical skill. Also people management skills required will change as work force moves to a higher level of skill and education.
<ul style="list-style-type: none"> QC Staff 	<ul style="list-style-type: none"> Becoming more technically demanding as automation progresses and quality management improves. Numbers may fall significantly in some operations as inspection becomes more automated.
<ul style="list-style-type: none"> Process Design Engineers 	<ul style="list-style-type: none"> Very small numbers in industry (or in consultancy operations) with sufficient skill. Critical area where significantly more are needed to drive effective automation.
<ul style="list-style-type: none"> Validation Engineers 	<ul style="list-style-type: none"> To increasingly require engineering graduates rather than scientists. To become more intellectually challenging as automation makes processes more complex.
<ul style="list-style-type: none"> Production Engineers & QA staff 	<ul style="list-style-type: none"> To become more intellectually challenging as automation makes processes more complex.
<ul style="list-style-type: none"> Engineers (mechanical, biomedical, electronic, and a few materials engineers) 	<ul style="list-style-type: none"> Need more experienced development engineers. Need more new graduates who are strong in practical engineering design.
<ul style="list-style-type: none"> Clinicians (mainly external) 	<ul style="list-style-type: none"> Need much greater engagement in innovation and commercialisation by Irish clinicians.
<ul style="list-style-type: none"> Development Technicians (especially prototyping) 	<ul style="list-style-type: none"> Increasing need as development increases, but total numbers will still be quite small. Likely to come from a variety of educational backgrounds - craft as well as

	higher education.
<ul style="list-style-type: none"> ▪ Clinical Trial Managers 	<ul style="list-style-type: none"> ▪ More innovation will require more people strong in design and management of clinical trials. Often come out of nursing in the US.
<ul style="list-style-type: none"> ▪ Regulatory Affairs 	<ul style="list-style-type: none"> ▪ Need more now and in future
<ul style="list-style-type: none"> ▪ Healthcare Economists 	<ul style="list-style-type: none"> ▪ Need to develop locally. In interim, may need contacts with US specialists for part of work.
<ul style="list-style-type: none"> ▪ Specialist Legal, VC, ... 	<ul style="list-style-type: none"> ▪ Need to develop locally. In interim, need contacts with US specialists for part of work.
<ul style="list-style-type: none"> ▪ Sales Management & Sales 	<ul style="list-style-type: none"> ▪ Need to develop sales management skills. May need in-country experienced recruits rather than Irish sales people for start-ups.

The full EGFSN Medical Devices Report is available at:

<http://www.skillsireland.ie/publication/egfsnSearch.jsp?ft=/publications/2008/title,2514,en.php>

3.7 Future Skills Requirements of the Wholesale and Retail Sector (May 2010)

Skills shortages unlikely out to 2016, however, Higher Education Institutes need to ensure there is adequate provision in modules such as:

- Category management
- Supply chain modelling
- Professional sourcing, purchasing and negotiation
- Geographic Information Systems (GIS) and Location Analysts
- Price sensitivity analysts
- Systems analysts with specialist knowledge of retail
- Customer loyalty/Relationship Management
- Retail, distribution centre and supply chain management
- Property management
- Business to Business Selling and Account Management
- Data mining
- Online Marketing
- Product Expertise
- People Development
- Lean/Quality improvement
- Communication
- Sales, Marketing, Brand Management
- SME Management
- Finance
- Leadership
- Business Strategy
- Security

See relevant NFQ levels by skill/qualification area in Draft Retail Skills Framework below.

Given current high unemployment, HEI's should employ a highly targeted approach to offering modules for unemployed people in wholesale/retail. Candidates should be specifically targeted (significant previous retail experience, particularly supervisory with modules to build on their expertise) and programmes in conjunction with employers should be prioritised.

Link to report:

<http://www.egfsn.ie/publication/egfsnSearch.jsp?ft=/publications/2010/title,6230,en.php>

Retail Skills Framework

	Level in National Framework of Qualifications	Level 6	Level 7	Level 8	Level 9	Level 10
		Management/ Supervision	Store Management	Management & Retail Professional	Corporate Leadership	Corporate Leadership
Business Leadership	Business Strategy					
	Leadership					
	Finance					
	Brand Management					
	Enterprise and Small Business Management					
Professional Disciplines	Category Management					
	Supply Chain Management					
	Customer Loyalty / Relationship Management Systems					
	Sourcing & Purchasing					
	Retail, Distribution Centre and Supply Chain Technology					
	Property Management					
	Business-to-Business Selling and Account Management					
	Data Mining					
	Online Marketing					
Retail Operations	Customer Service					
	Payment / Point of Sale					
	Merchandising					
	Selling					
	Marketing					
	Security					
	Brand Consistency					
	Retail Stock Control					
	Retail Back Office					
Cross-Cutting Competencies	Product Expertise					
	People Development					
	Lean / Quality / Improvement					
	Application of Retail and Distribution Centre Technology					
Distribution Centre and Logistics Operations	Warehouse Picking					
	Packing					
	Driving and Delivery					
	Distribution Centre Back Office					
	Security					
Personal Skills	Technology User Skills					
	Personal Effectiveness					
	Communication					
	Relationships					

4. Enterprise/Generic Skills Needs

A number of skills gaps have emerged in EGFSN sectoral reports that are apparent across sectors, including: the need to improve mathematical proficiency and foreign language capabilities; to develop business acumen and entrepreneurship in tandem with technical skills (for example within software engineering); to develop skills for creativity, innovation and design and; improving generic skills such as communication, project management and team working. The main objective is not to address these skills gaps individually but to embed them within existing programmes so that they can be practically applied and developed.

4.1 Mathematics

The need to improve mathematical proficiency (from basic and high end skills) has emerged as a common feature in a number of sectoral EGFSN reports, including High Level ICT Skills, the Bio-pharma/Pharmachem report; International Financial Services; future skills needs within the Green Economy and Future Skills Needs of the Wholesale and Retail Sector.

The current level of mathematical achievement is of serious concern to employers. Mathematical concepts, models and techniques are central to working in all sectors of employment and are equally important to service jobs as to manufacturing jobs. The proficiency level of students in mathematics is a key factor influencing the domestic supply of graduates for sectors with growth potential such as the ICT content industry, Life Sciences, Green Economy and Business, Financial and Professional Services. Boosting the level of our mathematical capability would help ensure opportunities for employment growth could be fully realised.

Mathematical proficiency is not limited only to high-skilled jobs. Workers in low and medium skilled level jobs also require at least basic mathematical proficiency - for example, the ability of retail workers to function effectively when engaged in tasks involving numbers e.g. sales transactions, stocktaking, product layout, etc. Mathematical and numeracy skills are essential for people living and working in a knowledge society and for accessing good quality employment opportunities. It imparts analytical and problem-solving skills which along with team-working, communication skills and creative thinking are core skills increasingly required across all jobs. Mathematical competence is an essential life skill required by all school leavers and adults for participating in a modern society.

4.2 Foreign Language Skills

The recent Government report "*Trading and Investing in a Smart Economy*" stressed the importance of greater understanding of international markets. In this context the ability of Irish-based enterprises to communicate effectively with other nationalities and cultures can enhance their success. International business relationships will be crucial to indigenous enterprise in the future. Success in marketing and selling Irish goods and services will be contingent on the ability of the indigenous sector to establish and maintain close relationships with customers in global markets. In addition, partnerships and collaborations with foreign enterprises will be key drivers of innovation and growth.

Cultural awareness is a prerequisite for forging successful cross-cultural relationships. Language capability and cultural awareness are inextricably linked: the former greatly facilitates the acquisition of the latter. Irish firms with in-house language expertise will be at a considerable advantage in forging such relationships. Firms without such expertise will find it more difficult to move “closer to their customers”, as advocated by the Enterprise Strategy Group. In addition, the availability of an internal supply of foreign language skills will enhance the attractiveness of Ireland as a location for foreign multi-nationals wishing to engage in international service activities.

Language skills are complementary to other skills such as business, science, engineering and technology and are not in competition with them, nor are these skills mutually exclusive. A renewed focus on language skills across disciplines throughout the higher education system will serve to enhance the value of these other skills to students. Owing mainly to historical factors, throughout the education system the provision of languages education is concentrated in a limited number of foreign languages. It should be considered how current provision of foreign languages and cultures education relates to enterprise needs and how they could be enhanced in order that enterprises can maximise opportunities in foreign-language markets, particularly emerging economies such as Brazil, Russia, India and China^{2, 3}. Foreign language shortages are repeatedly reported in the annual National Skills Bulletin, particularly within the ICT sector.

4.3 Skills for Creativity, Design and Innovation

The 2009 EGFSN report Skills for Creativity, Innovation and Design highlighted that these skills are needed in all industries and in all occupations. While there is some variation between occupations and across industries, some universal points emerge.

- Depth of skill and knowledge is important to creativity and innovation.
- Creativity relies heavily on finding new ways to combine existing ideas. In skills terms, this means that the capability to work well with people whose deep skills lie in other areas is critical.
- All other capabilities have to be underpinned by strong generic skills in areas including communication skills, team-working and problem solving.
- Creativity and innovation are influenced heavily by the culture of the organisation, and how innovation is managed and led.

The need to improve skills for Creativity, Innovation and Design has emerged as an issue across a number of EGFSN sectoral reports, particularly within the Bio-pharma/Pharmachem sector, the Green Economy and the Food and Beverages Report.

² The Expert Group on Future Skills Needs report on foreign languages made some specific recommendations in this regard. See full report at the following link: <http://www.skillsireland.ie/publication/egfsnSearch.jsp?ft=/publications/2005/title,2576,en.php>

³ EGFSN (2005) The Supply and Demand of Foreign Language Skills in the Enterprise Sector.

4.4 Management Skills (particularly within SMEs)

In 2006, the EGFSN report *SME Management Development in Ireland* highlighted deficits across a range of management capabilities including general management such as HR, marketing and finance skills, strategic management skills such as inability to plan ahead, product management skills, and functional management skills (sales, training, marketing, supply chain management, IT and R&D). In response to this report and subsequent endorsement by the Small Business Forum report, the Management Development Council (MDC) was established. The MDC has found that most participation in management development education/training is in short compliance type courses, and that more emphasis needs to be placed on transformational change and leadership. These have been reiterated in a number of EGFSN sectoral reports, for example, within the Wholesale and Retail Sector, the Food and Beverage Sector and within the Green Economy. Management development training should facilitate managers to assist companies survive the current recession, improve productivity, and develop new strategies.

4.5 Other Generic/'Soft' Skills

It would appear that virtually all sectors of industry are becoming more knowledge-intensive, in the very broad sense of the term. This involves a change in the types of skills required, with a rise in the importance of generic skills, including the ability of individuals to work more autonomously; be self-managing, work as part of flexible teams, adapt to change, solve complex problems, think creatively and engage with innovation as a continuous process.

What is encompassed within individual generic skills has also been expanding in scope. Thus, what was seen as the 'specialist' skill of IT just 10-15 years ago is now regarded as a 'basic' skill, essential for a great proportion of jobs and occupations, although the level and complexity of actual skill utilised will vary substantially across and even within occupations.

Based on the national and international academic evidence available, the Expert Group has identified the key and most widely shared elements that should be included in a generic skills portfolio as:

- Basic/fundamental skills – such as literacy, using numbers, technological literacy;
- People-related skills – such as communication, interpersonal, team-working, customer-service skills; and
- Conceptual/thinking skills – such as collecting and organising information, problem-solving, planning and organising, learning-to-learn skills, innovation and creative skills.

The need to improve soft and generic skills has emerged consistently throughout EGFSN reports, for example, the Wholesale and Retail Sector; the Green Economy; for engineering and science graduates in the Bio-pharma and Pharmachem sectors; the Food and Beverages Report and within the ICT sector. These skills are required by enterprises in addition to core specialisms and expertise (for example science, engineering, technology) and should be embedded in programmes.

5. Current occupational skills shortages identified in the EGFSN *National Skills Bulletin 2010*.

Skills shortages are identified annually through the Skills and Labour Market Research Unit (SLMRU) Recruitment Agency Survey, which reports on posts or occupations that are ‘difficult to fill’ for employers. The skill shortages identified in the National Skills Bulletin 2010 relate to a small number of posts and are confined to:

- specialists within an occupation (e.g. electrical engineers with an expertise in high voltage grids)
- senior positions (e.g. senior software developer)
- niche areas (e.g. telesales with Nordic languages)
- a specific skill mix (e.g. ICT and business).

The information presented here should be read in conjunction with the sectoral information on future skills needs presented earlier.

5.1 Science Occupations

Current skills shortages have been identified for high calibre niche area R&D scientists (chemists, biologists etc.), managers (clinical trials, supply chain etc.), animal nutritionists, science technicians (prototyping/development), regulation experts and multidisciplinary experts (e.g. bio-convergence, blend of science and business etc.).

The following factors are expected to positively impact on the future demand for science occupations:

- global demand for pharmaceuticals, biotechnology products and medical devices has proven to be relatively resilient; despite some job losses expected to occur as a result of consolidation within the sector (mergers and acquisitions), bio-pharma and related activities are expected to be the key drivers of export led growth in the recovery, which is evident in recent announcements on job creation (e.g. Warner Chilcott, PPD, Freund Corporations and EirGen Pharma)
- the Irish Government has made a commitment to further advance job creation in science related areas (e.g. Science Foundation Ireland’s Strategy on Powering the Smart Economy in 2009, partial funding of the National Institute for Bio-processing Research and Training etc.); recently, it has allocated a multi-million fund for the establishment of competence centres which are expected to employ high calibre researchers in the fields of science, ICT, engineering etc.
- the green agenda (environmental protection (e.g. impact assessment on flora and fauna), renewable energy, etc.)) is expected to create an additional demand for natural scientists in the future
- advances in products and services associated with bio-convergence are expected to drive the future demand for blended science, nanotechnology and ICT expertise
- the structure of operations in the biopharma-chemical sector has been changing towards higher value added (e.g. R&D, clinical trials, supply chain management) but less labour intensive

activities, as some manufacturing operations move to lower cost locations (e.g. China); as a result, the demand for skills is moving away from operative to professional (scientists) and associate professional (scientific technicians) levels; in addition, manufacturing operations are likely to increasingly employ skilled 'super-operatives' in the areas of science, regulation and ICT.

5.2 Engineering Occupations

Shortages have been identified for the following high level engineering skills: mechanical design and innovation, process (pharmaceutical industry, medical devices, water purification), quality control, validation (pharmaceutical and medical devices sectors), wind energy and high voltage electrical engineering.

There are a number of factors which are expected to positively impact on the future demand for engineering skills:

- exposure to global competition – companies in food processing, medical devices, pharmaceuticals etc. are being forced to increase productivity, quality and flexibility through changes in system architecture, the application of leaner manufacturing processes (e.g. Six Sigma) and through further automation. All of these processes require the application of professional engineering skills.
- the expansion of R&D and other activities to facilitate improvements in power generation and the management and transmission of energy is expected to continue into future; recent investment announcements include Texas Instruments (power management semiconductor engineering), PAS Technologies (gas turbines), Sierra Support Services, United Technologies, Crompton Greaves, Endesa and Eirgrid.
- the green agenda – renewable energy (solar, wind, wave and tidal) and environmental protection, is expected to be a significant driver of job opportunities for engineering skills (mechanical, electric, electronic, civil, environmental, design, development etc.).

5.3 ICT Professional Occupations

Shortages of senior software developers (JAVA, SQL, C++, .net, VB6, Search Engine Optimisation (SEO), PHP), IT security experts, network experts and IT project managers have been identified. The sourcing of high level IT skills from abroad continued during the recession, with 400 employment permits issued to non-EEA software engineers and programmers in 2009. IT experts were one of the most frequently mentioned difficult to source occupations in the FÁS/ESRI Recruitment Agency Survey. In 2009, vacancies for IT occupations were among the top ten most frequently advertised by the Irish Times and Irishjobs.ie.

IT skills are expected to be instrumental in driving employment growth in the recovery. Expected job creation in IT related areas is supported by recent investment announcements by Gala Networks (games), Alcatel-Lucent (IT applications, platforms and servers for fixed and mobile operators), Infineon Technologies AG and University of Limerick (R&D centre of excellence in applied research for semiconductor supply chain), Disney Research and CLARITY (multimedia), IBM (IT services for urban planning), Havoc (games) and Openet (software solutions for telecommunications).

5.4 Business and Financial Occupations

Despite the global and domestic financial crises and significant number of job losses (e.g. Bank of Scotland Ireland), shortages of high level financial skills have been identified. Difficult to source occupations include actuaries, risk experts, business analysts, senior claims handlers, fund specialists and senior accountants with specific skills (e.g. regulation, MiFID). Almost 100 financial professionals were sourced from outside the EEA in 2009.

The insurance sector has been holding up well during the recession. Despite the anticipated job losses from Quinn insurance, job creation is expected from recent investment announcements by Zurich Financial Services Group, Generali PanEurope and Allianz.

The demand for financial skills (e.g. accounting, quantitative finance and risk management) is expected to be driven by changes in the regulatory environment, product innovation, system changes to support more complex product sets and industry consolidation (mergers into a smaller number of large 'global banks').

5.5 Healthcare Occupations

Job opportunities in the public healthcare sector remain limited primarily due to funding issues. However, shortages of the following skills have been identified:

- medical practitioners (general practitioners, non-consultant hospital doctors and specialist doctors (e.g. consultant radiologists)): over 500 doctors were sourced from outside the EEA in 2009
- advanced nursing practitioners (theatre nurses, and those specialising in radiology, diabetes, renal medicine and midwifery)
- senior therapists: occupational and speech and language (33 employment permits were issued in 2009); physiotherapists (14 employment permits were issued in 2009) in niche areas e.g. paediatric disability
- medical radiographers (e.g. sonographers, mammographers etc.) were reported as difficult to source by recruitment agencies, while 26 employment permits were issued for this occupation in 2009
- the level of education and training output from dentistry has not kept pace with the growing demand for dental/orthodontic services, resulting in a shortage in this area.

5.6 Construction Professional and Associate Professional Occupations

As a result of the sharp contraction in construction activities, there are currently no shortages of professional construction skills in Ireland. Job creation in the recovery is expected to be concentrated in the following construction-related areas:

- infrastructure for the generation and transmission of energy (including renewables); recent investment announcements include those by Endesa and Eirgrid
- energy efficiency (e.g. retro-fitting; compliance with the Energy Performance of Buildings Directive (EPBD) and improved energy efficiency standards under Part L of the Building Regulations)
- site assessment
- water supply and water treatment

- management and treatment of waste
- construction of 'alternative' waste treatment plants
- export of new building materials and processes.

5.7 Transport and Logistics Occupations

There is some evidence of a shortage of international supply chain managers. The requirement is for experienced individuals with IT skills, forecasting skills, familiarity with material requirements planning (MRP) and master production scheduling (MPS), enterprise resource planning, global team management, proficiency in foreign languages etc.

5.8 Sales Occupations

There is some evidence of a shortage of experienced marketing managers with specific industry and product knowledge. They have been mentioned as difficult to source in the recruitment agency survey and 54 employment permits were issued to non-EEA marketing managers in 2009. Marketing experts are expected to be instrumental in Ireland's efforts to increase its market share of the global demand for products and services.

There is also a shortage of multilingual telesales/customer care workers with IT skills. They have been frequently mentioned as difficult to source in the recruitment agency survey. In particular, there is a demand for persons proficient in Nordic languages and German. The shortage is likely to continue as most of the recent job creation was in the customer care and telesales areas (e.g. StreamServe (customer care for documentation solutions), PayPal (customer care for internet payment solutions), HP (IT customer support call centre), eBay, Datapack, Abtran etc.

In addition, recruiters are continuing to report difficulties in sourcing experienced sales representatives with specific product or technical knowledge (e.g. medical sales and technical sales).

5.9 Quantitative Estimates of Skills Shortages

In assessing skills shortages, the SLMRU also provided some tentative estimates as to numbers concerned in current skills shortages.

Note: Shortage estimates are highly tentative; they are based primarily on the estimated excess demand expressed through difficult to fill vacancies and without a detailed analysis of the supply side. An estimate of less than 50 is a suggestion that the initial response should be one, at most two, classes with the follow up on the number of applicants and the employment position following the programme completion guiding future provision levels; more than 50 suggests that two classes would be the minimum initial response.

Shortage	Shortage specifics	Tentative magnitude estimates*
ICT - Programmers	<i>Senior software developers (e.g. Java, SQL, C++, .net, VB6, Search Engine Optimisation (SEO), web development (Personal Home Page Tools (PHP))</i>	<100
ICT - Network experts	<i>Collection of collaboration functions, process management modules, search modules and a document-management platform</i>	<50
ICT - security experts	<i>Certified IT systems security architecture, engineering and management</i>	<50
ICT -Telecommunications experts	<i>Mobile telephony</i>	<50
ICT - Project management	<i>IT professionals with ability to define objectives, costs and risks, control processes, manage people, new technologies, new markets and new regulatory environment</i>	<100
Science - R&D	<i>Chemical engineers, biologists</i>	<50
Science - Clinical trials managers	<i>Bio-pharma chemicals</i>	<20
Science - Regulation compliance officers	<i>E.g. Environmental Impact assessment, Safety</i>	<30 <30
Science - Supply chain managers	<i>Bio-pharma chemicals</i>	<20
Science technicians	<i>Laboratory technicians</i>	50+
	<i>Prototyping technicians</i>	50+
Science	<i>Animal nutritionists</i>	<20
Interdisciplinary experts	<i>Science + engineering (energy)</i>	<50
	<i>Science + IT+ nanotechnology (bio-convergence)</i>	<20
Engineers -Design, innovation, process, and quality control	<i>Process automation design</i> <i>Process diagnostics</i> <i>Lean manufacturing/Six sigma</i>	<100
Engineers - Electrical and mechanical	<i>Renewable energy (e.g. wind)</i>	<50
	<i>Conventional energy (generation and transmission, high voltage)</i>	<50
Engineers - Environment	<i>Management of eco-systems (impact assessment)</i>	<50
Sales - Marketing managers	<i>Experience in markets and products</i> <i>Foreign languages</i>	50+

Shortage	Shortage specifics	Tentative magnitude estimates*
		100+
Sales - Technical sales representatives	<i>Medical sales</i> <i>Technical sales</i> <i>Telesales (foreign languages)</i>	20+ 20+ 100+
Sales - Hybrid	<i>IT + marketing + international business + global markets + foreign languages (on line sales)</i>	100+
Transport - supply chain specialists	<i>International supply chain management with IT, forecasting, foreign management proficiency</i>	<50
Healthcare - Medical practitioners	<i>General practitioners</i> <i>Specialist doctors</i>	DOH decision
Healthcare - Nurses	<i>Theatre</i> <i>Intensive care</i> <i>Paediatric critical care</i> <i>Oncology</i> <i>Cardiac</i>	DOH decision
Healthcare - Dentists	<i>Dentist</i> <i>Orthodontist</i>	50+
Healthcare - Medical radiographers	<i>Sonographers</i> <i>Mammographers</i>	<50
Healthcare - Senior therapists	<i>Occupational therapy</i> <i>Physiotherapy</i> <i>Speech and language therapy</i>	<50
Finance - Accountants	<i>Chartered accountants (e.g. management, system, project etc.)</i>	<50
Finance - Actuaries	<i>Actuarial</i>	<50
Finance - Compliance experts	<i>Regulation</i>	<50
Finance - Senior claims handlers	<i>Insurance</i>	<50
Finance - Risk experts	<i>Market, product and operational risk management</i>	<50

Appendix 1: ICT/Cloud Computing: Top 10 technical skills in demand in 2010 ⁴

1. PROJECT MANAGEMENT: Organisations are putting pressure on IT to only implement projects that can show real return-on-investment. The first step to achieving this is professional project planning and implementation. Project managers require people skills, leadership and professionalism.

2. SECURITY: The number of spam messages containing malware has increased nine-fold to represent 2% of e-mails, while there are increasing attacks on social networking sites such as Twitter. Sought-after security skills are information risk management, operations security, certification and accreditation, security management, and security architecture.

3. NETWORK ADMINISTRATION: Organisations are expected to upgrade to Windows Server 2008 R2 and the Windows 7 client, and perhaps install Exchange Server 2010 and SharePoint 2010. Enterprises need network administrators to ensure network traffic.

4. VIRTUALIZATION - CLOUD: It is difficult for enterprises to find professionals with substantial relevant experience. Instead companies are drawing expertise from a range of IT skill sets, including storage, networks and desktop. Initially companies will set up cross-functional teams to buy and implement virtualization, but eventually cloud computing will be an expected skill set of systems administrators.

5. BUSINESS ANALYSIS: Factors such as the economic downturn and regulatory compliance have forced companies to take a step back and to think through business problems and their solutions. IT professionals are good candidates for business analysis jobs. Business analysts identify opportunities for business change and help implement the changes.

6. BUSINESS PROCESS IMPROVEMENT: Management professionals use business process management techniques and technologies to help companies optimize their business processes. This helps to reduce operating costs and to improve cash flow.

7. WEB DEVELOPMENT:

Developing Facebook games is a main example of the Web development spectrum. Building iPhone applications is also expected to be profitable. Other popular Web development skills include framework knowledge, widget development, content management system customizations and Javascript Plugin creation.

8. DATABASE MANAGEMENT: Databases drive payroll, manufacturing, sales, and transaction processing systems. Programmers must be able to build programs that interface with the database management system, while database administrators must be able to bring the power of database features to bear on business problems.

9. WINDOWS ADMINISTRATION: Enterprises are upgrading to Windows Server 2008 R2 and perhaps install Exchange Server 2010 and SharePoint 2010 as well. Windows administration skills are key for enterprises implementing and maintaining existing and upgraded systems.

10. DESKTOP SUPPORT: It is anticipated that businesses will need desktop support personnel to support new workers as organizations begin hiring as the economy improves. The introduction of Microsoft Windows 7 is also expected to generate additional interest.

⁴ Global Knowledge/TechRepublic 2010 Salary Survey

Appendix 2: ICT/Cloud Computing: Top 10 Technological Strategic Trends for 2011⁵

- (1) **Cloud Computing Services** exist along a spectrum from open public to closed private. The next three years is expected to see the delivery of a range of cloud service approaches that fall between these two extremes. Vendors will offer packaged private cloud implementations that deliver the vendor's public cloud service technologies in a form that can be implemented inside the consumer's enterprise.
- (2) **Mobile Applications and Media Tablets.** It is estimated that 1.2 billion people carry handsets capable of mobile commerce providing an ideal environment for the convergence of mobility and the Web. There are thousands of applications for platforms like the Apple iPhone. The quality of the experience on these devices is leading [customers to interact with companies preferentially through mobile devices](#).
- (3) **Social Media** can be divided into: (1) Social networking –social profile management products. (2) Social collaboration –technologies, such as wikis, blogs, instant messaging, collaborative office, and crowd sourcing. (3) Social publishing –technologies that assist communities in pooling individual content. (4) Social feedback gaining feedback and opinion from the community on specific items.
- (4) **Video** use in non-media companies is expanding rapidly. Technology trends in digital photography, consumer electronics, the Web, social software, unified communications, digital and Internet-based television and mobile computing are all reaching critical tipping points that bring video into the mainstream.
- (5) **Next Generation Analytics:** Increasing compute capabilities of computers, including mobile devices, along with improving connectivity, are enabling business to run simulations in real time to support individual business action.
- (6) **Social Analytics** describes the process of measuring, analyzing and interpreting the results of interactions and associations among people, topics and ideas. These interactions may occur on social software applications used in the workplace, in internally or externally facing communities or on the social Web.
- (7) **Context-Aware Computing** centres on the concept of using information about an end user or object's environment, activities, connections and preferences to improve the quality of interaction with that end user. A contextually aware system anticipates user's needs and customized content, product or service.
- (8) **Storage Class Memory.** A huge use of flash memory is anticipated in consumer devices, entertainment equipment and other embedded IT systems. It also offers a new layer of the storage hierarchy in servers and client computers that has key advantages – space, heat and performance. Flash memory is persistent even when power is removed.
- (9) **Ubiquitous Computing.** The coming third wave of computing is where computers are invisibly embedded into the world. Networks will surpass the scale that can be managed in traditional centralized ways.
- (10) **Fabric-based infrastructure and computer** is a modular form of computing. In its basic form, a fabric-based computer comprises a separate processor, memory, I/O, and offload modules that are connected to a switched interconnect and, importantly, the software required to configure and manage the resulting system(s).

⁵ Gartner Inc <http://www.itbusinessedge.com/slideshows/show.aspx?c=85144&slide=2>

