

**OECD SCIENCE, TECHNOLOGY AND INDUSTRY OUTLOOK 2004
COUNTRY RESPONSE TO POLICY QUESTIONNAIRE**

IRELAND

1. General Framework and trends in science, technology and innovation policy

After an extended period of strong economic growth, Ireland in the period under review faced an economic crossroads in terms of the challenge of building on national prosperity against a backdrop of slower international growth and unprecedented international competition in the sectors on which Ireland's prosperity most depends. Science, technology and innovation are seen as central in addressing these challenges and in creating and maintaining an economy that is competitive and dynamic.

There continues to be a strong focus on the role of science and technology in supporting economic growth and development in Ireland. While Ireland has been extraordinarily successful in attracting foreign investment, industrial policy has now shifted to focus support on high value and knowledge driven industry, both from abroad and indigenously. This is underpinned by investment in education, and particularly higher education.

Ireland has with other EU countries adopted the Lisbon strategy to make the EU the world reference point as a competitive knowledge driven economy. A key target in that strategy is to enhance research investment to 3% of GDP by 2010; Ireland's gross expenditure on R&D currently stands at approximately 1.4% of GNP and would hope to double this over the period to 2010.

The National Development Plan 2000-2006 (NDP) provides the overall framework for science and technology investment in Ireland, with the objective of developing Ireland as an innovation and knowledge based economy. The NDP has allocated €2.5 billion for Research, Technology Development and Innovation over the period, of which €1.5 billion is earmarked for RTDI for industrial development activities. This money will be used as a means of enhancing innovation and competitiveness, in order to increase output and employment.

The following key institutional arrangements give effect to the objectives in the NDP:

- *Forfás* - the national policy and advisory board for enterprise, trade, science, technology and innovation.
- *IDA Ireland and Enterprise Ireland* - the enterprise agencies for Irish industry. IDA Ireland's strategy and operations include increasingly strong emphasis on the STI aspects of inward investment. Enterprise Ireland has strengthened and refined its range of measures supporting innovation in Irish industry which is outlined in their Technology Innovation Strategy document. (<http://www.enterprises-ireland.com/documents/uploaded/EI-Sci101003.pdf>).

- *Higher Education Authority (HEA)* – the planning and development body for higher education;
- *Science Foundation Ireland* – the National Foundation for Excellence in Scientific Research Science Foundation Ireland (www.sfi.ie) was established as a statutory body in 2003 and has to date committed €320M in support of basic research in two strategic areas for Ireland, namely Biotechnology and ICT. A central component of this programme is attracting world-class researchers, both Irish and non-Irish, to locate in Ireland to head-up cutting-edge research projects within third-level institutions.
- *Other state agencies* - supporting the evolution of Ireland as a ‘knowledge-based society’.

In January 2003, a high-level steering group was established to assess the implications of the key emerging European Research Area (ERA) policy initiatives with an initial priority of developing an action plan on the ERA 3% gross expenditure on R&D as a percentage of GDP target for Ireland.

There have been a number of organisational changes within the science, technology and innovation policy structure in Ireland. There has been a major reorganisation of responsibilities for science, technology and innovation within the Department of Enterprise, Trade & Employment. Firstly, after the Government elections in April 2002, the science, technology and innovation portfolio now lies directly with the Tánaiste (deputy Prime Minister) and Minister for Enterprise, Trade & Employment; previously it had been the responsibility of a Minister of State.

A new division has been created within the Department – the Science and Technology and Intellectual Property Division, which combines the responsibilities of two units, the Office of Science and Technology and the Intellectual Property Unit, both of which had formerly been situated in two separate divisions. This signals the importance that the Government is placing on science, technology and innovation. Also a new National Integrated Awareness Programme, was launched in October 2003 bringing together the many existing science, engineering, technology and innovation awareness activities previously managed by different bodies, both public and private.

In a wider economic and industrial context, the Tánaiste (deputy Prime Minister) and Minister for Enterprise, Trade and Employment set up an Enterprise Strategy Group to develop Ireland’s enterprise strategy over the next ten years. This group is due to report mid 2004. The Minister for Education and Science has also invited the OECD to review Irish higher education, with a view to ascertaining inter alia, future directions for research policy. Reports from both groups are due later in 2004.

2. Public sector research and public research organizations

Two new research councils were established by the Department of Education and Science with funding by the National Development Plan. These Councils are the Irish Research Council for Science, Engineering and Technology (IRCSET) and the Irish Research Council for Humanities and Social Sciences (IRCHSS).

One of the main changes in Enterprise Ireland’s supports has been the launch of its Commercialisation Fund¹. This is divided along three broad phases:

- *Proof of Concept*: Provision of funding for research that might have commercial potential.

¹ (<http://www.enterprise-ireland.com/services/details.asp?section=industry&subsection=industry-support&id=46>).

- *Technology Development* (previously the Advanced Technology Research Programme). This phase concentrates on technically feasible research that requires more detailed technology development in order to realise its commercial potential.
- *Business Development*. This phase comprises the Campus Company Programme, supported by incubators and the Enterprise Platform initiative (a one-year incubation programme designed to provide hands-on support and management development for entrepreneurs wanting to set up their own business).

Science Foundation Ireland (SFI) is central to Ireland's goal of becoming a global knowledge based economy. Through strategic investments in the people, ideas and partnerships essential to outstanding research in strategic areas, SFI will help build in Ireland research of globally recognised excellence and nationally significant importance. The overall mission of SFI is to build and strengthen scientific engineering research and its infrastructure in the areas of greatest strategic value and benefit to Ireland's long term competitiveness and development. SFI has developed a number of programmes aimed at recruiting and retaining researchers and research groups capable of developing high-impact, internationally significant discoveries in the fields underpinning biotechnology and information and communications technology. SFI also launched a new initiative for Centres for Science, Engineering and Technology: Campus-Industry Partnerships (CSETs). The main objective of the programme is to fund scientists who will build collaborative efforts that develop internationally competitive research clusters allied to industry.

The Programme for Research in Third Level Institutions (PRTLTI) is a government initiative, to strengthen the basic research capabilities of third level institutions in Ireland. Primarily, it supports a strategic capability enhancement of the third level research system. PRTLTI provides the foundation and enabling conditions, both within and between institutions that will improve their capacity for engagement in high quality basic research, nationally and internationally. It addresses the core capabilities of the higher education research system as a whole and requires applicant institutions to demonstrate a strategic and carefully planned approach in developing their capabilities, including provision for collaboration with other Irish institutions and internationally. The Programme is currently funded under the National Development Plan 2000-2006, with assistance from the European Regional Development Fund and with private funding through a public/private financial framework. It supports both programmatic and infrastructural requirements. A comprehensive assessment of the progress, results and achievements of PRTLTI to date is currently being undertaken. The objectives of the assessment are to monitor the progress, performance and achievements of PRTLTI programmes and to address broader research policy and funding issues including the role of PRTLTI in the funding of research core capacity and capital funding in Ireland.

As a result of an assessment, undertaken by Forfás in 2001, for Irish membership of inter-governmental research organizations, Ireland joined the European Molecular Biology Laboratory (EMBL) in January 2004. Ireland's membership of EMBL will enable Irish researchers across a range of disciplines, in both public and private research, to have unlimited access to the facilities and opportunities afforded by this world-class facility. Membership should have the effect of stimulating the research community in Ireland to strengthen their research capacity, in addition to increasing networking and collaborative activity with scientists in other countries.

A key feature of enhanced industry/science relations is the development of effective means for technology transfer between the academic and business communities. Support is already being provided by EI to facilitate project and thematic development within the higher education institutions (HEIs). As part of its submission to the Enterprise Strategy Group, the HEA has also called for the development of a new and dedicated stream of funding to support the higher education institutions in the development of a strategic approach to technology transfer between the institutions and industry. This support would

complement that of Enterprise Ireland, supporting the institutions in their overall thrust to develop a strategic approach to technology transfer at an intuitional level.

The specific measures included in the Budget for 2004 announced by the Government in December 2003 are:

- 62% increase in funding for Science Foundation Ireland to €113.7 million for 2004 by the Department of Enterprise, Trade and Employment;
- €3.1 million for the Programme for Research in Third Level Institutions (PRTLTI) in 2004, through the allocation of €5.6 million for current expenditure (€4.9m. 2003) and a capital provision of €2.5 million (€7.5m in 2003) by the Department of Education and Science;
- 12% increase in funding to Enterprise Ireland for applied and in-company research to €2.8 million, provided by the Department of Enterprise, Trade and Employment;
- allocation of €1.5 million for the new integrated awareness programme '*Discover Science & Engineering*', by the Department of Enterprise, Trade and Employment for 2004.

3. Government support for private-sector R&D and innovation

The Government has a range of direct and indirect policy measures to encourage and support private sector investment in R&D. Among the measures announced in the Budget for 2004 by the Government were R&D tax credits, stamp duty exemption for transfers of intellectual property such as copyright, patents and trademarks and Business Expansion and Seed Capital Schemes.

Tax incentives

Tax Credits for R&D are being introduced in 2004. The credits will apply to incremental or new R&D spending, exceeding €50,000 in a given tax year. A tax credit of 20% of such expenditure will be allowed against corporation tax. The proposal will provide an effective incentive to industry to increase R&D expenditure.

IPR

In April 2003, the Irish Council for Science, Technology and Innovation (ICSTI) issued a Statement entitled 'Utilising Intellectual Property for Competitive Advantage' which reviewed the technology practices of several countries and recommended a National Code of Practice to develop the systems to support the identification and exploitation of Ireland's intellectual property. ICSTI is now about to publish a National Code of Practice for management of intellectual property arising from 100% publicly funded research. The aim of the Code is to build on existing knowledge and expertise and to harmonise IP management systems across Public Research Organisations (PROs). The Code of Practice provides guidelines and a framework for commercialisation of public investment in Irish R&D. PROs are encouraged to adopt the Code, on a voluntary basis, to ensure that robust, harmonised IP management systems are in place to deliver on commercialisation.

With regard to IPR, Enterprise Ireland will shortly launch a €1m pilot Patent Fund. Under this, a college may receive support to register a patent and develop it. The aim of this is to make researchers more aware of the importance of effective IP management within the commercialisation issue.

4. Enhancing collaboration and networking among innovating organizations

In the main, the EU Framework Programme represents the primary mechanism for international co-operation between Irish-based and overseas firms, universities and research institutes.

Science Foundation Ireland (SFI) actively seeks applications from overseas researchers who are prepared to undertake research in Ireland. The Basic Research Grant Scheme, operated by SFI, is also open to overseas researchers.

Enterprise Ireland operates at individual level with companies and also at sectoral level. It funds a number of networks, including the *Technology Transfer Initiative* (www.technologytransfer.ie). One of the primary objectives of this initiative is to encourage and facilitate intra-industry and academia-industry interaction. A similar network, *Tecnet*, exists in co-operation with the Institutes of Technology (www.tecnet.ie). Enterprise Ireland funds *Innovation Partnerships* as another element in its work on industry-academia interaction. This scheme funds joint research projects between companies and academic researchers to promote company innovation. Enterprise Ireland has also formed a series of partnerships with private sector institutions, corporates and venture capitalists, to establish new *venture capital funds* to invest in Irish SMEs and to encourage growth and development of the venture capital sector in Ireland (<http://www.enterprise-ireland.com/services-details.asp?section=industry&subsection=industry-support&id=101>).

5. Human resources for S&T

The need for additional researcher resources is a key challenge for Ireland, as R&D becomes an increasingly important element of the industrial structure. The total number of researchers in Ireland increased three fold over the 1990's to reach 13,374 in 2001. For Ireland to reach the 3% target for Europe would require an additional 12,500 researchers. Ireland has the potential to produce 7,500 of these domestically and would require an additional 5,000 from abroad. So sustaining interest among young people in the sciences and encouraging more of them to take up careers as scientists, both in industry and in public research organizations and the international mobility of research personnel is a key issue for large and small countries alike.

Increasing the level of interest in science, engineering and technology related courses in Ireland, continues to be a focus of policy. There is evidence from a number of indicators that the waning interest in the sciences in Ireland has been arrested over the past two years. This may signify that a number of policy initiatives in recent years aimed at tackling this problem are beginning to yield dividends. The most recently available data on the supply of science and engineering skills respectively, from Irish universities and institutes of technology are shown in Annex 1. While applications for Science courses continue to decline, applications for Engineering & Technology courses have increased slightly.

A number of Government initiatives have been launched over the past two years, with the aim of improving the supply of Science, Engineering and Technology graduates.

Task Force on the Physical Sciences

As a response to the growing concern about the decline in interest in science and technology at both 2nd and 3rd level, the Minister for Education and Science established a Task Force on the Physical Sciences (www.sciencetaskforce.ie) in 2000. Its mandate was to examine the issues surrounding the decline in take-

up of the physical sciences and to provide a set of recommendations for addressing this problem. The Task Force issued its report² in March 2002 which advanced recommendations under six headings:

1. Planning and Resources for School Science;
2. Equity of Access;
3. Teaching and Learning of Science;
4. School Curriculum and Assessment;
5. Promotion of Science and Careers; and
6. Science Education at Third-Level.

Implementation of these recommendations is on-going. Significant progress has been made on a number of fronts:

- *Curricular Reform.* A new science curriculum at second level for *Junior Cycle* students (ages 12-15) was introduced in September 2003. New *Senior Cycle* (ages 16-18) syllabi in *Physics* and *Chemistry* were examined for the first time in 2002. A new *Senior Cycle Biology* syllabus was introduced in September 2002. A new *Physical Sciences* syllabus for *Senior Cycle*, to replace the combined *Physics* and *Chemistry* one, is currently being developed. A revised science curriculum at primary level was introduced in September 2003. Two guiding principles have influenced these new syllabi, namely the need to establish the relevance of Science and Technology to contemporary life and society and secondly, the importance of hands-on laboratory experiments.
- *Teacher Training.* An integral part of these developments has been the provision of *in-service* training for teachers at both primary and secondary level.
- *Resources.* A physical sciences grant was paid to all primary schools in Dec. 2002, to the total value of €3M. This is on top of curriculum support grants to the value of €4M and €3.5M issued to schools in 1999 and 2001 respectively. A grant to support the implementation of the *Junior Cycle* science was made available in 2003 to the value of €12M.
- *Reviews.* Reviews of the *Senior Cycle* Mathematics syllabus, the grading of subjects in the Leaving Certificate examination and gender equality issues in science, are on-going.

Expert Group on Future Skills Needs

The *Expert Group on Future Skills Needs* advises the Irish Government on aspects of education and training policy related to the future skills requirements of the enterprise sector of the Irish economy. It published its fourth report³ in Oct. 2003, which highlighted a number of sectors such as Biotechnology, ICT and Engineering whose future growth could be curtailed if the supply of skills in S&T did not increase over the next 5 years. The Group put forward recommendations for achieving this objective through better linkages between higher education and business.

² www.sciencetaskforce.ie/report/report.pdf

³ www.forfas.ie/publications/egfsn031002/webopt/egfsn_4skills_report.pdf

The Group's remit was expanded in Dec. 2003 to encompass the issue of training in the workplace. The Group is particularly conscious of the fact that up-skilling or re-skilling in workforce can play an important role in increasing the supply of S&T skills.

S&T Awareness

A new awareness programme, *Discover Science & Engineering*, was launched in October 2003 (www.science.ie). This programme integrates a number of separate awareness programmes, which had been established previously by public and private organisations, under the umbrella of Forfás (www.forfas.ie). The underlying aims of Discover Science & Engineering are to

- Raise awareness levels of the physical sciences;
- Promote a greater understanding of science amongst the general public;
- Increase the numbers of students studying the physical sciences;
- Promote a positive attitude to careers in science and technology.

The target audience of Discover Science & Engineering are young people, school students their parents and teachers as well as the wider public. It works closely with the media, politicians and industry to achieve its aims.

The Education, Skills and Research (ESR) Division of IDA has identified some of the S&T skill requirements of overseas companies in Ireland and made representations to the Expert Group on Future Skill Needs (EGFSN), Task Force on Physical Sciences and the Department of Education on the matter. It has also contributed to an OECD review of Higher Education in Ireland and highlighted the critical role of the education sector as the source of S&T graduates and of nurturing a creative and research oriented culture. The on-going in-house training and development activities of private companies supplement the medium to long-term provision of the human resources for S&T activities delivered by national educational and training institutions.

Policies to boost innovation in the service sector

All Enterprise Ireland R&D programmes are aimed at manufacturing and internationally traded services firms. The organisation operates a dedicated unit to encourage start-up firms in the service sector. This provides assistance on business planning, feasibility studies, as well as access to other Enterprise Ireland services such as technical expertise and the organisation's overseas office network. IDA's suite of R&D and innovation promoting instruments are available for use by both manufacturing companies and firms operating in the internationally-traded services sector.

IDA is aware that the process of technology development and innovation within services companies is generally less compartmentalized than in manufacturing where dedicated R&D units often play a leading role. In services, technology development is more heavily focussed on the customer interface and shaped by quite rapid product/service life cycles and a strong emphasis on design. The appropriate way in which to encourage innovation in the internationally-traded services sector is the subject of on-going work within IDA.

7. Policy evaluation

The substantial increase in public funding of R&D (under the National Development Programme 2000-2006) and the establishment of new R&D funding mechanisms (e.g. Science Foundation Ireland) has led to an increased awareness of the need for ongoing evaluations of the elements of innovation policy: researchers, institutions, programmes, overall policy directions and the innovation system.

The methodologies used in evaluations of key national funding programmes draw on international good practice and perspectives. The use of new methodologies is considered in the design of evaluations on a case by case basis in terms of the use of qualitative vs. quantitative methods, international perspectives.

There is increased evaluation activity in the public sector funding agencies some of which (e.g. Health Research Board, Teagasc, Enterprise Ireland) have recently established a formal evaluation function. Steering groups are established for each evaluation commissioned by the Department of Enterprise, Trade and Employment and include representatives of the relevant Government Department, State agencies and other policy bodies, on a case by case basis as appropriate.

The Department of Education and Science has invited the OECD to carry out an independent review of higher education in Ireland. The review is aimed at supporting Ireland's strategic objectives of placing its higher education system in the top rank among OECD countries and of developing a dynamic, socially cohesive, knowledge-based economy.

ANNEX 1

Table 5.1: Science Graduates (Dept. Education & Science)

Year	Science Primary		Science Postgraduate		Total no. degrees awarded (all disciplines)
		%		%	
2002	4,215	13.8	1,345	4.4	30,576
2001	3,842	13.5	1,671	5.9	28,381

Table 5.2: Engineering Graduates (Dept. Education & Science)

Year	Engineering Primary		Engineering Postgraduate		Total no. degrees awarded (all disciplines)
		%		%	
2002	1,913	6.3	448	1.5	30,576
2001	1,110	3.9	246	0.9	28,381