

STI OUTLOOK 2006 – POLICY QUESTIONNAIRE

Purpose

1. DSTI is preparing the 2006 edition of its biennial publication, *Science, Technology and Industry Outlook*, which will be issued in the Autumn of 2006. The document will contain a chapter reviewing national science, technology, and industry policies in OECD countries. The enclosed questionnaire is intended to compile information on science, technology and innovation policies that are being developed, were recently implemented, or were recently evaluated by Member countries. It also gathers information about anticipated trends and policy challenges. The topics addressed in the questionnaire relate to areas of ongoing or future interest to the CSTP and its working parties, including policy mixes, globalisation of innovation and human resources for S&T, and will contribute to monitoring the implementation of previous recommendations and development of further policy recommendations.
2. The OECD Secretariat intends to synthesise the information provided by Member countries in a summary document for comment and/or discussion by the Committee for Scientific and Technological Policy (CSTP) at its first regular session in 2006. The revised document will form the basis of a chapter of the 2006 *Outlook* that reviews main trends and expectations in science, technology and innovation policy. Some of the information gathered through the questionnaire will be incorporated into other chapters of the *Outlook* that focus on specific policy issues. The individual country responses will also be made available on the OECD's public Web site, www.oecd.org/sti/sti-outlook.
3. The success of this exercise is directly dependent on the quality of information provided by Member countries, and the Secretariat appreciates the comprehensive responses provided by many countries for previous *Outlooks*. In addition to providing information for the *Outlook*, this exercise provides Delegations with a framework to compare their experiences, exchange views on the effectiveness of different policies and discuss the international implications of recent trends in science, technology and industry policies. It also helps the CSTP identify future projects and issues for investigation.

Guidelines

4. In completing this questionnaire, countries are requested to provide a general overview of the science, technology, and innovation policies implemented in their countries and to provide information on major changes that took place in 2004 and 2005 or are anticipated in the future in specific policy areas listed below. Delegates will have an opportunity to update this information prior to publication in order to incorporate information on policies introduced in early 2006. Countries need not provide information on all the topics indicated below, but should concentrate on those areas in which the most significant policy developments have occurred. They may draw upon existing policy documents where possible and are encouraged to submit additional supporting materials and links to relevant Web sites along with their written responses.
5. The responses to this survey need not be excessively long, but because they will provide the primary material for the Secretariat's report, they should at minimum: *i*) highlight significant policy changes in the areas listed and outline the background and rationale of these policy changes (such as assessments of previous policy initiatives), *ii*) indicate and describe the new programmes and measures that

reflect these policy changes and how they differ from past policies, *iii*) briefly recall ongoing programmes or measures that remain in place (indicating changes in implementation conditions that may have occurred)¹, and *iv*) include supporting quantitative data where possible. For reference, the previous country responses for the 2004 edition of the Outlook may be consulted on the OECD Web site. (www.oecd.org/sti/sti-outlook)

6. In terms of its content, this questionnaire differs from previous Outlook questionnaires in two important ways:

It includes more questions regarding perceived *changes* in policies and priorities and the *balance* among them, as well as expectations regarding *future* priorities. These are intended to help identify important trends in policy development and implementation.

It also requests more quantitative information about programmes and policy instruments (such as levels of financing, numbers of participants) to enable more direct comparison among national policies.

7. In addition, Delegates will this year have two options for completing the questionnaire. As in the past, they may insert responses into the electronic version (MS Word version) of the questionnaire and send it to the Secretariat via email. In addition, the Secretariat is developing a dedicated Web site that will permit Delegates to insert responses directly into a Web-based form. Further information on the Web site will be made available in a separate Room Document and on the Outlook Web page [www.oecd.org/sti/sti-outlook]. Delegates wishing to use the Web-base system may also contact the Secretariat directly for information [Mr. Byung-Seon Jeong].

8. It is requested that countries' responses be submitted to the Secretariat **no later than 15 January 2006** to allow the Secretariat sufficient time to clarify information and draft a summary document for the CSTP meeting in March. Additional background material such as white papers (in English or French) may be sent by regular mail if they are not readily available in electronic format. Email responses should be sent to:

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9. In completing the Questionnaire, CSTP delegates are encouraged to consult with delegates to CSTP working parties (TIP, WPB, NESTI) as appropriate. Nevertheless, country delegations are requested to designate a **primary contact person** with whom Secretariat staff can communicate regarding the survey responses.

¹. References could be made to country responses to the 2004 *STI Outlook* questionnaire.

REQUEST FOR INFORMATION

10. Please provide a written response for Section A below, which addresses general science, technology and innovation policies, and for those topics identified in Sections B through G in which significant shifts in policy have been made or new initiatives launched in 2004 or 2005. Information on anticipated changes in 2006 (or beyond) should also be included, where possible.

Section A: General framework and trends in science, technology, and innovation policy

1. Please provide a brief overview of the main directions, objectives and elements of national policies for science, technology, and innovation, highlighting the following topics:

- Main features of recent science, technology, and innovation policy developments (*e.g.*, including new innovation strategies) and the rationale behind them:

Response:

Ireland is at a pivotal juncture in its economic development. Its continued success will depend, in large part, to its ability to evolve into a knowledge economy in which its indigenous and foreign-owned sectors perform strongly.

Considered thinking and careful implementation is required to achieve this. Enterprise policy was the subject of a recent major strategic review by the Enterprise Strategy Group that was specifically set up for that purpose. Its report, "Ahead of the Curve: Ireland's Place in the Global Economy" (published July 2004) makes a series of key recommendations designed to ensure competitive advantage and to build the conditions for strong and sustainable enterprises in Ireland to 2015. Central to these was the recognised need to enhance expertise in

- International sales and marketing,
- Research and technological development.

At the same time, a high-level steering group established by the then Deputy Prime Minister and Minister for Enterprise, Trade and Employment in the context of the EU Lisbon process and 3% GDP target for Europe published its report "Building Ireland's Knowledge Economy: the Irish Action Plan for Promoting Investment in R&D to 2010". This landmark report provides a vision that "*Ireland by 2010 will be internationally renowned for the excellence of its research and be at the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture*".

To achieve this, recommendations are made to:

- Develop a national pro-innovation culture supportive of invention, risk-taking and entrepreneurship.

- Re-orient the enterprise support budget to R&D and develop a new and less bureaucratic approach to such support that encourages a systematic and continuous approach to R&D within enterprises.
- Strongly support the development of strategic research competencies based on enterprise needs.
- Develop the seed capital markets for early stage ventures.
- Develop a national plan to increase the performance, productivity and efficiency of research in the higher education and the public sectors.
- Sustain Ireland's commitment to building an international reputation for research excellence.
- Make Ireland a highly attractive environment for high quality researchers and research careers.
- Develop the intellectual property management and commercialisation expertise and resources necessary to ensure effective and rapid exploitation of research generated in higher education and public research sectors.

The next phase of this is its implementation. A more detailed Strategy for Science, Technology and Innovation (2006-2013) will be launched shortly in which actions to effect the recommendations and vision above will be identified and taken up by the appropriate bodies. The focus will continue on excellent research and researchers, commercialisation, building absorptive capacity in companies, science education in schools and developing stronger linkages between the various actors in the national innovation system and beyond.

- Major changes in the legislative, administrative, organisational, institutional, or budgetary framework for the formulation and implementation of science, technology, and innovation policies (*e.g.*, new Ministerial structures, better inter-Ministerial coordination, increased involvement of non-governmental stakeholders):

Response:

In June 2004 the Government took a number of decisions to strengthen the oversight and review framework for national science, technology and innovation (STI) policy. These new structures include:

- Establishment of a Cabinet Committee on STI;
- Establishment of an Inter-Departmental Committee (IDC) on STI of Senior Officials to support the Cabinet Committee;
- Appointment of a Chief Science Adviser (CSA) to Government;
- Establishment of an Advisory Science Council to act as the primary interface between stakeholders and policymakers in the STI arena.

Significant progress has been achieved in establishing this new framework. The key challenge for these arrangements is to deliver a high degree of coherence and co-ordination in research funding. The overriding principle is to maintain the freedom of Government Departments and funding agencies to meet their policy objectives, while at the same time reducing the fragmentation of the national innovation system and increasing the productivity and efficiency of research expenditure.

- New policy measures to foster increased innovation and productivity growth in the service sector (both services in general and specific service-sector, finance, etc.).

Response:

In a Forfas study on stimulating innovation in industry in Ireland (2003), it was acknowledged that the services sector industries required a different approach to support mechanisms than those applied to the manufacturing and processing industries. A policy study is expected to be completed during early 2006 setting out a policy framework designed to address innovation issues specifically for the services sector. This will be focused on internationally traded services and knowledge intensive services.

2. Please describe major shifts or changes in the priority given to different areas of science, technology, and innovation policy listed below or the policy instruments used to achieve them: i) strengthening the science system; ii) supporting business innovation; iii) linking science to innovation; iv) developing human resources for S&T; and v) establishing framework conditions that are conducive to innovation (e.g., IPR regimes).

Response:

Ireland will continue to concentrate on each of these areas: as its system develops, it is working to ensure that all actors and links between them are progressing in such a way that investments across the system are maximised.

(i) Strengthening the science system

Investment in excellent research will continue through Science Foundation Ireland (SFI) and the Higher Education Authority (HEA). SFI funds excellence in basic research based on international competition and international peer review. The HEA supports the third level sector primarily through competitive funding based on institutional strategies (under the Programme for Research in Third Level Institutions) and block funding.

Given the greater level of research activity that is being financed, corresponding support for commercialisation will increase over the coming period to ensure that the returns on our investment in research are optimised. This will take the form primarily of strengthening the technology transfer offices in the colleges and fostering stable frameworks in which they can operate.

A recent linked development was the establishment of AURIL Ireland to help professionalise the technology transfer directors in the nine universities across the island.

In its latest budget, the Government announced large sums of funding for the higher education sector: €300m for a Strategic Innovation Fund and a further €900m for a 5-year capital programme. In addition to building up the research capacity and activity of the third level sector, it will invest in creating a sustainable “fourth level” in Irish academia that will position Ireland as an internationally attractive location in which to conduct research.

For other educational levels, the ‘broadband for all schools’ programme is aimed to be deployed to all primary and secondary schools by the end of 2006. Supporting measures to promote ICT use in the classroom are also underway.

(ii) Supporting business innovation

In order to foster such relationships, the absorptive capacity of enterprise must be such that it is able to engage: increasing the number of firms performing R&D and the research intensity of that activity are key priorities for Ireland over the coming years. This is manifested in the strategies and initiatives of the

enterprise development agencies, Enterprise Ireland (www.enterprise-ireland.com) and the Industrial Development Agency (www.idaireland.com).

(iii) Linking science to enterprise

Greater attention is also being paid to increasing industry's input to the research agenda. In order to

- i. Ensure that the State's investment in research is aligned with enterprise needs
- ii. Support a longer-term firm perspective on R&D, and
- iii. Enable the research community to engage more active on issues of strategic industrial importance to Ireland,

Firms are being encouraged to come together to identify mutual medium-term technology interests, *e.g.* in industry-driven research networks, Centres for Science, Engineering and Technology (CSETs) and Innovation Partnerships.

(iv) Developing skilled resources for S&T

Developing skilled people has been, and will even more so be, a central plank of Ireland's industrial development policy, as set out in the range of reports by the Expert Group on Future Skills Needs (www.egfsn.ie).

Science Foundation Ireland's primary mission is to develop human capital and to train first-class researchers through working with Principal Investigators attracted to Ireland who are true leaders in their field globally

Facilitating the mobility of internationally excellent researchers into Ireland is also being considered by, among others, the EGFSN and the IUA. An EU-backed initiative is establishing a European Network of Mobility Centres to remove obstacles to the mobility of researchers. DETE supports the IUA to operate Ireland's national mobility centre and portal. The Centre provides assistance to researchers wishing to pursue careers in academia and industry.

Researcher careers is a critical issue in this because PhD graduates that do not take up positions in enterprise or tenured academic positions can face uncertain career prospects and risk becoming "perpetual postdocs". The fundamental issue is that there are not enough permanent positions in the public research systems to retain the best. This structural weakness needs to be addressed and is under consideration by a number of interested stakeholders, including the Irish Universities Association (IUA).

(v) Framework conditions, including IPR regimes

A National Code of Practice for managing intellectual property from publicly funded research was launched in April 2004. This was followed in November 2005 with a Code of Practice for Managing and Commercialising IP from Public-Private Collaborative Research. Together, these Codes provide a comprehensive set of guidelines for IP management and commercialisation and a framework for IP negotiations to facilitate the development of enterprise-academic relations.

3. Please describe the primary challenges that are expected to be addressed in future science technology and innovation policy initiatives and/or that have been identified in forward-looking exercises, such as foresight and technology road mapping (*i.e.*, in the 2007-08 timeframe).

Response:

The forthcoming Strategy on Science, Technology and Innovation will progress Ireland's R&D Action Plan by detailing the actions that will be initiated or enhanced to deliver on this and identifying those entrusted with this mission.

The challenges facing Ireland include:

- Strengthening the science system with the aid of more stable research careers and more internationally attractive research environments.
- Building the absorptive capacity of firms in Ireland.
- Attracting and embedding the R&D operations of foreign-owned firms.
- Identifying the technology needs of future and potential enterprise in Ireland and using this valuable information to influence public funding of research so that the interests of the industrial and academic research communities are more closely aligned. Forfas is planning to conduct further work in 2006 on this in close co-operation with enterprise and the research funding agencies.
- Enhancing research commercialisation support and thereby increasing commercialisation activity, be it in the form of more technology-based start-ups or licences to firms that will deliver returns to the Irish economy.
- Developing a clear STI internationalisation strategy to improve and optimise our links with actors overseas.

Section B: Public sector research and public research organisations

Please describe major policy changes related to the financing of public R&D, to include the following:

- Changes in overall levels of R&D funding for public research organisations during last few years.

Response:

	2003	2004	2005 (e)	2006 (f)	2007 (f)
Public R&D	446	585.5	634.3	710	780
Higher Ed.	264.5	395.9	413.7	450	500
Govt.	125.3	127.9	122.5	140	150
Business	53.5	50.3	85.4	105	120
Extramural	2.7	11.4	12.7	15	10

- Shifts in the allocation of funding across the following areas (please provide quantitative information if available):

- 1) different types of public research organisations (*e.g.* universities vs. government research institutions)

R&D activities performed by universities increased by 61% between 2002 and 2004 to stand at €461.3m, while expenditure in the institutes of technology climbed 20.3% in nominal terms in the same period to reach €30.4m.

Response:

2) different socio-economic objectives (*e.g.* general advancement of knowledge, health, national security, environment, energy)

Response:

Different fields of science and technology (*e.g.* information and communications technology, biotechnology, and nanotechnology.)

Response:

All fields of science saw increases in higher education expenditure between 2002 and 2004. There were some small changes in the relative proportions:

<i>Field of science & technology</i>	<i>2002</i>	<i>2004</i>
Natural sciences	36%	39%
Medical sciences	16%	18%
Social sciences	19%	17%
Engineering	17%	17%
Humanities	10%	8%
Agricultural sciences	2%	2%

- Changes in the use of different types of funding instruments for financing R&D or the balance among them, *e.g.* institutional funding (block grants) and project funding (contracts and grants), or public funding vs. private funding. To what extent have funding mechanisms become more competitive?

Response:

Research income in the higher education sector comes from a number of different sources that fall under three main headings:

- 1. Direct government funding,
- 2. Indirect government funding,
- 3. Other sources.

Direct government funding totalled €203m in 2004, an increase of 48.2% from 2002.

Indirect sources of R&D funding are derived from the annual ‘block grant’ from the Higher Education Authority. It rose by 57% between 2002 and 2004 to €205m

2. Please describe major initiatives to reform the organisation and governance of universities and other public research organisations to improve the quality of their R&D or their ability to contribute to economic growth and other social objectives. Please consider reforms such as:

- Initiatives to increase the flexibility and/or accountability of universities and other public research organisations (*e.g.* granting more autonomy, performance measurement systems or stronger evaluation, new funding structures).

The Government recently announced a major Strategic Innovation Fund for higher education institutions. It will be based on national priorities and individual university strengths and inter-institutional

collaboration will be encouraged. Through an internationally peer reviewed competitive tender, the SIF will support the universities in increasing their capacity to produce high quality 3rd level and 4th level outputs.

Based on lessons learned since 1997 and an independent review by the European University Association, enhanced policies for both external and internal quality assurance procedures are now being implemented across the universities. The focus of these includes teaching and learning, as well as R&D activities.

The governing bodies of several universities have been undergoing modifications, including the introduction of external chair persons and greater representation of non-academic stakeholders.

In 2005, a performance management and development system for all staff members across all publicly-funded higher education institutions was introduced.

Response:

- New organisational structures for performing R&D, such as larger-scale research teams, centres of excellence, multi-disciplinary research centres, research networks, etc.:

Response:

The programmes of Science Foundation Ireland and the Higher Education Authority (through the PRTL) have specifically targeted the development of centres of excellence over the last five years. Over thirty centres have been established with leading research teams and are in the process of ramping up their activity.

The HEA recently published an international assessment of the impact of the PRTL. The report takes a positive view of the PRTL's impact to date and strongly recommends its continuation beyond the current National Development Plan. It makes a number of recommendations for Government, the HEA and institutions in the future management of the programme.

An assessment of the first five years of Science Foundation Ireland was also recently completed. It found that SFI has had a positive effect on the research system in Ireland and that good progress has been made towards strengthening research capability in ICT and biotechnology in a short period of time.

Further details on industry-academia collaborative activities are set out in Section D.

All universities have now established a central research office led by Vice Presidents/ Deans of Research. These have the role of co-ordinating the universities research activities, leading major research proposals, providing seed funding for staff, providing support to researchers to access national and international research funding programmes.

- Revised procedures for setting research priorities at the institutional level in universities and public research organisations (*e.g.* involvement of outside stakeholders):

Response:

The PRTL provides integrated financial support for institutional strategies, programmes and infrastructure and ensures that institutions have the capacity and incentives to formulate and implement research strategies, which will give them critical mass and world level capacity in key areas of research.

One of the key objectives of the programme is to enable a strategic and planned approach by third-level institutions to the long-term development of their research capabilities, consistent with their existing and developing research strengths and capabilities.

- Reformed rules governing ownership and licensing of publicly-funded research results, support for technology licensing, etc., whether or not these measures are focused on a specific type of IPR (patents, copyright, etc.) or certain technological fields:

Response:

As noted in Section A, Question 2 (v), two National Codes of Practice for managing intellectual practice have recently been launched. In addition, the strengthening of the technology transfer function within the colleges will be a priority under the forthcoming Strategy for Science, Technology and Innovation with an allocation of €6m in 2006 to push this.

Other

Response:

3. Please identify major shifts or changes in priority among the approaches for strengthening public sector research, including efforts to: i) increase levels of funding; ii) alter the structure of funding (e.g., institutional vs. project-based funding; public vs. private-sector funding); iii) reform the governance of public research organisations; iv) implement new structures for performing research (e.g., centres of excellence, multi-disciplinary centres); v) changing guidelines for ownership and management of IPR; and vi) implementing new evaluation procedures).

Response:

Teagasc is currently developing its research resources and activities into centres of excellence which are located strategically around the country. 5 research centres are dedicated to aspects of agricultural research while a further 2 focus on food research.

4. Please describe any new or recent changes in policies adopted by government, public research funding bodies or public research institutions to improve access to data resulting from publicly funded research.²

Response:

RELAY, a publicly funded inter-institutional food research dissemination project, has been established with FIRM funding.

Looking to the future, what are the main challenges that the science system is expected to face and the main issues that policy makers will need to address? What future actions are anticipated?

The main challenges include:

- Science curriculum and teaching at 2nd level: unresolved issues raised by the Task Force on Physical Sciences,

² Delegates may wish to consult with experts participating in the electronic discussion group to develop OECD guidelines for access to research data.

- Sustained decline in enrolments on S&T 3rd level courses, particularly ICT, compounded by underlying demographics.
- Gender performance: male under-performance at 2nd level, loss of females from S&T research and careers.
- Involvement of the public in making science policy to ensure acceptance of new technologies,
- Sustained multiannual funding that represents a long term commitment by the government to fund science,
- Establishing research as an attractive career,
- Attracting researchers from within and to Ireland,
- Maximum exploitation of research results.

Section C: Government support for private-sector R&D and innovation

1. Please describe major policy changes in the instruments used to support private sector R&D and innovation, including:

The Government has a range of direct and indirect policy measures to encourage and support private sector investment in R&D.

- Tax treatment of business R&D (*e.g.* tax credits for R&D expenditure, changes in corporate tax regimes that could affect business R&D activities):

Response:

In 2004, a tax credit for incremental R&D spend was introduced. A tax credit of 20% of such expenditure will be allowed against corporation tax.

In the same year, the Government announced its intention to abolish stamp duty on the transfer of intellectual property. The Finance Bill 2004 provided for a stamp duty exemption for the sale, transfer or other disposition of intellectual property, including any patent, trademark, copyright, registered design, design right, invention, domain name, supplementary protection certificate or plant breeders' rights.

- Direct public funding of business R&D and innovation (*e.g.* grants, contracts, loans, etc.):

Response:

Increasing the number of firms engaging in R&D and intensifying the actions of existing performers will be central to the success of Ireland's R&D Action Plan. Business expenditure on R&D increased to €1.15bn in 2004. Relative to GNP it remained static at 0.93%. Significant change is required if Ireland is to reach the target of 1.63% (*i.e.* two thirds of the 2.5% overall target under our national R&D Action Plan).

The enterprise development agencies provide a range of financial supports to companies to promote in-company R&D activity. The main mechanisms are

- The RTI (Competitive) Grants Scheme for R&D projects,
- R&D Capability support for facilities.

These are being pushed with more proactive awareness and advisory activities on the part of agency staff, *e.g.* the R&D Awareness Initiative, R&D Advocates, to encourage more companies to participate and to support those who do to undertake more research (rather than development) intensive work.

- Public procurement policies, new contractual guidelines, more competitive selection processes, etc:

Response:

There were no major policy changes in relation to public procurement to support private sector R&D. That said, there were a number of notable more general developments for public procurement and capital expenditure, including:

Publication of a National Public Procurement Policy Framework in October 2005,
Publication of revised guidelines in February 2005 that update procedures for appraisal
and management of capital expenditure proposals in the public sector.

The potential for initiatives in this area that can drive innovation are being considered at present by the Department of Finance, Forfas and the European Commission.

- Changes in IPR regimes to create additional incentives for business investments in innovation, such as via new or revised guidelines for specific types of inventions (*e.g.* genetic, software, business methods), or new or strengthened mechanisms for enforcement of IPR (*e.g.* specialised courts):

Response:

A new Commercial Division of the High Court has been set up to take cases entered after 12 January 2004. It is hoped that the formation of this specialist Division will serve to strengthen further the legal protection around IP in Ireland, as IP cases can now be brought before judges who have the opportunity to develop a specialist competence in commercial matters. It is contended that this strengthens mechanisms for the enforcement of IPR in Ireland and correspondingly may enhance Ireland's attractiveness as a location in which to register and from which to manage IP.

- Other forms of public support for innovation (*e.g.* consulting services and extension programmes):

Response:

The R&D Awareness Initiative takes the form of regional seminars to demonstrate to low or non-R&D performers the importance of R&D and the realities involved in undertaking it. A key element of the seminar is the opportunity to avail of personalised consultancy support for a company to explore its needs and options.

In recent months a new impetus was injected to this awareness-raising with the appointment of special R&D advocates to visit companies on a systematic basis and encourage them to start R&D.

In terms of training, the Innovation Management Initiative offers a range of training courses on R&D management to company personnel, ranging from introductory to more advanced.

2. Please describe policy changes in programmes to support R&D and innovation in SMEs and new technology-based firms, *e.g.*, via efforts to:

- Establish and develop venture capital funds and/or second-stage financing for the support of new technology-based firms or spin-offs from public research organisations:

Response:

The State, through Enterprise Ireland, has actively engaged with the financial sector to develop the venture capital sector for higher risk investments. The agency also takes equity in technology start-ups and through the early stage growth of companies.

- Provide additional R&D funding targeted to SMEs and new technology-based firms

Response:

Enterprise Ireland's supports are targeted at indigenous firms, the bulk of whom are SMEs, and at start-ups. Grant rates are more favourable for smaller companies (and also for those in less advantaged regional locations).

- Encourage entrepreneurship through training, information services, or other means:

Response:

Entrepreneurship is encouraged through a spectrum of measures, including support from colleges for research-based start-ups and from enterprise development agencies.

In 2005, Enterprise Ireland re-organised its divisions and, as part of this, created a dedicated High Potential Start-Up (HPSU) Unit to meet the needs of those seeking to develop companies with high growth potential.

On campuses, assistance includes incubation space, education and financial support (for more details see Section D, Question 2 below).

3. Please identify major shifts or changes in the mix of instruments used to provide public support for private sector R&D and innovation, to include: i) direct financing of R&D, ii) R&D tax incentives, iii) support to entrepreneurship and SMEs and iv) IPR protection and other framework conditions. What shifts in the policy mix are anticipated in coming years?

Response:

Grant support for R&D activity within firms has recently been supplemented with the introduction of an R&D Tax credit.

At the same time, there is increasing recognition of the need to improve the advisory support to accompany the funding: in order to help firms make optimal decisions and investments. This involves a holistic perspective on company needs and opportunities as well as a keen understanding of the best approach to R&D for that particular firm.

4. Looking to the future, what are the main issues that policy makers will need to address regarding support to the business innovation system? Please describe any efforts that have been taken to identify or address them.

In terms of supporting in-company R&D, a key priority will be the improvement of the absorptive capacity of firms in Ireland so that they are properly equipped to identify, access and leverage other knowledge sources, as well as making the most of their own.

This requires

- Improved management capability,
- Skilled R&D personnel,
- Better R&D facilities and equipment.

Underpinning these lies the business strategy and within that a strong and forward-looking technology strategy.

Policy makers here are thus focusing on the totality of support for business R&D. This will be a central element of the forthcoming Strategy for Science, Technology and Innovation.

Section D: Enhancing collaboration and networking among innovating and research organisations

1. Please describe major initiatives to promote collaboration and networking among innovating firms, e.g. via joint R&D programmes, regional innovative clusters, international co-operation (attracting research labs of foreign firms or supporting access of domestic firms to foreign programmes).

Response:

Ultimately it is success in the markets that provides jobs, growth and the resources for additional investment in research; effective links between markets and the research base are therefore important to enhance the efficient allocation of limited public resources for research. Linkages between firms with mutual interests are of increasing importance within this and they are correspondingly receiving greater attention in Ireland at present.

We have recently ramped up activity in this area:

Industry-driven research networks:

Five pilot networks of companies in key emerging technology areas, e.g. wireless, power electronics, are being developed. These are company-driven initiatives in which the firms involved agree sub-themes of mutual interest within the technology area for further research and subsequently select a research group(s) to engage actively with them to carry out the work.

It is intended that each network, facilitated by Enterprise Ireland, will run for 2 to 3 years during which time strategically important research will be conducted from which participants will benefit by means of knowledge and skills transfer.

A key feature of each network will be the strong relationship between the research group(s) and industry, allowing the direction of the research to be modified in line with emerging enterprise needs.

- *The attraction of the R&D labs of major foreign firms to Ireland* is a primary objective of Ireland's industrial development and the IDA has been extremely successful in this venture. In 2003, foreign affiliates accounted for 72% of business expenditure on R&D. Ireland is developing as a major gateway for many of the world's leading R&D performing companies from the US to establish R&D activities in Europe.
- This success notwithstanding, the promotion and marketing of Ireland as a location for mobile enterprise R&D is being stepped up significantly and a stronger approach being adopted with the existing base of foreign firms in Ireland to attract additional R&D functions. To maximise the spillovers and returns to the local economy from foreign firm R&D activities, effective links also need to be grown with indigenous companies where possible.
- *Irish participation in the EU's Framework Programme* is actively promoted. Take up of the remaining calls in the Sixth Framework Programme is being pursued with academics and industry alike while, at the same time, preparations are well underway to position Ireland strongly for the Seventh Framework Programme.
- *Developing More Structured Engagement Based on Identified Enterprise Needs:* For Ireland to truly develop into a knowledge-based economy, it is vital that the research base and enterprise are more closely aligned. To achieve this, the technology needs of groups of companies must be identified and articulated. Work is commencing with the research funding agencies and

with industry to agree a process that will deliver these outputs and thus enable the creation of support mechanisms for greater collaborative activity, for example, competence centres. At the same time, existing competence centres such as the Tyndall Institute in Cork and the National Diagnostics Centre in Galway are the subject of renewed attention. Recent additions, including the National Centre for Bioprocessing Research and Training and the National Digital Research Centre, will be supported and monitored closely as they are built up.

2. Please describe major policy initiatives to promote stronger industry-science relationships, such as efforts to:

- Enhance collaborative research (*e.g.*, through changes in regulations governing the types of agreements negotiated between public research organisations and businesses and their implications for access to and exploitation of research results);

Response:

Historically, the levels of research collaboration in Ireland have been low, due to the low absorptive capacity of enterprise, shortages of funding and cultural barriers in terms of timeframes and operating procedures as between enterprise and academia. Harnessing the full potential of the increased public investment in research necessitates very close relationships between the enterprise and science bases.

The role of Government is, in part, to provide clear and stable policy and regulatory frameworks that facilitate and foster collaboration and commercialisation of intellectual property. As noted earlier, National Codes of Practice for Publicly Funded Research and for Public-Private Collaborative have been published (April 2004 and November 2005 respectively) to provide a consistent yet flexible framework for intellectual property negotiations.

It is also taking steps to enhance the technology transfer functions within the colleges so that the infrastructure for managing intellectual property mirrors the increasing sophistication of our research effort. The systems and infrastructure within the public research institutions for the protection, management and commercialisation of IP must be upgraded progressively and action will be taken in 2006 to progress this.

The Advisory Science Council has established a Task Force to examine the issue of industry-academia links: to what extent they exist in Ireland, how other countries approach the matter and what additional/ different supports could improve activity here.

- Increase the mobility of human resources between public and private sectors (*e.g.* by revising employment and financial rules governing public-sector researchers to allow them to more easily collaborate with industry, move between the public and private sectors, participate in the creation of spin-offs, take equity positions in technology-based firms emerging out of public research, *etc.*);

Response:

Academics are encouraged to participate in spin-off creation with both financial and advisory support. By the end of 2006, nearly all universities and Institutes of Technology will enjoy top-class incubation facilities. This will be accompanied by Incubator Plus: training for centre managers so that they are equipped to deal with the variety of requirements of their target client base.

Academic entrepreneurs can avail of financial support through Enterprise Ireland's Commercialisation of R&D (CORD) grants and advice through the workshops/ seminars offered by the colleges as well as the one-year fulltime training under the Enterprise Platform Programme.

When a start-up demonstrates clear potential to succeed, it is supported closely by Enterprise Ireland's dedicated High Potential Start-Up unit. The agency has also formed a series of partnerships with private sector institutions and venture capitalists to establish venture capital funds to invest in budding companies and to foster the growth of the venture capital sector in Ireland.

- Set up new modes of public/private partnerships for research and innovation:

Response:

These are discussed in Section D, Question 1 above.

- Others:

Response:

In addition to commencing new activities to foster multilateral collaboration between companies with colleges, the agencies support other forms of industry-science engagement, e.g. bilateral project work, very advanced research, and more informal networking:

Innovation Partnerships

Support for bilateral collaboration continues to perform an important role in the collaborative landscape, building up relationships between companies and colleges and often acting as a precursor to longer-term multilateral engagement.

- *Centres for Science, Engineering and Technology:*
Science Foundation Ireland is supporting a number of centres (CSETs) around the country that link more technologically advanced industry to frontier research.
- *Third Level Access Networks:*
Support is provided for network-building between companies and colleges through TecNet (linking the Institutes of Technology to industry) and the Technology Transfer Initiative (linking industry to the three universities outside Dublin: NUI Galway, University of Limerick and NUI Cork).

3. How has policy shifted in recent years in its support for different channels of industry-science linkages (e.g., collaboration, licensing, spin-outs, public/private partnerships). Please describe any anticipated shifts or changes in policy for strengthening industry-science linkages.

Shifts in policy in this area will entail an intensification of activity, as summarized above, rather than a change in direction. Future priorities will include:

- Articulation and use of (existing and potential) enterprise technology needs to direct public research funding and to balance the present significant investment in academic-driven research in order to build a cohesive yet flexible collaborative research environment in Ireland.
- Strengthening the commercialization function and culture within public research organizations.

- Embedding the R&D operations of foreign affiliates and maximizing their returns to the local economy.

Section E: Globalisation³

1. Please describe the most important policy issues and objectives with respect to the process of internationalisation of R&D:

Response:

The global nature of knowledge generation and diffusion today calls for clear strategies to ensure that firms in Ireland can maximise their involvement and gains in this space. This involves

- Attracting international R&D operations of leading multinationals. The IDA is bolstering its drive for this and achieving significant success in its activities.
- Maximising Ireland's participation in international R&D initiatives, e.g. Framework Programme, ESA.
- Leveraging international technology transfer opportunities, e.g. through the Innovation Relay Centre and efforts by Enterprise Ireland to identify IP generated by foreign firms considered non-strategic by them that is of use to Irish enterprise.

2. Please identify and describe changes in policies to attract R&D through foreign direct investment. This may concern:

- Direct financial support
- Fiscal incentives (tax breaks, R&D tax credits ...)
- Administrative support
- Provision of infrastructure
- Public procurement
- Active recruitment of foreign firms
- Advertising
- Other measures:

Please check the boxes above to indicate the types of policies used and provide more detail information here:

³ Many of these questions on globalisation were asked in a questionnaire circulated in November 2004 in the context of the CSTP/TIP project on globalisation of R&D. 13 countries (Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, Netherlands, New Zealand, Norway, and Poland) replied. These countries are invited report only significant changes since November 2004.

3. Please describe any changes in the principles concerning the treatment of foreign firms (both non-domiciled firms and foreign-owned subsidiaries) or foreign research institutions in national R&D programmes (e.g. access to national R&D funding programmes, rules for co-operation with domestic public research institutions, rules for co-operation in public private partnerships, public procurement, etc.)

Response:

4. Please describe specific measures to support the internationalisation of domestic public research institutions (e.g., such as additional funding for projects with international partners, co-funding for project partners not located in-country, support for setting-up affiliates abroad).

Response:

5. Please describe measures to link domestic firms, in particular SMEs, to foreign sources of research and innovation, including international co-operation in R&D (e.g., additional/preferential funding for projects with international partners; co-funding for project partners not located in the country; and support to find international partners, etc.).

Response:

Enterprise Ireland supports domestic firms to access a range of international research initiatives, including

- The EU's Sixth Framework Programme,
- The activities of the European Space Agency,
- EUREKA.

It also links firms into other international sources of R&D expertise, e.g. the Fraunhofer in Germany and visits firms overseas.

Section F: Human resources⁴

1. Please identify and describe recent efforts to improve supplies of university graduates with science and engineering degrees (both quantity and quality), in particular as relate to the following areas:

- Raising interest in and awareness of science among youth;
- Revising academic curricula to make science and technology more attractive to students, such as by expanding interdisciplinary training in S&E education;
- Improving teaching in mathematics and science, including through the use of ICT in teaching content and delivery;
- Reducing gender and ethnic minority gaps in science and technology education

⁴ These questions are broader than those included in the OECD Questionnaire on the Working Conditions and Attractiveness of Research Careers in the Higher Education and Public Research Sectors (April 2005). Delegates may wish to consult their SFRI delegates in responding to these questions.

- Enhancing financing opportunities for PhD study and post-doctorate training (such as through fellowships, funded research opportunities, *etc.*)
- Improving the quality of secondary university research laboratories/infrastructure
- Demand-side policies to increase the attractiveness of employment in public research organisations, make public sector employment more flexible, or improve provision of information to students regarding job opportunities in the public and private sectors.
- Others:

Please check the boxes above to indicate the types of policies used and provide more detail information here:

- **Discover Science & Engineering:**

The Discover Primary Science programme is a key function of DSE, which seeks to promote science and science resources to primary schools nationwide. There are 1,300 primary schools registered and 600 teachers have completed training days in over 40 host centres to help them bring science to life in the classroom. Registered schools seek to attain an Award of Science Excellence, and to retain it annually thereafter. The programme has a dedicated website: www.primaryscience.ie.

SCOPE TV is a popular science television programme run by DSE that is now in its third series. It airs once a week on Ireland's national TV station RTÉ 2. The programme specifically targets post primary students and their parents in raising awareness about science.

Each year the DSE programme co-ordinates Science Week Ireland, a week of science events dedicated to raising awareness of science among the general public, young people, teachers and parents. DSE provides science roadshows at various venues around the country, as well as co-ordinating regional efforts. A dedicated website www.scienceweek.ie provides valuable resources for those getting involved.

In 2006 DSE became Gold Partners at the BT Young Scientist & Technology Exhibition with an interactive stand, exploring the world of robots. The exhibition is the biggest of its kind in the country. For more information visit: www.btyoungscientist.ie.

DSE places advertisements and editorial in publications such as student handbooks, career directories, education reference guides, national newspapers, Irish science magazines and the Institute of Guidance Counsellors yearbook so as to reach young people and their key influencers. DSE's main website www.science.ie provides live newsfeeds on science-related topics, a comprehensive directory of industry and education links, career profiles, science-related news articles and an ongoing diary of science and engineering events happening in Ireland.

- **Year of the Researcher 2005**

The aims of this European Commission-backed initiative were to

- Promote a better public understanding of the contribution of researchers in society, in terms of innovation, job creation, competitiveness and economic growth,
- Encourage more young people to embark on careers in R&D and contribute increase the number of researchers in Europe.

Activities included a major European conference on the key issues in Ireland in November 2005 and national events such as "Save the Robots" And "Cabinets of Curiosity".

Progress has been made on a range of recommendations made by the Task Force on the Physical Sciences including:

- Academic curricula

€3m was issued to primary schools to support a new science curriculum in 2003. In secondary schools, revised science syllabi have been introduced at Junior Certificate level and for Leaving Certificate physics, biology and chemistry.

The Discover Primary Science site www.primaryscience.ie hosts over 30 activities supporting the SESE science curriculum. A Teachers Area for registered teachers, links to Discover Centres and relevant websites, as well as information on the programme as a whole are also available at the site. Teachers are offered training and issued school resource packs. DSE is currently developing a number of pilot projects at second-level, including Junior Science Investigator, Transition Year project blogs and technology careers resources for Leaving Certificate (with STEPS to Engineering).

- Teaching and use of ICT

A grant scheme of €12m was established to re-equip schools opting into the revised Junior Certificate science syllabus.

ICT integration projects in teaching and learning have been provided under the Schools IT Initiative.

DSE, through its projects, encourages its audiences, including teachers, to actively use the internet for registration, news updates etc. It also promotes programme content for its projects via the internet.

- Reducing gender and ethnic minority gaps

The Gender Equality Unit at the Department of Education and Science is working in this area.

DETE, through Science Foundation Ireland, has launched a €1m fund to promote greater female participation in research careers and to enable women to return to research careers.

DSE provides careers and lifestyle information through its television programme and by actively promoting career opportunities in science and engineering for young people at second level.

- Funding for PhD and Postdocs

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. The Group's reports (available at www.egfsn.ie) include recommendations on the need for more highly trained personnel to meet the demand of the high-tech sectors that the Government is seeking to nurture.

Some progress has been made on this: annual output of PhDs in SET disciplines will have increased by 60% to over 500 annually between 2002 and 2006. The OECD Review of Higher Education (September 2004) recommended that Ireland double the number of PhD students by 2010. A commensurate increase in the number of Principal Investigators/ leading researchers will be required.

This will involve concerted effort from all involved, including Science Foundation Ireland, the HEA and the two research councils (Irish Council for Humanities and Social Sciences and Irish Council for Science, Engineering and Technology). An essential dimension of this is ensuring that support is channelled into areas of strategic importance to Ireland.

2. Please describe recent policy changes to enhance the international mobility of scientific and high-skilled personnel, including programmes to attract foreign (and expatriate) talent and encourage students/workers to gain international experience. Consider such policies as:

- Changes in immigration legislation;
- Funding of scholarships, grants for international mobility of students/scholars;
- Creation of special positions at universities or public research centres;
- Fiscal incentives (*e.g.*, income tax breaks) for foreign workers
- Programmes to promote return migration of expatriate students, scientists and engineers
- Other measures:

Please check the boxes above to indicate the types of policies used and provide more detail information here:

In May 2004, the Irish Government granted immediate access to the Irish labour market for workers from the 10 then accession states of the European Union. Based on work carried out by the Expert Group on Future Skills Needs (“Skills Needs in the Irish Economy: the role of migration”), legislation is currently passing through Parliament on a skilled migration policy.

The Department of Justice launched a consultation process for a new Bill on Immigration in 2005. Stakeholders have been working to find and implement a common position with respect to third country researchers and their families.

Science Foundation Ireland operates a number of initiatives aimed at attracting researchers and research groups to Ireland who are capable of developing high-impact, internationally significant discoveries in the fields underpinning biotechnology and ICT.

A number of international networks are in place to re-connect expatriates with Ireland and to alert them to the increasing attractiveness of the research environment here, *e.g.* Enterprise Ireland’s Biolink USA initiative.

An EU-backed initiative is establishing a European Network of Mobility Centres to remove obstacles to the mobility of researchers. DETE supports the IUA to operate Ireland’s national mobility centre and portal. The Centre provides assistance to researchers wishing to pursue careers in academia and industry.

3. Please describe recent policy efforts to foster development of specific skills other than S&T skills needed to foster innovation in a knowledge-based economy (*e.g.*, management, communication, legal), notably as relates to the service sector.

Response:

As well as fostering R&D skills, Enterprise Ireland, Fas and others are working to enhance public support for training and development for companies on skillsets including:

- International selling,
- Management capability.

4. Please describe any major shifts or changes in the priorities and mix of instruments used for developing human resources for innovation, e.g., between development of domestic talent versus attraction of foreign talent; between development of S&T skills and non-S&T skills; between stimulation of demand and development of supplies; between support for teaching and support for research; etc.

Response:

There is clear recognition in Ireland of the imperative to develop human capital for the knowledge economy. The most significant trend is intensified activity in this area. This will continue and translate into further actions. Within these, an appropriate balance will be sought within each of talent sources (domestic, foreign), skills required (S&T, non-S&T) and resources for training and education.

5. Looking to the future, what are the main changes anticipated in the supply and demand for human resources, and what are the main policy challenges that policy makers will need to address? Please describe any efforts being made to identify future challenges or develop future policy directions.

Increased demand for human resources will become more apparent as the economy becomes more innovation-driven and R&D intensive. In order to meet the targets set out in Ireland's R&D Action Plan, steps will be taken to

- Build up a sustainable system of world class research teams in terms of people and supporting infrastructure,
- Double our output of top level postgraduates.

One of the imminent policy priorities is to identify skills and technology areas in which postgraduate numbers should be grown – based on the future requirements of existing and potential industry in Ireland.

Supply issues that will be addressed include:

- A decline in the internal supply of human resources due to demographics.
- A consequent increased reliance on migration,
- Overcoming gender imbalances.

These are being considered and progressed by, among others, the EGFSN and the Gender Equality Unit at the Department of Education and Science.

Section G: Policy evaluation

1. Please describe recent changes in policies regarding ex-ante or ex-post evaluation of innovation policies and programmes, including new legislation or regulations, methodologies employed, criteria considered and the organisations/institutions that perform the evaluations.

Response:

The substantial increase in public funding of R&D under the NDP and the establishment of new R&D funding channels, e.g. Science Foundation Ireland, has led to an increased awareness of the need for ongoing evaluation of the innovation system: researchers, institutions, programmes, overall policy directions and the system.

An Expenditure Review of Science and Technology expenditure was recently undertaken building on three evaluations of specific aspects of the system and drawing them together to assess the overall level of activity and outputs.

There have been no significant recent changes which are specific to the evaluation of innovation policies and programmes but the Department of Finance has updated the capital appraisal guidelines recently. Under the capital investment framework, Departments must submit annual reports on capital investment identifying the expenditure made at programme level, the objectives, targets, outputs and outcomes.

2. Please describe recent changes in policies regarding the evaluation of public research organisations, including legislation or regulations requiring evaluation, methodologies employed, criteria considered and the organisations/institutions that perform the evaluations.

Response:

The OECD recently completed a comprehensive review of the higher education sector in Ireland. Its brief covered:

- The role of higher education,
- Strategic management and structure,
- Teaching and learning,
- Research and development,
- Investment and financing,
- International competitiveness.

The report is available at:

http://www.education.ie/servlet/blobServlet/oeed_review_national_policies_education.doc?language=EN

3. Please outline any significant changes in the priority given to evaluation in innovation policy, including the motivations for such changes and anticipated effects. Please include information about additional resources being invested in evaluation and approaches used to ensure that results of evaluation feed-back into policy making.

Response:

Evaluation is a complex and vital piece of work. Consequently, it is approached in a careful manner with substantial thought being put into how reviews are undertaken, for example the Expenditure Reviews conducted by the Department of Finance in co-operation with other Departments have been recently supported by training and clearer guidelines. Evaluation of STI policy has been an active area in Ireland for some time. Evaluation will come into play even more as investment in the area increases and matures, with questions about value for money and achievement of intended outcomes (i.e. efficiency and effectiveness) at the top of the list.

4. Please provide information or web-links, if available, about the outcomes of recent major evaluations of R&D or innovation policies.

Response:

Some of the major recent evaluations can be found on the Forfas web site:

- Evaluation of Supports for RTDI Collaboration (June 2004):

http://www.forfas.ie/publications/forfas040622/webopt/forfas_rtdi_040622.pdf

- Evaluation of Agency Supports for In-Company R&D (October 2004, May 2003):

http://www.forfas.ie/publications/forfas041025/webopt/forfas_rdevaluation_041025.pdf

http://www.forfas.ie/publications/forfas030509/webopt/forfas_ida_rd_030509.pdf

- Evaluation of the First Years of Science Foundation Ireland (December 2005):

http://www.forfas.ie/publications/forfas051215/webopt/forfas051215_sfi_evaluation_report_webopt.pdf