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**Monitoring and analysis of policies
and public financing instruments
conducive to higher levels of R&D investments
The “POLICY MIX” Project**

Country Review Ireland
[final draft]

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Introduction and Policy mix concept

The policy mix project

This report is one of the 31 country reviews produced as internal working papers for the research project “Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments” (Contract DG-RTD-2005-M-01-02, signed on 23 December 2005). This project is a research project conducted for DG Research, to serve as support for policy developments in Europe, notably in the framework of CREST activities. It does not form part of the ERAWATCH project, but the working documents are made available on ERAWATCH webpages for the purpose of steering a debate on the policy mix concept.

The “Policy Mix” project is run by a consortium of 7 partners:

- UNU-MERIT (The Netherlands), consortium leader
- Technopolis (The Netherlands)
- PREST – University of Manchester (United Kingdom)
- ZEW (Germany)
- Joanneum Research (Austria)
- Wiseguys Ltd. (United Kingdom)
- INTRASOFT International (Luxembourg).

Each country review is produced by an individual author, and provides expert’s view on the policy mix in the country. This report is not approved by the Commission or national authorities, and is produced under the responsibility of its author.

The role of country reviews is to provide an exploratory analysis of the current policy mixes in place in all countries and detect the most important areas of interactions between instruments as well as new modes of policy governance that are particularly adapted (or detrimental) for the building of policy mixes. They provide analytical material for the analysis of the policy mix concept and its implementation in Europe. This material will be used as background for further reports of the project and for the construction of a tool for policy-makers (to be made available in late 2007 and 2008).

The policy mix concept

The country reviews are based on the methodological framework produced by the consortium to frame the “policy mix” concept. They have been implemented on the basis of expert assessments derived from the analysis of National Innovation Systems characteristics and policy mix settings, using key information sources such as Trendchart and ERAWATCH reports, OECD reviews, and national sources, among which the National Reform Programmes.

In this work, the “policy mix for R&D” is defined by the consortium as: **“the combination of policy instruments, which interact to influence the quantity and quality of R&D investments in public and private sectors.”**

In this definition, policy instruments are: “all programmes, organisations, rules and regulations with an active involvement of the public sector, which intentionally or unintentionally affect R&D investments”. This usually involves some public funding, but not always, as e.g. regulatory changes affect R&D investments without the intervention of public funds.

Interactions refer to: “the fact that the influence of one policy instrument is modified by the co-existence of other policy instruments in the policy mix”.

Influences on R&D investments are: “influences on R&D investments are either direct (in this case we consider instruments from the field of R&D policy) or indirect (in that case we consider all policy instruments from any policy field which indirectly impact on R&D investments)”.

Structure of the report

The report is structured along the following questions.

First, in section 1, and in order to place the policy mix in context, the general challenges faced by the National Innovation System (NIS) are analysed by the expert. The view is here not restricted to the challenges with regard to raising R&D investments, but rather encompasses all the conditions that directly or indirectly affect the functioning of the NIS and R&D expenditures. These context conditions are very important for the discussion of the relevance of the policy mix later on.

Second, the stated main objectives and priorities of R&D policy in the country are spelled out in section 2, as well as their evolution over the last ca. five years. This discussion is based on White Papers and official documents, i.e. on published policy statements. The reality of these objectives compared to actual working of policy instruments will appear in section 5.

The third section provides an expert assessment and critical analysis of a possible gap or convergence between the NIS challenges and the main policy objectives and priorities stated before.

Section 4 presents the policy mix in place, following the above definition, i.e. policy instruments affecting R&D activities in the private and in the public sector, either directly for instruments from the R&D policy domain, but also indirectly for instruments outside the R&D domain which are of particular relevance to R&D activities. A typology of instruments is used, to categorise the R&D-specific and non-R&D specific instruments. A short description of each instrument is provided: aim, nature, target group, budget.

Then, section 5 discusses whether there is a gap between the main policy objectives and priorities stated in section 2, and the instruments in place. This is done by

comparing the set of objectives with the set of instruments at work. When individual evaluations of programmes or policy instruments are available, their results are used if they shed light on contribution of these instruments towards the policy objectives.

Section 6 discusses the orientation of the policy mix, indicating priorities amongst various possible routes to increase R&D investments. Policy instruments are categorised under 6 different routes according to their relevance, and this categorisation is followed by a discussion on the range of instruments affecting each route, missing instruments, routes that are not addressed by instruments, possible redundancies or overlaps, etc.

Section 7 provides another view on the policy mix, focusing on the relative importance of each types of instruments. The aim is to get a picture of the policy mix, the balance between (sets of) instruments, and the relative weight between them.

From section 8 onwards, the review turns to the crucial question of policy governance. That section discusses the emergence of the policy mix through examination of the following question: how did the set of R&D policy instruments arrive ? What is the rationale behind them, what were the driving force behind their establishment, and how is this evolving recently. A crucial question relates to the existence of some consideration of possible interactions when establishing new or suppressing existing instruments. The section tries to establish whether the policy design process is incremental or radical, analytical or non-analytical. From this, that section discusses if the policy mix is a “construct” or an “ex post” reality.

The next section, section 9, focuses on the governance of the system of R&D policy instruments take place. It examines the key question of interactions, i.e. whether there is a form of co-ordination between R&D policy and policy instruments from outside the R&D domain, and the existing mechanisms that favour or hinder such interactions.

The final section, section 10, deals with the core question of the policy mix concept: it endeavours to discuss interactions between policy instruments to affect R&D expenditure. The section discusses possible positive, neutral and negative effects of R&D policy instruments; both within the R&D policy domain, but also with instruments from other policy domains. In most cases, this takes the form of hypotheses rather than hard evidence.

Feedback welcome

Feedback on this report is gladly received. Individual country reports will not be updated but discussion on policy mixes is welcome during the timeframe of the study (2006-2008). Please send your comments to:

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1. National Innovation Systems Challenges

The 1996 *White Paper on Science, Technology and Innovation* set out a completely new context for science, technology and innovation policy in the Republic of Ireland. The introduction to the White Paper itself acknowledged that “for much of the period since the foundation of the State, Science and Technology (S&T) has been very much ignored and neglected” (White Paper, 1996, p1). Though some attempts had been made in the 1970s and 1980s to improve the co-ordination of S&T activities and to better harness these towards social and economic goals (see for instance Yearley, 1995 for the history of these developments) the period following partition can be characterised as one of a lack of both supply and demand: domestically owned industry was dominated by small companies in traditional sectors and neither conducted nor used R&D whilst Irish subsidiaries of the international companies increasingly attracted to the country obtained their technology from the parent company and thus R&D done abroad. Universities were largely focused on teaching with little funding for research available: what public funds were expended were largely spent on applied agricultural research mostly conducted outside the university sector.

From the late 1980’s the success of an economy increasingly characterised by high levels of external trade and foreign direct investment (FDI) arguably reinforced the perception that Ireland could ‘buy in’ technology and innovation from overseas. Some political economy commentators dispute the extent to which Ireland’s economic success was the result of a move towards a ‘competition state’ in which all government action is taken in the context of global market disciplines and away from the model of a ‘developmental state’ actively intervening in social and economic affairs in order to promote policy goals but in any case it must be recognised that the Irish economy was – and is – one of the most open (in trade terms) of the OECD member states (Smith, 2006). However by the late 1990’s confidence had turned to concern over the possibility that fleet-of-foot international companies which account for much high-tech activity in Ireland could move out just as easily as they had moved in and that expected impacts of FDI in enhancing the indigenous innovation system had thus far failed to materialise (Pontikakis et al, 2005). The Tierney Report on Science, Technology and Innovation which preceded the 1996 White Paper noted that Ireland had effectively failed to develop an indigenous ‘national system of innovation’. Tierney and the White Paper represent the Irish manifestation of a more general trend towards the uptake in policy rationales of the concept of ‘innovation system’ influenced by promotion of the concept by the OECD and perhaps also by the earlier uptake of systems rationales in the 1993 UK White Paper *Realising Our Potential*. As with *Realising Our Potential*, the 1996 Irish White Paper explicitly links policy for science and technology, including policy for basic research and policy for scientific skills development, with economic competitiveness rationales.

Since the publication of the White Paper the institutional set up for the governance of science, technology and innovation in the Irish system has been transformed and indeed continues to evolve. New funds and funding bodies have been created, new advisory groups formed and systematic planning and prioritisation processes have been established. Overall R&D spending increased three-fold during the 1990s but is

still below the EU average at 1.4% of GNP. The 2004 R&D Action Plan *Building Ireland's Knowledge Economy* restates the priorities of Irish STI policy, with the overall goal being 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”.
(*Building Ireland's Knowledge Economy*, p18)

Four key innovation policy challenges facing Ireland today can be identified as follows:

Challenge 1: Building the research capacity of the public sector research base

The 1996 White Paper accepted the importance of basic research in underpinning areas of strategic national importance and in training and retaining a pool of highly-skilled researchers to strengthen the research capacity of the innovation system more generally. The White Paper acknowledged the need to improve the status of research activities in the third level sector and pointed to the lack of an equivalent system for the funding of basic research to the research councils seen in many other countries. At this point the only significant source of funding for research in the third level sector had been EU Framework programmes and Irish researchers were successful in ‘punching above their weight’ in winning FP funding - but the level of research which could be carried out in the sector was limited by serious shortcomings in the research infrastructure in third level institutions and public sector research establishments.

The 1996 White Paper acknowledged this situation and committed the State to raising the level of public funding for basic and strategic research “as resources permit”. Though the White Paper contained no specific proposals on basic research funding other than this broad commitment, the creation in 1998 of the **Programme for Research in Third-level Institutions** (PRTLTI, part funded by the Government and partly by Atlantic Philanthropies, a US based philanthropic organisation and managed through the Higher Education Authority) and a new **Science Foundation Ireland** (SFI) marked the beginning of a transformation in the fortunes of basic research in the Irish Republic (Trend Chart Annual Report on Ireland, 2006).

The competitive PRTLTI scheme has to date awarded €605 million in large grants aimed at improving the research capacity – including research infrastructure - of third level institutions, establishing more than 20 major research centres of more than € million each. The scheme was suspended for a year in 2002, due to fiscal constraints, but was subsequently reinstated after public criticism of the decision. SFI was formed as part of the National Development Plan (NDP) 2000-2006, which committed €2.48 billion to R&D and which specifically set aside €648 million to focus funding on the twin priority areas of ICT and biotechnology identified by the national Technology Foresight programme in 1999. The Foundation formed as a result of this initiative has since spent more than €300 million supporting research projects and establishing six new collaborative centres in science, technology and engineering (CSETS) to

promote joint working between leading researchers and leading firms. Outside the priority areas two research councils were established covering science and engineering subjects (**Irish Research Council for Science, Engineering and Technology, IRCSET**) and humanities (**Irish Research Council for the Humanities and Social Sciences, IRCHSS**) respectively. The NDP also boosted funding for research in the public sector research establishments including the Marine Institute and Teagasc, the large, multi-institute food and agriculture research and advisory organisation. As a result the previously largely applied research effort in this area has been steered a little more towards basic and strategic research. Most recently in December 2005, the Government announced a €900 million capital programme for the third level sector.

The R&D Action Plan *Building Ireland's Knowledge Economy* states as a target that GERD should increase from 1.4% of GNP in 2001 to 2.5% by 2010. R&D investment in the HE sector, through initiatives such as those described above, has risen from €22 million in 2002 to €492 in 2004, a 53% increase. The growth of HERD to around 0.4% of GNP (compared to an EU-15 average in 2004 of 1.25%) accounts for much of the increase in GERD seen thus far. Evaluations of PRTL and SFI have both been positive, and the challenge for Ireland now is to capitalise upon the improvements in public sector research capacity achieved thus far and better harness that capacity towards addressing the other key challenges facing Irish innovation policy.

Challenge 2: Increase the R&D and innovation intensity of business enterprises

It has already been emphasised that building an indigenous innovation system has been the overriding goal of Irish innovation policy over the past decade or more. Key to this is raising the innovation intensity of Irish enterprises. BERD data show that business R&D spending is indeed growing rapidly, though from an extremely low base. However the growth in R&D spending has broadly kept pace with the overall growth in the economy, meaning that R&D intensity of the Irish economy has remained just below 1% of GNP. The R&D Action Plan *Building Ireland's Knowledge Economy* states as a target that BERD should rise from €17 million in 2001 to €2.5 billion by 2010, reaching 1.7% of GNP by 2013. The Action Plan also emphasises the need to strengthen private sector R&D capacity, currently concentrated within a relatively small number of enterprises, with a target to triple the number of enterprises operating significant R&D activities (defined as R&D greater than €2 million) to 250 by 2013.



Figure 1: BERD in Ireland (1993-2001)

Source: Science and Technology in Ireland (Forfás 2004)

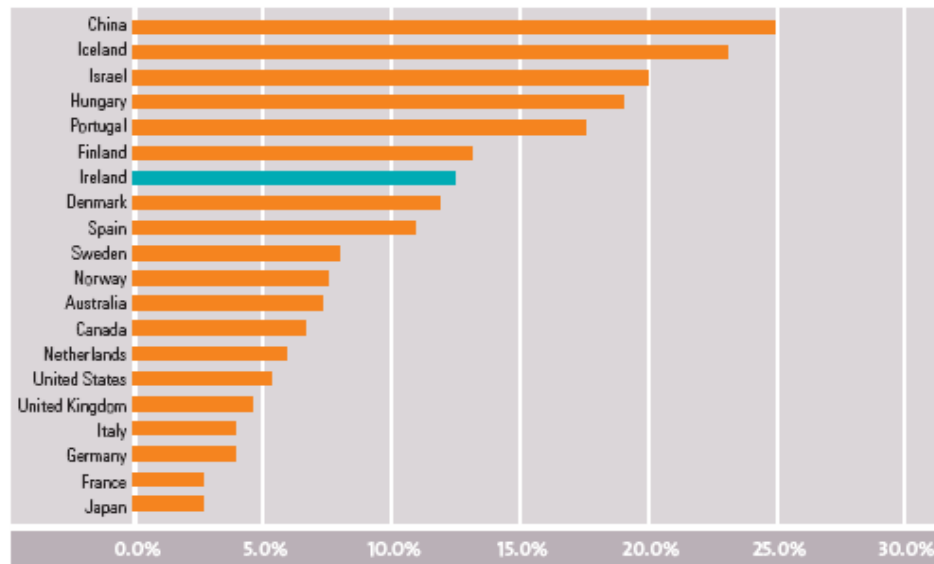


Figure 2: Average Annual BERD Growth Rate (1993-2003)

Source: Forfás Annual Report 2005

Challenge 3: Improve business-academic links

Almost inevitably this challenge follows on from the first two: if key goals are to strengthen public sector research capacity and to raise the innovation intensity of Irish enterprises then better linking – or at least articulating – supply and demand is likely to follow as a further objective. Much of the effort of Irish STI policy over the past decade or so has been to build capacity in the institutions making up the Irish NIS, with a focus on the supply of knowledge and skills (research and education capacity in the third level sector) on the one hand and on co-ordination (governance capacity) within the system on the other. To illustrate, one issue identified by the 2003/4 review of the PRTL scheme was the need to instil an ethos of commercialisation into the new centres funded by the scheme. However, a recent policy statement by the

Minister with responsibility for S&T identified a priority need to promote strong collaborative links between industry and the third level sector and to create a pro-commercialisation culture in third level institutions. One recent policy response has been the establishment of the Industry-led Research Networks initiative, piloted by Enterprise Ireland with six initial networks. The aim of the initiative is to allow small groups of companies with complementary research needs to come together as a network, identify specific research needs and work with third level institutions to meet those needs. An all-island initiative INNOVA is another pilot programme aiming to promote firm-to-firm collaboration and the diffusion of technology within the island of Ireland with support by research institutions where necessary. The initiative is managed by the cross-border body InterTradeIreland, whose role it is to promote trade between Northern Ireland (part of the United Kingdom) and the Republic of Ireland.

Challenge 4: Matching future skills needs and improving the supply of high quality labour

The R&D Action Plan *Building Ireland's Knowledge Economy* states as a target that the number of researchers should increase from 5.1 per thousand (of total employment) in 2001 to 9.3 per thousand by 2010. In late 2005 the Government announced a new Strategic Innovation Fund (SIF) worth €300 million to 2010, and focused on enhancing the quality of higher education provision through innovation in teaching delivery, improvements in access to higher education, etc.

With the expansion of third level provision in Ireland over the past two decades or so higher education participation rates have grown and Ireland performs well by OECD standards, with 55% of the cohort participating by 2003. Furthermore the proportion of science and engineering graduates as a percentage of all graduates in Ireland is, at 35%, the highest for 16 OECD countries and much higher than the EU average of 26% (see Figure 4). However, it should be noted that whilst in most other countries engineers outnumber scientists, in Ireland the reverse is the case.

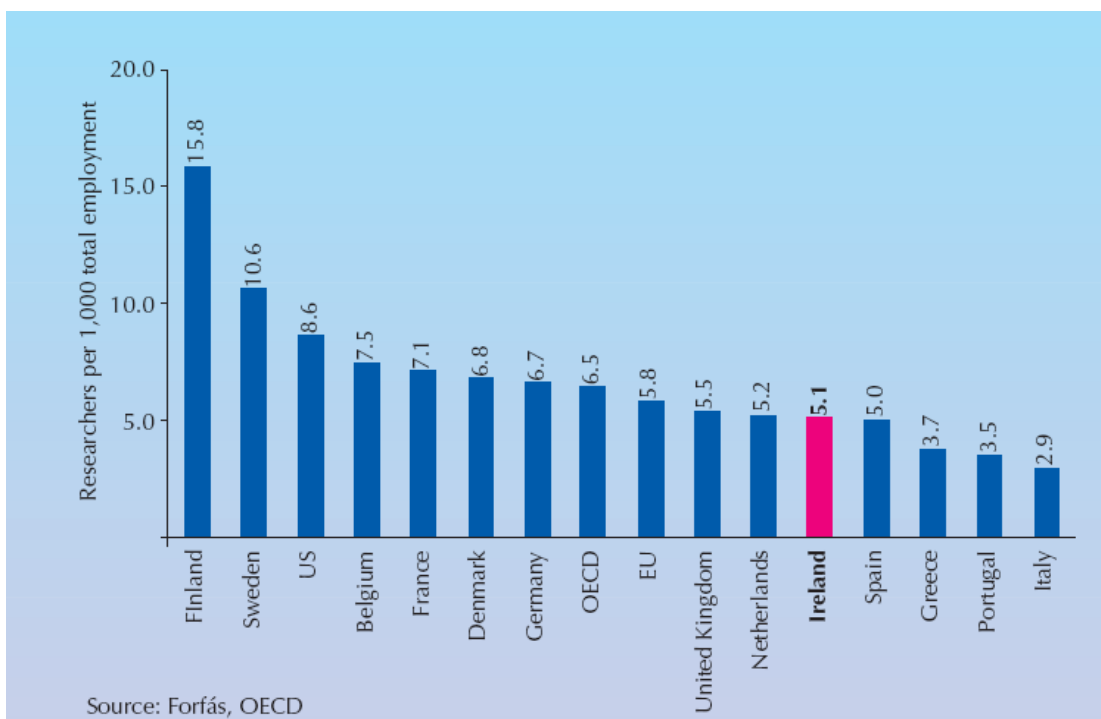


Figure 3: Researchers per 1,000 Total Employment (2001)
 Source: *Building Ireland’s Knowledge Economy (IDCSTI, 2004)*

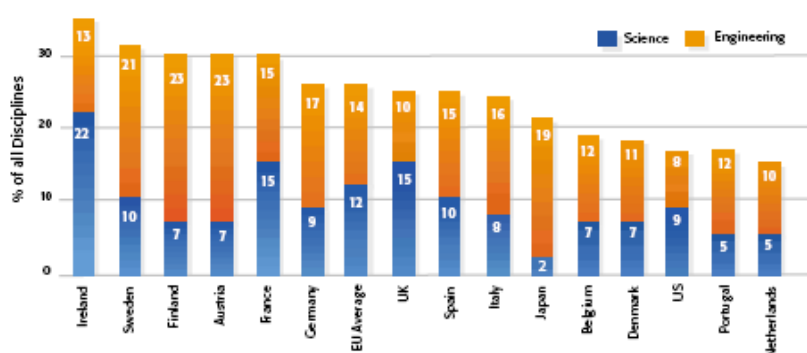


Figure 4: Science & Engineering Third Level Graduates (including PhDs & Masters) as a Percentage of All Disciplines (2000)
 Source: *Science and Technology in Ireland (Forfás 2004)*

Ireland has the lowest unemployment rate of any EU member state, at around 4.3% in 2006. Some of the success of the Irish economy as a site for FDI can be ascribed to the combination of an unusual demographic situation for a Western European developed nation, high standards of general education and of course relatively low wages. As a result Ireland had the competitive advantage of a young, well-educated, English-speaking workforce. As Ireland’s demographic situation normalises relative to other countries recent employment growth has been driven by increased participation in the workforce and, especially, by immigration from the new Member States of the EU. Accordingly the emphasis on education and training at the third level is expanding to consider lifelong learning, promoting increased participation in

the workforce by women and the economically inactive and on the provision of technical skills in the enterprise sector, including consideration of a skills-based migration policy. As far as workplace skills are concerned, the EC Continuing Vocational Survey suggests that Irish companies actually compare well in terms of the provision of employee training.

2. Objectives and priorities of R&D policy

The most recent restatement of the R&D related policy objectives of the Irish Republic is the *Science, Technology and Innovation Strategy 2006-2013*. The document outlines six themes or broad objectives, but for the purposes of this discussion we can consider three of these themes to be major R&D or innovation policy related priorities with the remaining three – whilst remaining important public policy goals in their own right – supporting priorities. These STI or R&D policy priorities can be considered alongside the broader goals of Irish public policy in connection with the Lisbon agenda, as stated in the recent National Reform Programme document for Ireland. The relevant NRP goals are as follows:

- To promote, protect and enhance competitiveness
- To increase R&D investment, capacity and output
- To encourage greater innovation and entrepreneurship across the enterprise sector
- To focus on education and training, including lifelong learning, to develop a high skilled, innovative and adaptable workforce for the knowledge economy

The over-riding vision outlined in the *Strategy* is that “Ireland by 2013 will be internationally renowned for the excellence of its research, and will be to the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture”.

The “top 3” priorities are as follows:

1. Promoting World-class research

This goal focuses on improving the research capacity of the public sector science base, and on raising the quality of research done and the volume of outputs with a focus on doctoral training, university reform and generally more focus on improving the management of research and innovation environments including the wider public research system outside the HEI/third-level sector. There are two subsidiary goals identified by the document:

- a. Building a sustainable system of world-class research teams across all disciplines
- b. Doubling the output of PhDs from the Irish system

2. Capturing, protecting and commercialising ideas and knowhow

This goal focuses on raising awareness of the importance of IP protection, knowledge transfer and commercialisation in the public sector S&T base, with the aim of strengthening institutional processes and promoting academic-industry collaboration.

3. Harnessing R&D for enterprise, innovation and growth

Unlike the first two goals, this goal is focused on the private sector, and has the aim of bringing about “a transformational change” in company attitudes to R&D in order to achieve the target of raising BERD to €2.5 billion by 2013. As well as changing attitudes to R&D and innovation, the strategy emphasises the need to build the absorptive capacity of enterprises by raising the level of technical skills in firms not currently engaged in significant R&D activities. The strategy also notes the need to simplify and regionalise the system of R&D grants to enterprises in order to promote higher take-up of such grants, and promises a review of fiscal incentives to perform R&D.

The remaining priority themes identified in the strategy can, for the purposes of this report, be considered as horizontal themes which are broadly supportive of the three priorities listed above. These are:

4. To strengthen science education in schools and at Third Level
5. To better mobilise mission-oriented government research budgets (whether performed in public sector research establishments or in Third Level institutions) in support of social and economic goals
6. To promote all-Island and international S&T collaboration

Recent evolution of policy objectives

The current goals or priorities of Irish R&D and innovation policy are broadly consistent with the overarching policy priority advanced since the 1996 White Paper, namely to create new sources of competitive advantage for the Irish economy based around knowledge and innovation. Early policies and the 2000-2006 National Development Plan emphasised the need to build up public sector research capacity and infrastructure, and this remains a major feature of the current portfolio of objectives, though with more emphasis on reform and on the wider public sector science base as well as the third level sector. However there also seems to be greater emphasis now on the problem of linking the public sector research capacity with the enterprise sector through better commercialisation and more active collaboration, and on improving the research capacity of the private sector. A further significant policy trend which is not captured in formal priorities has been the recent emphasis on improving the co-ordination and governance of the NIS and especially on improving the processes through which STI policies are formulated (see Section Nine for further commentary on this process).

3. Coherence between NIS challenges and R&D objectives and priorities

As can be seen from the table below the restated objectives of Irish STI policy as documented in the *Strategy* and *National Reform Programme* do seem to map well onto the challenges identified earlier in this report. However, it will be necessary to examine how policy implementation emphasises the different priorities, and specifically to explore the array of instruments and policy measures comprising the broader policy mix, in order to evaluate how closely the challenges are in fact being addressed. As has already been noted, and will be discussed again in Section Five, much of the emphasis of policy action over the past decade or so has been on the supply side. Dealing with the demand side is far more problematic and Ireland would not be alone if there proved to be a mismatch between the challenges facing the country and the mix of instruments and measures applied to meet those challenges. The Irish NIS also has some unusual characteristics which present particular challenges for policy makers: for instance Ireland does very well on some indicators of progress on the Lisbon agenda, especially around employment and education, yet scores very badly on many R&D and innovation indicators.

Table 1: Matching challenges to policy objectives and priorities

Challenges	Objectives/priorities
Building the research capacity of the public sector research base	“World-class research”
Increase the R&D and innovation intensity of business enterprises	“R&D for enterprise, innovation and growth”
Improve business-academic links	“Capturing, protecting and commercialising ideas and knowhow”
Matching future skills needs and improving the supply of high quality labour	“World-class research (emphasis on graduate and post-doctoral training)” “To focus on education and training, including lifelong learning, to develop a high skilled, innovative and adaptable workforce for the knowledge economy [NRP]”

4. Composition of the policy mix for R&D

4.1 Policy measures targeting the public sector

These tend to be oriented towards building and sustaining research capacity in the third level sector (i.e. in HEIs). These are typified by two major initiatives funded under the National Development Plan, namely the **Programme of Research in Third-Level Institutions** (PRTLTI) and **Science Foundation Ireland** (SFI). The competitive PRTLTI scheme has to date awarded €605 million in large grants aimed at improving the research capacity – including research infrastructure - of third level institutions, establishing more than 20 major research centres of more than €5 million each. The scheme was suspended for a year in 2002, due to fiscal constraints, but was subsequently reinstated after public criticism of the decision. SFI was formed to focus significant (more than €600m) funding on the twin priority research areas of ICT and biotechnology. SFI has so far spent more than €300m awarded project grants and established six new collaborative centres in science, technology and engineering (CSETS) to promote joint working between leading researchers in the public sector research base and leading firms. The former Basic Research Grants Scheme of Enterprise Ireland, which provided modest grants to researchers, was transferred to SFI after several years under the administration of the IRCSET (see below). The Scheme now seems to have become subsumed into the investigators schemes of SFI.

Outside the priority areas two research councils were established, the **Irish Research Council for Science, Engineering and Technology** (IRCSET) and the **Irish Research Council for the Humanities and Social Sciences** (IRCHSS) respectively. The councils provide individual support for research primarily through fellowships for post-graduate researchers and academics rather than through significant project grants.

The long-standing Programmes of Advanced Technology (PATs) have been replaced with the **Advanced Technologies Research Programme**, which has the objective of supporting strategic research of relevance to Irish industry in HEIs. The aim is to generate new technologies, products or processes that could provide the basis of new companies or otherwise raise the competitiveness of Irish industry, though only HEIs are eligible to apply for funding.

Attention is increasingly shifting towards the wider public sector, with new investment in more mission-oriented/sectoral public research capacity and associated reform of non-HEI public sector research establishments. The NDP had also boosted funding for research in the public sector research establishments including the **Marine Institute** and **Teagasc**, the large, multi-institute food and agriculture research and advisory organisation and as a result the previously largely applied research effort in this area has been steered a little more towards basic and strategic research, with more of a focus on collaboration with HEIs.

4.2 Policy measures targeting both the public and private sector

Recent policy statements recognise that building public sector research capacity will not necessarily by itself increase the level of R&D and innovation in Irish enterprises. To this end the long-standing Enterprise Ireland Applied Research Grants Scheme - which funded applied research projects conducted by HEIs - has been replaced with the **Innovation Partnership Initiative**. This initiative requires collaborative proposals from an HEI (or HEIs) and an enterprise (or a consortium of enterprises). The proposed research must offer clear benefit to the collaborating enterprise or enterprises to be eligible for funding.

Another recent policy initiative is the establishment of the **Industry-led Research Networks** initiative, with six initial networks receiving pilot funding from Enterprise Ireland (co-financed by Structural Funds and, of course, some firm contributions). The aim of the initiative is to allow small groups of companies with complementary research needs to come together as a network, identify specific research needs and work with third level institutions to meet those needs. The budget allocated for each network is estimated by Trend Chart to be around the €1-2m mark. An all-island initiative **INNOVA** is another pilot programme aiming to promote firm-to-firm collaboration and the diffusion of technology within the island of Ireland with support by research institutions where necessary. This being a cross-border initiative the focus is on promoting cross-border collaboration, so at least one firm must be based in each jurisdiction. The initiative is worth around €6 million to 2008. A further all-island initiative **FUSION** is reminiscent of the long-standing Knowledge Transfer Partnerships/Teaching Company Scheme initiative of the UK. The scheme promotes three way partnerships and projects between an enterprise, an HEI or research centre and a high-calibre graduate recruited to work in the company and progress the project. The scheme began in 2002 and runs to 2007 with an overall budget of €13.6 million of public funding. There seems to be no explicit requirement for cross-border collaborations in this scheme.

A further recent focus of attention is commercialisation and IP protection. Whether in HEIs or in firms this activity is largely promoted by Enterprise Ireland. EI fund staff in the Technology Transfer Offices in HEIs, including the private Royal College of Surgeons in Ireland (RCSI). They also maintain a central advisory staff which is on hand to advise HEIs on commercialisation issues. In addition they manage new and existing programmes to promote commercialisation and IP registration such as the **TechSearch** scheme for enterprises (see below), the **Commercialisation Fund**, and the **Intellectual Property Fund** (targeted at protecting IP generated in HEIs), the **Competitive Fund for Technology Transfer in HEIs**. The Commercialisation Fund comprises a range of measures designed to further proof of concept or technology development projects in HEIs in areas of relevance to industry. Around €20m per year is allocated. A final phase of commercialisation revolving around market- and viability-testing is supported under the heading **Commercialisation of Research and Development (CORD)** which is in turn part of the **Campus Companies Programme**. This programme is aimed at generating spin-off companies from HEIs. A further actor **TecNet**, the collaborative alliance of the various Institutes of Technology, advises on and promotes commercialisation in that sector. Finally a small **Graduate Enterprise Programme** supports entrepreneurial HEI graduates at the earliest stages of starting their own businesses.

4.3 Policy measures targeting the private sector

Both Enterprise Ireland and IDA Ireland fund technology programmes which provide financial assistance to enterprises in engaging in R&D. The former promotes economic development generally whilst the latter concentrates on foreign investment. Some €5 million is dedicated per annum across the two agencies. The current instruments/measures are the shared **RTI Competitive Scheme** and the separate EI and IDA **Capability schemes**. The RTI Initiative is particularly directed at established companies planning to undertake their first R&D projects, and companies significantly developing their existing R&D activity. The funding support can be up to a maximum of €50,000 and projects can relate to either product or process development. A *competitive scheme* promotes R&D projects with expenditure more than €5,200 (budgeted at €300m for 200-2006) whilst projects with expenditure of less than this sum can be funded under a *non-competitive scheme*. Enterprise Ireland also encourages applications for significant R&D capital-related projects requiring a funding in excess of €3 million on an individual non-programme basis. This kind of tailor-made support could include the establishment of an R&D facility or a significant R&D project over a three-year timeframe.

The **IDA Capability Scheme** seeks to help companies establish or substantially expand their existing Irish R&D function, contributing to the capital costs of establishing an R&D unit (e.g. buildings, equipment etc.) in addition to the current costs of running the unit for a defined period. The development must represent a clear and substantial “step up” in a companies R&D activities in Ireland. Finally, the **TechSearch** scheme operated by Enterprise Ireland is a technology licensing and partnering service which operates across all industrial sectors and provides assistance and expertise to clients to licence technologies from international sources.

The *Science, Technology and Innovation Strategy* recognises the need to “join up” the various EI and IDA innovation support measures, and to this end a “virtual” structure, Technology Ireland, will be established to bring together the innovation promotion activities of Enterprise Ireland and IDA Ireland under the purview of the Office of Science, Technology and Innovation (OSTI) of the Department of Enterprise, Trade and Employment. The aim of this new development is to progressively “mainstream” (and at the same time simplify) the R&D support offerings of EI and IDA making innovation support a key element of overall firm support activities thus raising awareness of the importance of R&D and innovation. Consideration is also being given to removing the current requirement for eventual repayment in some schemes. A key aim, and the most difficult challenge, is to build private sector research capacity and here initiatives will seek to place experienced researchers, technologists and technology managers in firms, and will promote training for those already in firms. Technology Ireland will target all three target groups: new R&D performers, existing performers, and firms capable of making more sophisticated research efforts.

4.4 Regional policy measures

Up until 2000, Ireland had eight NUTS II regions which contributed to planning policy discussions and which implemented infrastructure developments. However decisions relating to STI were essentially centralised and most STI policy was also implemented by national agencies. In 2000, the country was divided into two new NUTS II regions to replace the previous smaller regions:

- The Border, Midlands and Western region (BMW) – an objective 1 region
- The Southern and Eastern region (S&E) – a region in transition

It is unclear to what extent this reorganisation was prompted by the need to protect objective 1 status for parts of the country threatened by the economic growth enjoyed by the south and east but certainly several other EU15 member states reorganised their regions with this in mind around the same time.

Both regions inputted into the National Development Plan process and, for the first time, modest regional innovation programmes were established (each programme accounted for less than 1% of total expenditure). The S&E programme concentrated on promoting rural competitiveness through pilot schemes for the application of ICT and through the promotion of knowledge transfer to rural SMEs. The BMW programme undertook an ‘innovation audit’ whilst at the same time promoting ICT and education & training related initiatives and conducting a regional foresight exercise. This programme is to be followed up by a new programme focused on raising R&D intensity and knowledge transfer within the region. These programmes are currently under evaluation as part of the broader evaluation of all regional programmes.

The creation of regions with the capacity (however limited) to formulate programmes related to innovation, coupled with the existence of cross-border, all-Island initiatives, demonstrates the emergence of a uniquely complex multi-level governance situation. The recent *Strategy for Science, Technology and Innovation* states that R&D support schemes for enterprises may be devolved to the regional level in order to make them more attractive and responsive to firms, suggesting that the dispersal of limited power and resources to influence R&D and innovation downwards may become more significant in the near future.

4.5 Policy measures outside the R&D domain

Health

The most significant R&D relevant policy domain is without a doubt health. The Department for Health and Children holds responsibility for the Health Research Board, a body which has become particularly pro-active in recent years in building capacity for health research and in raising the level (and the scale) of health research in Ireland.

Strategy for health research is laid out in the Department of Health and Children document *Making Knowledge Work for Health*, produced in 2001. Over the past few years expenditure by the HRB has increased dramatically – from €6.8 million in 1998 to over €21.3 million in 2002. As funds spent have increased, so has the scale of project supported – with the 2004 evaluation of the HRB project grants scheme indicating that the average size of project has increased since 1997 from around €2,000 to €138,000.

Making Knowledge Work for Health emphasised two overarching needs, one to better support project-based research and the development of new knowledge, and the other to improve the capacity to develop and apply knowledge within the Irish health system. Closely mapping onto these needs, the HRB supports research under two strands:

1. “Science for Health” supports investigator-led research in the health, life and social sciences that improves understanding of health and disease and contributes to the discovery of new or improved therapies. Priority is given to translational research which seeks to ensure new findings are ultimately applied to improved treatments and services.
2. “R&D for Health” targets funds at developing a structure within the Irish health system to support R&D in order to improve the application of knowledge to health problems and to make the health system more effective in achieving its goals

This second area in particular is a challenging priority for public policy, with particular challenges surrounding the question of how to enable clinicians within the health service to have a research career. A recent (2005) injection of €50 million over 5 years to promote research ‘for health and wealth’ has allowed progress to be made on building research capacity in translational research and in building clinical research capacity in the health system. A joint programme with the UK-based biomedical research foundation the Wellcome Trust (also in 2005) is intended to fund at least one protected translational research centre based in a hospital environment. However the *Strategy* recognises the challenge of continuing to build and sustain such capacity in a situation of severe constraints on the growth of health budgets.

Agriculture and Food

Agri-food is one of Ireland’s largest indigenous industries, employing approximately 170,000 people. The sector is important politically not least because the majority of enterprises are located outside the Dublin area. Levels of R&D in the sector are very low, with only a small number of larger companies having significant R&D activities which in many cases are located outside Ireland. Building the research capacity of the private agri-food sector is a major challenge for public policy. However the public research capacity in agri-food is strong with a long-standing public sector research and agricultural extension institute, Teagasc, increasingly complemented by research done in other institutions, especially the universities. Indeed the emphasis of recent Department of Agriculture and Food (DAF) funding policy has been to promote

collaborative research between these different agri-food research actors. Teagasc, which could formerly count on receiving most DAF research funding, has been encouraged to build collaborative links with university groups and to concentrate its funding on 'centres of excellence' more focused towards the biotechnology/biosciences end of agri-food research. This has been achieved by the progressive substitution of 'block' (core) funding with funds distributed by competitive programmes specifically designed to promote collaboration. In other words the proportion of DAF funding received by Teagasc as core funding has declined over recent years, with the shortfall being made up by increases in competitive DAF funding won. In addition Teagasc has been encouraged to seek additional funding via competitive programmes such as those of Science Foundation Ireland and the European Union. Another agency of DAF, COFORD, funds forestry research in Ireland. Finally the DAF has opened its own in-house agriculture and veterinary laboratories in direct support of its policy missions.

Environment and Marine

The Environmental Protection Agency (EPA), under the Department of the Environment, Heritage and Local Government, funds environmental research to generate the knowledge and expertise needed to protect and manage Ireland's environment. Under the NDP, €32m was allocated under the Environmental Research, Technological Development and Innovation (ERTDI) Programme. This includes the Cleaner, Greener Production Programme (CGPP), which is intended to promote more sustainable manufacturing and services. The EPA has also built co-operative funding links with other R&D agencies such as Teagasc, COFORD and the Marine Institute, and with third-level institutes (HEIs). On the latter front an Environmental Research Centre is being developed as a centre of excellence to improve research capacity within EPA (in collaboration with HEIs).

The Marine sector in Ireland supports some 44,000 direct and indirect jobs. As with agri-food the sector is characterised by small and micro-enterprises. Only about 10% of marine firms are actively engaged in R&D. The Irish Marine Institute provides competitive R&D funding (through the NDP) to SMEs and the marine research community. The Institute carries out research and works with marine researchers and groups in HEIs. As with agri-food and environment, the NDP has seen investment in research capacity and infrastructure in the marine area, with the construction of a new state-of-the-art facility to host the Marine Institute. There are also two research and services vessels for inshore and offshore work. The Institute is currently finalising a National Marine Research and Innovation Strategy for the period to 2013, drawing on the results of a major foresight exercise. The aims of the new strategy are to strengthen the competitiveness of the sector whilst supporting the transition of the sector (including marine tourism) to higher value added activities; to promote leading edge and interdisciplinary marine research; and to provide a knowledge base to underpin policy making.

Energy

Sustainable Energy Ireland (SEI) commissions significant energy research through NDP funds. In total about 130 energy research, development and demonstration (RD&D) projects were funded in 2005-6 (with a total value of around €25 million). This represents a significant increase on previous years. Research is also conducted in support of energy policy making. Agencies such as Teagasc, the EPA, the Marine Institute and Enterprise Ireland also fund relevant research whilst the Economic and Social Research Institute undertakes some work relevant to energy policy. A strategic review of energy RD&D in 2004 concluded that too much energy research was ‘stop-start’ in nature and not conducive to building a sustainable energy research capacity for Ireland. Hence current attention is on improving the co-ordination and alignment of energy research activities.

Table 2: Policy mix for R&D in Ireland

Policy categories	Policy instruments: short description and target group
R&D Domain	
R&D policy generic	<ul style="list-style-type: none"> • SFI – grants • SFI – centres (CSETS) • IRCHSS – grants and fellowships • IRCSET – grants and fellowships • Enterprise Ireland - Advanced Research Technology Programme (strategic research in HEIs) • Enterprise Ireland - RTI schemes (support for industrial R&D projects) • Enterprise Ireland – tailor-made support (support for large R&D investments) • Enterprise Ireland - Commercialisation Fund (technology development funding) • IDA R&D Capability Grant Scheme (R&D investments at Irish subsidiaries of foreign-owned companies)
R&D policy sectoral	<ul style="list-style-type: none"> • DAF - Agri-food Programmes • Marine Institute
R&D / Innovation policy – Linkage	<ul style="list-style-type: none"> • Innovation Partnerships scheme • Industry-led networks • INNOVA (InterTradeIreland – a cross-border all-island initiative) • FUSION (InterTradeIreland – a cross-border all-island initiative) • TecNet (Institutes of Technology) • Competence Centres (including CSETS)
R&D / Innovation policy – IPR	<ul style="list-style-type: none"> • Enterprise Ireland - TechSearch scheme for enterprises • EI - Commercialisation Fund • EI - Intellectual Property Fund • EI - Competitive Fund for Technology Transfer in HEIs • Enterprise Ireland support for Technology Transfer Offices (TTOs) in HEIs • TecNet (Institutes of Technology)
R&D specific financial and fiscal policy	<ul style="list-style-type: none"> • R&D tax credits
R&D specific education policy	<ul style="list-style-type: none"> • HEA - grant funding to third level institutions • HEA – PRTLTI
R&D specific employment policy	
Finance Domain	

Financial and fiscal policy	
Macroeconomic policy	
Human Capital Domain	
Education policy	• Funding for post-graduate research training (e.g. through IRCHSS, IRCSET)
Employment policy	
Innovation Domain	
Innovation policy generic	• Graduate Enterprise Programme
Innovation policy sectoral	
Other policies - industry	
Other policies - trade	
Other policies - defence	
Other policies – consumer protection	
Other policies – health and safety	• Health Research Board programmes
Other policies - environment	• Environmental Protection Agency • Marine Research Institute
Other policies – regional development	• Regional Innovation Programmes - BMW region • Regional Innovation Programmes – S&E region
Other policies - competition	
Other policies – social security	

5. Coherence between main policy objectives and priorities, and policy instruments

The link between the broad challenges facing the Irish NIS, the Government’s policy objectives and the instruments put in place to support the achievement of these objectives are presented in Table 3. As can be seen there seems to be good coverage of each challenge and objective with the possible exception of the final objective, “To develop a high skilled, innovative and adaptable workforce for the knowledge economy”. This objective, derived from the National Reform Programme statement for Ireland, is perhaps too recently-formulated to be expected to map onto multiple instruments. Instruments may still be in development. Alternatively a broader range of non-innovation instruments may be applicable and have not so far been identified.

Table 3: Challenges, policy objectives and instruments

Challenges	Objectives/priorities	Instruments responding to the challenge
1) Building the research capacity of the public sector research base	<ul style="list-style-type: none"> World-class research (building a sustainable system of world-class research teams across all disciplines) 	<ul style="list-style-type: none"> IRCSET/IRCHSS grants and fellowship schemes SFI – grants and fellowships SFI – centres (CSETS) HEA – block university funding HEA – PRTLTI EI – Advanced Research Technology Programme
	<ul style="list-style-type: none"> World-class research (graduate and post-doctoral training) 	<ul style="list-style-type: none"> IRCSET/IRCHSS grants and fellowship schemes SFI – grants and fellowships HEA – block university funding HEA - PRTLTI
2) Increase the R&D and innovation intensity of business enterprises	<ul style="list-style-type: none"> Capturing, protecting and commercialising ideas and knowhow 	<ul style="list-style-type: none"> Enterprise Ireland (EI) – TechSearch EI – Commercialisation Fund EI – IP Fund EI – Competitive Fund for TT in HEIs EI – HEI TTO support TecNet (Institutes of Technology)
	<ul style="list-style-type: none"> Harnessing R&D for enterprise, innovation and growth 	<ul style="list-style-type: none"> Innovation Partnerships Scheme Industry-led Networks InterTradeIreland – INNOVA InterTradeIreland – FUSION TecNet Competence Centres (– including SFI CSETS) R&D Tax Credits
3) Improve business-academic links	<ul style="list-style-type: none"> Capturing, protecting and commercialising ideas and knowhow 	<ul style="list-style-type: none"> Enterprise Ireland (EI) – TechSearch EI – Commercialisation Fund EI – IP Fund EI – Competitive Fund for TT in

		HEIs • EI – HEI TTO support TecNet (Institutes of Technology)
	• Harnessing R&D for enterprise, innovation and growth	• Innovation Partnerships Scheme • Industry-led Networks • InterTradeIreland – INNOVA • InterTradeIreland – FUSION • TecNet • Competence Centres (– including SFI CSETS) • R&D Tax Credits • Graduate Enterprise Programme
3) Match future skills needs and improving the supply of high quality labour	• World-class research (graduate and post-doctoral training)	• IRCSET/IRCHSS grants and fellowship schemes • SFI – grants and fellowships • HEA – block university funding • HEA - PRTLTI
	• To develop a high skilled, innovative and adaptable workforce for the knowledge economy	• InterTradeIreland – FUSION

Comments

As already noted there seems to be some degree of coherence between challenges, objectives and measures. However, considering the target groups for the measures identified here, it could be argued that there is still undue attention to the knowledge supply side of the NIS, at the expense of the demand side. Much of the attention of recent policy action in Ireland has been towards building up the public sector research base. The strategy has thus been science-led. Though there is now policy recognition of the need to refocus, with a range of new initiatives on commercialisation and HEI-industry links, in order to promote spillover from this research investment. However there are still relatively few measures that principally target the demand side for knowledge - the enterprise sector.

6. Policy mix instruments and target groups

See Table 4, below.

Table 4: Policy instruments and broad routes to increase R&D investments

Policy categories	Policy instruments	ROUTE 1: promote establishment of new indigenous R&D-performing firms	ROUTE 2: stimulate greater R&D investment in R&D-performing firms	ROUTE 3: stimulate R&D investments in firms non-performing R&D	ROUTE 4: attract R&D-performing firms from abroad	ROUTE 5: increasing extramural R&D carried out in cooperation with public sector	ROUTE 6: increase R&D in public sector
R&D Domain							
R&D policy generic	<ul style="list-style-type: none"> SFI – grants IRCHSS – grants and fellowships IRCSET – grants and fellowships Enterprise Ireland - Advanced Research Technology Programme (strategic research in HEIs) 	-	-	-	-	-	XX
	<ul style="list-style-type: none"> SFI – centres (CSETS) 					X	XX
	<ul style="list-style-type: none"> Enterprise Ireland - RTI schemes (support for industrial R&D projects) 	X	XX	-	-	-	-
	<ul style="list-style-type: none"> Enterprise Ireland – tailor-made support (support for large R&D investments) 	-	XX	-	XX	-	-
	<ul style="list-style-type: none"> Enterprise Ireland - Commercialisation Fund (technology development funding) 	XX	-	-	-	-	-
	<ul style="list-style-type: none"> IDA R&D Capability Grant Scheme (R&D investments at Irish subsidiaries of foreign-owned companies) 	-	XX	-	XX	-	-
R&D policy sectoral	<ul style="list-style-type: none"> DAF - Agri-food Programmes Marine Institute/Marine research 	-	X	X	-	X	XX
R&D / Innovation policy – Linkage	<ul style="list-style-type: none"> Innovation Partnerships scheme Industry-led networks INNOVA (InterTradeIreland – a cross-border all-island initiative) FUSION (InterTradeIreland – a cross-border all-island initiative) 	X	XX	XX	X	XX	X

	<ul style="list-style-type: none"> TecNet (Institutes of Technology) Competence Centres (including CSETS) 						
R&D / Innovation policy – IPR	<ul style="list-style-type: none"> Enterprise Ireland - TechSearch scheme for enterprises EI - Commercialisation Fund EI - Intellectual Property Fund EI - Competitive Fund for Technology Transfer in HEIs Enterprise Ireland support for Technology Transfer Offices (TTOs) in HEIs TecNet (Institutes of Technology) 	XX	X	X	X	XX	-
R&D specific financial and fiscal policy	<ul style="list-style-type: none"> R&D tax credits 	X	XX	XX	XX	X	-
R&D specific education policy	<ul style="list-style-type: none"> HEA - grant funding to third level institutions HEA – PRTLII 	-	-	-	-	X	XX
R&D specific employment policy							
Finance Domain							
Financial and fiscal policy							
Macroeconomic policy							
Human Capital Domain							
Education policy	<ul style="list-style-type: none"> Funding for post-graduate research training (e.g. through IRCHSS, IRCSET) 	X					X
Employment policy	<ul style="list-style-type: none"> 						
Innovation Domain							
Innovation policy	<ul style="list-style-type: none"> Graduate Enterprise Programme 	XX	-	-	-	-	-

generic							
Innovation policy sectoral							
Other policies - industry							
Other policies - trade							
Other policies - defence							
Other policies – consumer protection							
Other policies – health and safety	<ul style="list-style-type: none"> Health Research Board programmes 	X	X		X	X	XX
Other policies - environment	<ul style="list-style-type: none"> Environmental Protection Agency Marine Research Institute 		X	X			X
Other policies – reg'n'l developm'nt	<ul style="list-style-type: none"> Regional Innovation Programmes - BMW region Regional Innovation Programmes – S&E region 	XX	XX	XX		X	
Other policies - competition							
Other policies – social security							

7. Balance within R&D policy mix

Table 5: Assessment of ‘importance’ of R&D policy instruments

(Key: a) Overall contribution to increase of private R&D expenditures; b) Impact on specific aspects of the NIS or R&D performers (when possible); c) Public attention/attention by policy makers; d) Volume of public funding involved; e) Beneficiary of a shift in public funding)

<i>Public Programme</i>	<i>NDP allocated funding for 2000-06</i> <i>€m</i>	<i>Criteria</i>				
		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
SFI grants schemes	57.7		+	++	+	++
SFI strategic basic research (ICT & biotechnology)	778.7		++	++	+++	++
HEA - Programme for Research in Third-level Institutions (PRTLII)	530.6		+++	++	++	++
Irish Research Council for Science, Engineering and Technology (IRCSET) Irish Research Council for Humanities and Social Science (IRCHSS)	163.4		+	+	+	+
Dept of Agriculture and Food (agriculture and food research programmes, Teagasc)	138		++	+	+	
National Council for Forest R&D (forest research programmes, COFORD, Teagasc)	17.4	+	+	+		
Dept of Communications, Marine and Natural Resources (Marine Research programmes and Marine Institute)	52.7	+	+	+	+	
Dept of Environment and Local Govt (environmental programmes, EPA)	45.1		+	+	+	
Dept of Health and Children (Health Research Board)	n/a*		+			
Enterprise Ireland Innovation Partnerships Enterprise Ireland Research Innovation Fund Enterprise Ireland Advanced Technology Research Programme	232.3		+		++	
Enterprise Ireland Competitive R&D in firms	531.4	++	++		++	
IDA Ireland R&D in firms	744.3	++	++		+++	

* Health research does not appear as a separate instrument in the 2000-2006 NDP. However, in the forthcoming 2007-2012 NDP some €301 million is allocated.

8. Emergence of R&D policy mix

The 1996 *White Paper on Science, Technology and Innovation* set out a completely new context for science, technology and innovation policy in the Republic of Ireland. The introduction to the White Paper itself acknowledged that “for much of the period since the foundation of the State, Science and Technology (S&T) has been very much ignored and neglected” (White Paper, 1996, p1). Though some attempts had been made in the 1970s and 1980s to improve the co-ordination of S&T activities and to better harness these towards social and economic goals (see for instance Yearley, 1995 for the history of these developments) the period following partition can be characterised as one of a lack of both supply and demand: domestically owned industry was dominated by small companies in traditional sectors and neither conducted nor used R&D whilst Irish subsidiaries of the international companies increasingly attracted to the country obtained their technology from the parent company and thus R&D done abroad. Universities were largely focused on teaching with little funding for research available: what public funds were expended were largely spent on applied agricultural research mostly conducted outside the university sector.

From the late 1980's the success of an economy increasingly characterised by high levels of external trade and foreign direct investment (FDI) arguably reinforced the perception that Ireland could ‘buy in’ technology and innovation from overseas. Some political economy commentators dispute the extent to which Ireland's economic success was the result of a move towards a ‘competition state’ in which all government action is taken in the context of global market disciplines and away from the model of a ‘developmental state’ actively intervening in social and economic affairs in order to promote policy goals but in any case it must be recognised that the Irish economy was – and is – one of the most open (in trade terms) of the OECD member states (Smith, 2006). However by the late 1990's confidence had turned to concern over the possibility that fleet-of-foot international companies which account for much high-tech activity in Ireland could move out just as easily as they had moved in and that expected impacts of FDI in enhancing the indigenous innovation system had thus far failed to materialise (Pontikakis et al, 2005). The Tierney Report on Science, Technology and Innovation which preceded the 1996 White Paper noted that Ireland had effectively failed to develop an indigenous ‘national system of innovation’. Tierney and the White Paper represent the Irish manifestation of a more general trend towards the uptake in policy rationales of the concept of ‘innovation system’ influenced by promotion of the concept by the OECD and perhaps also by the earlier uptake of systems rationales in the 1993 UK White Paper *Realising Our Potential*. As with *Realising Our Potential*, the 1996 Irish White Paper explicitly links policy for science and technology, including policy for basic research and policy for scientific skills development, with economic competitiveness rationales.

Since the publication of the White Paper the institutional set up for the governance of science, technology and innovation in the Irish system has been transformed and indeed continues to evolve. New funds and funding bodies have been created, new advisory groups formed and systematic planning and prioritisation processes have been established. Overall R&D spending increased three-fold during the 1990s but is

still below the EU average at 1.4% of GNP. The 2004 R&D Action Plan *Building Ireland's Knowledge Economy* restated the priorities of Irish STI policy, with the overall goal being 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”.
(*Building Ireland's Knowledge Economy*, p18)

The current goals or priorities of Irish R&D and innovation policy as stated in the *Strategy for Science, Technology and Innovation 2006-2013* and the *National Reform Programme* document are broadly consistent with the overarching policy priority advanced since the 1996 White Paper, namely to create new sources of competitive advantage for the Irish economy based around knowledge and innovation. Whilst early policies and the 2000-2006 National Development Plan emphasised the need to build up public sector research capacity and infrastructure (and indeed this remains a major feature of the current portfolio of objectives, though with more emphasis on reform and on the wider public sector science base as well as the third level sector) there also seems to be greater emphasis now on the problem of linking the public sector research capacity with the enterprise sector through better commercialisation and more active collaboration, and on improving the research capacity of the private sector. A further significant policy trend has been the recent emphasis on improving the co-ordination and governance of the NIS and especially on improving the processes through which STI policies are formulated. This will be discussed in more detail in the following section.

Summary and analysis

The current policy mix and portfolio of goals can in some ways be seen as an incremental evolution of the (at the time) radical position advocated in the 1996 White Paper. Though Ireland is still characterised by a (sometimes bewildering to the outside observer) multiplicity of agencies and actors involved in the formulation and implementation of R&D and ST&I policy, often demonstrating a (difficult to objectively justify) degree of overlapping responsibilities, the trend is towards greater co-ordination and an increasingly analytical approach towards the design of policy and selection of measures. Policy learning from OECD and EU member states (for instance in relation to the adoption of R&D tax credits), in particular, has become a standard tool in the development of new or revised measures – as has systematic and rigorous evaluation. The Irish appear to be no more or no less immune to policy fashions than any other nation. In short, and as in most countries, the policy mix is both a ‘construct’ and an ‘ex post reality’: it is the result of an explicit attempt to craft a policy mix suited to the goals and circumstances of Ireland, constrained by path dependencies, institutional inertia, resource limitations, ideological strictures against active interference in the market, and probably a host of other factors.

9. Governance of the policy mix

As noted above the governance of Irish STI is surprisingly complex. Recent reforms have attempted to strengthen the co-ordination mechanisms somewhat. In particular the office of **Chief Science Adviser** (CSA) to the Irish Government was established in 2004, following the recommendation of a panel of international experts. The aim of creating the new position was to put an expert adviser in a co-ordinating role at the centre of the rather complex Irish apparatus for the governance of STI. Specifically the office of the CSA is required to:

- Provide independent expert advice on any aspect of STI as requested by the Government
- To provide analysis and opinion regarding major STI policy proposals
- To advise on STI issues stemming from EU or international developments
- To periodically advise the Government on the scale and balance of the overall State investment in STI activities, having consulted the relevant major stakeholders
- To oversee a system of independent evaluation of STI policies and programmes, paying particular attention to ‘cross-cutting’ issues
- To manage the gathering and reporting of data and intelligence, especially in relation to R&D spending and performance

The office of the CSA has no operational functions, but rather co-ordination and oversight responsibilities, and thus has a small staff.

Ireland has a **Cabinet Committee on Science and Technology**, which brings together senior ministers whose departments have a significant science agenda. The Committee includes both the Taoiseach (Prime Minister) and Tanáiste (Deputy PM) – who is also the Minister for Health and Children. The CSA both participates in meetings of this committee and reports to it. Below this committee an **Interdepartmental Committee on Science, Technology and Innovation** (ICSTI) brings together senior civil servants and the CSA. The purpose of the ICSTI is to ensure a “joined up” approach to STI governance. A further significant group is the **Research Funders Group** bringing together the major funders – the HEA, HRB, SFI and the two research councils – to improve co-ordination. The CSA also chairs this group. A pre-existing **Research Funders Committee** brings together much the same actors to discuss more operational issues.

Finally, an independent **Advisory Science Council** made up of senior scientists and industrialists represents the major stakeholders in STI policy. Again the CSA participates in the ASC, thus providing a link between the major groups involved in STI governance in Ireland.

There is no ministry of S&T in Ireland. Much as in the UK responsibility for S&T is largely structured along functional or sectoral lines with light-touch co-ordination. Thus many departments of state have S&T in their portfolios. The major co-ordination and oversight actor is the CSA, reporting to the Cabinet Committee on

STI. The major policy advisory and implementation agency for STI policy is **Forfás**, the national enterprise, science and innovation agency. It operates under the auspices of the **Department of Enterprise, Trade and Employment**. Within the Department an **Office of Science and Technology** (OST) is responsible for the development, promotion and co-ordination of Ireland's Science, Technology and Innovation policy; and Ireland's policy in European Union and international research activities. The Minister of Enterprise, Trade and Employment represents Ireland on STI issues at EU and international level. Two further state agencies implement innovation support for enterprises and commercialisation, **Enterprise Ireland** (focused on all Irish enterprises) and **IDA Ireland** (tasked with attracting, retaining and growing inward investments). Higher education funding is disbursed through the **Higher Education Agency**, under the auspices of the **Department for Education and Science**. The other significant funding actors for research in HEIs are **Science Foundation Ireland** (SFI) - formed to focus significant (more than €600m) funding on the twin priority research areas of ICT and biotechnology - and two research councils, the **Irish Research Council for Science, Engineering and Technology** (IRCSET) and the **Irish Research Council for the Humanities and Social Sciences** (IRCHSS). The councils provide individual support for research primarily through fellowships for post-graduate researchers and academics rather than through significant project grants. A further significant funder of research is the **Health Research Board** (HRB), under the auspices of the **Department of Health and Children**. The other significant government departments (and associated agencies) for sectoral and mission-oriented research activities are the **Department for Agriculture and Food** (and the multi-role, multi-institute agency **Teagasc** and the forest research funder **COFORD**) and the **Department for Environment, Heritage and Local Government** (**Environmental Protection Agency**) and the **Department of Communications, Marine and Natural Resources** (**Marine Institute**).

Thus the apparatus for STI policy making, implementation and oversight is rather complex. The creation of the role of CSA could be seen as further increasing the complexity of the situation, although the intention was clearly to provide an independent oversight and co-ordination role. Progress in co-ordination has thus far been hampered by the early resignation of the first CSA in mid-2005 following a mini-scandal concerning the validity or otherwise of his academic credentials. At the time of writing the role has not been permanently filled. Further reform of this system of governance seems inevitable, though the latest *Strategy 2006-2013* seems to propose further structures to deal with (or increase) the complexity, namely the "virtual" **Technology Ireland** (to consolidate the R&D and innovation support activities of Enterprise Ireland and IDA Ireland under a single umbrella) and a **Higher Education Research Group** to bring together representatives of the main bodies responsible for funding HEI research, namely the Departments of: Education and Science; Enterprise, Trade and Employment; and Finance; along, of course, with their various funding agencies. To add to the complexity still further it should be noted that the two **regional bodies**, though only having small executive staffs, are becoming active in innovation support. Finally, at a higher level of governance, cross-border, all-island bodies, principally **InterTrade Ireland**, act on behalf of the Governments of Ireland and the administration of Northern Ireland in order to promote North-South activities including the development of trade and research links.

10. Interactions between policy objectives and instruments

Evidence of interactions, whether positive or negative, between the various objectives and measures identified in this report, is hard to find. In Ireland as in any country the policy rhetoric tends to shy away from exploring the potential negative aspects of the policy portfolio, whilst evaluations tend to focus on specific instruments or objectives rather than interactions between them. Co-ordinating and advisory bodies such as the office of the CSA and the independent Advisory Science Council might be expected to raise issues related to interactions where they are identified but it is unclear to this observer as to what mechanisms would allow such problems to be diagnosed in the first place.

9.1 Positive, neutral and negative effects of R&D policy instruments

See Table 6 for the author's personal perspective on the likely interactions between the different instruments or measures. In reality the majority of instruments have a potentially complementary or substitutive effect on other instruments – and much will depend on implementation.

9.2 Interactions between direct and indirect R&D policy instruments

9.3 Interactions between financial R&D policy instruments (grants, tax credits etc.) and non-financial R&D measures (IPR, reform of public research, incentives for co-operation, infrastructure provision etc.)

The recent advent of the Irish R&D Tax Credit system (in 2004) makes it premature to assess the impacts of this measure or its interactions with other measures. Theoretically, a successful fiscal incentive to R&D should either complement measures relating to industry-academic links or licensing (by raising firm R&D levels) or, in some cases, should substitute those measures (by making internal R&D more attractive as a source of knowledge relative to external sources).

9.4 Effects of instruments from other policy domains on R&D expenditure (e.g. macroeconomic, financial, competition, sectoral policies)

9.5 Interactions between R&D policy instruments and policy instruments from other domains

As already noted the effects of active R&D policies in other sectors or policy domains such as health or agriculture is significant in the Irish case. In both cases this is an instance both of sectoral R&D policy (ie policy to promote innovation in the health or agri-food sectors) and of mission-oriented research policy (i.e. policy to promote the development of capacity and knowledge in support of policy missions in these domains).

Table 6: Assessment of potential effects of an increase in activity of a particular R&D policy instrument on the effect of other R&D policy instruments on the level of R&D expenditures in Ireland

effect upon \hat{e} \hat{e} increase in activity	SFI grants Research Council funding	SFI centres (CSETS) HEA – PRTLJ funding	EI Advanced Research Technology Programme	HEA block funding	EI TT in HEIs Fund	EI Commercialisation Fund	DAF Agri-food programmes	Marine programmes	HRB grants	EPA programme	EI Industry-led networks	EI Innovation partnerships	INNOVA	FUSION	EI TechSearch	EI RTI schemes	IDA R&D Capability Scheme	EI 'tailor-made' support	R&D tax credits	Regional Operational Programmes	
SFI grants Research Council funding		+	=/-	+	+	+	+/=	+/=	+/=	+/=	+/0	+/=	+/=	+/=	0	0	0	0	0	0	
SFI centres (CSETS) HEA – PRTLJ funding	=/-		+/0	+/=	+	+	+/0	+/0	+/0	+/0	+/=	+/=	+/=	+/=	0	0	0	0	+/0	0	
EI Advanced Research Technology Programme	=/-	+/0		+	+	+	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	0	0	0	+/0	0	
HEA block funding	+	+	+		+	+	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	0	0	0	0	0	0	
EI TT in HEIs Fund	0	+/0	+/0	+/0		+/0	+/0	+/0	+/0	+/0	+/0	+/0	+/0	+/0	+/=	0	0	0	0	0	
EI Commercialisation Fund	0	+/=	+/0	0	0/=		+/0	+/0	+/0	+/0	+/=	+/=	+/=	+/=	+/=	+/0	+/0	+/0	+/0	+/0	
DAF Agri-food programmes	0	+/=	+/=	+/=	+/0	+/0		0	0	0/=	+/=	+/=	+/=	+/=	+/0	+/0	+/0	+/0	+/0	+/=	
Marine programmes	0	+/=	+/=	+/=	+/0	+/0	+/0		0	0/=	+/=	+/=	+/=	+/=	+/0	+/=	+/=	+/=	+/0	+/=	
HRB grants	0	+/=	+/=	+/=	+/0	+/0	0	0		0/=	+/=	+/=	+/=	+/=	+/0	+/=	+/=	+/=	+/0	+/=	
EPA programme	0	+/=	+/=	+/=	+/0	+/0	0	0/=	0		+/=	+/=	+/=	+/=	+/0	+/=	+/=	+/=	+/0	+/=	
EI Industry-led networks	0	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=		+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	
EI Innovation partnerships	0	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=		+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	

effect upon \hat{c} \hat{c} increase in activity	SFI grants Research Council funding	SFI centres (CSETS) HEA – PRTL I funding	EI Advanced Research Technology Programme	HEA block funding	EI TT in HEIs Fund	EI Commercialisation Fund	DAF Agri-food programmes	Marine programmes	HRB grants	EPA programme	EI Industry-led networks	EI Innovation partnerships	INNOVA	FUSION	EI TechSearch	EI RTI schemes	IDA R&D Capability Scheme	EI 'tailor-made' support	R&D tax credits	Regional Operational Programmes	
INNOVA	0	0	+/=	0	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=		+/=	+/=	+/=	+/=	+/=	+/=	+/=	
FUSION	0	0	+/=	0	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=		+/=	+/=	+/=	+/=	+/=	+/=	
EI TechSearch	0	0	0	0	0	0	0	0	0	0	+/=	+/=	+/=	+/=		+/=	+/=	+/=	+/=	+/=	
EI RTI schemes	0	0	0	0	0	0	0	0	0	0	+/=	+/=	+/=	+/=	+/=		=	=	+/=	+/=	
IDA R&D Capability Scheme	0	0	0	0	0	0	0	0	0	0	+/=	+/=	+/=	+/=	+/=	=		=	+/=	+/=	
EI 'tailor-made' support	0	0	0	0	0	0	0	0	0	0	+/=	+/=	+/=	+/=	+/=	=	=		+/=	+/=	
R&D tax credits	0	0	0	0	0	0	0	0	0	0	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=		+/=	
Regional Operational Programmes	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=	+/=		

Key to possible interactions:

'+' = Complementary

'=' = Substitute/crowding out

'-' = Contradictory

'f' = Framework

'0' = no effect

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- ERAWATCH: country fiches and research programmes templates:
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