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ERAWATCH Country Report 2008
An assessment of research system and policies

Ireland

Tom Martin

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Executive Summary

Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs which aims to increase and improve investment in research and development, in particular in the private sector. The report aims at supporting the mutual learning process and the monitoring of Member States efforts. The main objective is to characterise and assess the performance of the national research system of Ireland and related policies in a structured manner that is comparable across countries. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. This report is based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

The stated ambition of the Irish government is to become a leader in innovation. This commitment to position Ireland as a leading knowledge economy is stressed in the Government's strategic plan, the Strategy for Science, Technology and Innovation 2006–2013 (SSTI), which sets out a vision 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."

Underpinning this mission statement is an acceptance by Government that research, technological development and innovation (RTDI) is of critical importance to competitiveness, employment and the enhancement of society. Public investment in RTDI is, therefore, a national priority. There is an acceptance by policy-makers that the factors that contributed to Ireland's successful economic performance in recent years are no longer sustainable (such as a low cost manufacturing location) and that a new approach based on developing innovative, higher added products and services was necessary for Ireland to stay competitive in a fast-evolving global knowledge economy.

The Government has committed €8.2b for RTDI under the National Development Plan (NDP) 2007–2013 to implement the Strategy for Science, Technology and Innovation 2006–2013 in supporting this objective.

The SSTI is concerned with putting in place an integrated framework and funding for the development of a world-class research and development capacity in the economy, including the development of a substantial 4th level in the higher education sector. One of the goals of the SSTI is to double the number of PhD graduates in science, engineering and technology (SET) by 2013 to nearly one thousand per annum. Achieving this target will be critical to the success of the SSTI and will rely on attracting high quality foreign researchers in what is a competitive international environment as well as developing indigenous talent.

Additionally, the SSTI lays an emphasis on building critical mass within the research system while at the same time maintaining leading-edge quality standards that have

been developed through the use of international peer review to assess research proposals.

One of the main challenges facing Ireland is that its research infrastructure is relatively new and it lacks some of the components of a national innovation system found in other EU Member States such as specialist research centres that link the knowledge producers with industry. A key priority of the SSTI is to continue to build the research capacity of the higher education and public research sectors.

In line with the increased level of research funding, new institutional structures have been developed to improve the coordination of research policy activities, to improve links between policy actors, research performers, in both the public and private sectors and stakeholders more generally.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Long term government commitment to increasing expenditure on R&D
	Securing long term investment in research	Expenditure on R&D by public sector has increased since 1996
	Dealing with barriers to private R&D investment	Development of new initiatives to encourage applied research
	Providing qualified human resources	Commitment to develop fourth level education (the provision of advanced post-graduate study and development education)
Knowledge demand	Identifying the drivers of knowledge demand	Evidence of "joined up" approach within government to science, technology and innovation policies
	Co-ordination and channelling knowledge demands	New oversight and monitoring structures have been developed and are being put in place
	Monitoring of demand fulfilment	New initiatives to stimulate demand among industry for knowledge generated by higher education and public research sectors
Knowledge production	Ensuring quality and excellence of knowledge production	Continuation of strategy to establish a quality research base by supporting excellence, as measured by international peer review
	Ensuring exploitability of knowledge	New support measures to increase the absorption capacity of indigenous SMEs
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	New initiatives to facilitate higher education-industry linkages
	Profiting from international knowledge	Declining number of Irish participants in Framework Programmes
	Enhancing absorptive capacity of knowledge users	Strategic focus on enhancing human capital to increase knowledge users' absorptive capacity

Ireland's future economic success is seen as closely linked to the success of the Lisbon strategy i.e. that science, technology and innovation are key drivers of competitiveness. The targets set in the SSTI closely mirror the EU's Lisbon goals. Additionally, there are complementarities between the SSTI and the Lisbon agenda in terms of key priorities such as research infrastructures and higher education-industry linkages. The Government perceives that EU-led initiatives will contribute towards the achievement of goals set out in the Strategy for Science, Technology and Innovation. Likewise, in implementing the SSTI, Ireland will be contributing towards the achievement of broader European goals.

Though while the Barcelona European Council meeting set a target of devoting 3% of EU GDP to research and development, the SSTI avoids specifying a target for Ireland though it notes that the Irish 3% action plan envisages a lower R&D

expenditure target for Ireland of 2.5% of GNP by 2010. The National Reform Programme 2008-2010 sets a gross expenditure on R&D target of 2.5% of GNP by 2013.

Improving Irish BERD performance will be one of the key drivers in attempts to further transform the economy to be a more competitive, dynamic and knowledge-driven economy. With multinational companies in Ireland accounting for over 70% of BERD in Ireland, the challenge for policy-makers is to encourage existing MNC R&D performers to increase their expenditure and seek to attract FDI projects with an R&D component.

Another equally significant challenge facing Ireland is to develop linkages between the higher education sector and indigenous SMEs that traditionally have been weak. Enterprise Ireland, the national agency with responsibility for indigenous industry, has launched a number of new support measures to address this weakness.

The main research policy opportunities and risks are listed below.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	Political support to develop Ireland as leading knowledge-intensive performer Opportunity to position Ireland as an attractive location for FDI R&D projects Increasing public policy interest in services innovation	Weak higher education-industry linkages may dissipate the returns from Ireland's technology foresight investment in biotechnology, ICT and energy Presence of some gaps between R&D and innovation policies Ireland is still lagging behind 3% targets; the Irish National Reform Programme sets a target of 2.5% of GNP by 2013
Knowledge demand	New structures outlined in SSTI may lead to greater oversight co-ordination between research and innovation policies	Lack of systematic use of strategic policy intelligence tools in RTDI policy-making
Knowledge production	Continued focus on development of research excellence could lead to a source of competitive international advantage	Potential mismatch between focus of basic research in the higher education sector and the capabilities/requirements of the enterprise sector Danger of sub-optimal return on State funding for R&D through inability to achieve critical mass in relation to research teams
Knowledge circulation	Emphasis on development of quality scientific research base to facilitate knowledge circulation and to underpin applied research	Student participation rates in science, engineering and technology disciplines are static

The Irish Government is committed to the aims of the European Research Area (ERA). The National Reform Programme 2008-2010 states that all of the actions aimed at developing Ireland's competitiveness and STI infrastructure, including the attraction of researchers to Ireland and the strengthening of research capacity within the Irish enterprise base, are framed within the context of the broader ERA agenda.

TABLE OF CONTENTS

Executive Summary 3
1 - Introduction and overview of analytical framework 9
1.1 Scope and methodology of the report in the context of the renewed Lisbon Strategy and the European Research Area 9
1.2 Overview of the structure of the national research system and its governance 11
2 - Resource mobilisation 14
2.1 Analysis of system characteristics 14
2.1.1 Justifying resource provision for research activities 14
2.1.2 Securing long term investment in research 15
2.1.3 Dealing with uncertain returns and other barriers to business R&D investment 16
2.1.4 Providing qualified human resources 17
2.2 Assessment of strengths and weaknesses 18
2.3 Analysis of recent policy changes 19
2.4 Assessment of policy opportunities and risks 19
2.5 Summary of the role of the ERA dimension 20
3 - Knowledge demand 20
3.1 Analysis of system characteristics 21
3.1.1 Identifying the drivers of knowledge demands 21
3.1.2 Co-ordinating and channelling knowledge demands 23
3.1.3 Monitoring demand fulfilment 24
3.2 Assessment of strengths and weaknesses 25
3.3 Analysis of recent policy changes 26
3.4 Assessment of policy opportunities and risks 26
3.5 Summary of the role of the ERA dimension 26
4 - Knowledge production 27
4.1 Analysis of system characteristics 27
4.1.1 Improving quality and excellence of knowledge production 27
4.1.2 Improving exploitability of knowledge production 29
4.2 Assessment of strengths and weaknesses 29
4.3 Analysis of recent policy changes 30
4.4 Assessment of policy opportunities and risks 30
4.5 Summary of the role of the ERA dimension 31
5 - Knowledge circulation 31
5.1 Analysis of system characteristics 31
5.1.1 Facilitating knowledge circulation between university, PRO and business sectors 31
5.1.2 Profiting from access to international knowledge 33
5.1.3 Absorptive capacity of knowledge users 34
5.2 Assessment of strengths and weaknesses 35

5.3 Analysis of recent policy changes 36
5.4 Assessment of policy opportunities and risks 36
5.5 Summary of the role of the ERA dimension 37
6 - Overall assessment and conclusions 37
6.1 Strengths and weaknesses of research system and governance 37
6.2 Policy dynamics, opportunities and risks from the perspective of the Lisbon agenda 38
6.3 System and policy dynamics from the perspective of the ERA 39
References 41
List of Abbreviations 42

1 - Introduction and overview of analytical framework

1.1 Scope and methodology of the report in the context of the renewed Lisbon Strategy and the European Research Area

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This aims to increase and improve investment in research and development (R&D), with a particular focus on the private sector. One task within ERAWATCH is to produce analytical country reports to support the mutual learning process and the monitoring of Member States' efforts.

The main objective is to analyse the performance of national research systems and related policies in a comparable manner. The desired result is an evidence-based and horizontally comparable assessment of strength and weaknesses and policy-related opportunities and risks. A particular consideration in the analysis is given to elements of Europeanisation in the governance of national research systems in the framework of the European Research Area, re-launched with the ERA Green Paper of the Commission in April 2007.

To ensure comparability across countries, a dual level analytical framework has been developed. On the *first level*, the analysis focuses on key processes relevant to system performance in four policy-relevant domains of the research system:

1. Resource mobilisation: the actors and institutions of the research system have to ensure and justify that adequate public and private financial and human resources are most appropriately mobilised for the operation of the system.
2. Knowledge demand: needs for knowledge have to be identified and governance mechanisms have to determine how these requirements can be met, setting priorities for the use of resources.
3. Knowledge production: the creation and development of scientific and technological knowledge is clearly the fundamental role of a research system.
4. Knowledge circulation: ensuring appropriate flows and distribution of knowledge between actors is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production.

These four domains differ in terms of the scope they offer for governance and policy intervention. Governance issues are therefore treated not as a separate domain but as an integral part of each domain analysis.

Figure 1: Domains and generic challenges of research systems

Resource mobilisation	Knowledge demand	Knowledge production	Knowledge circulation
• Justifying resource provision • Long term research investment • Barriers to private R&D funding • Qualified human resources	• Identification of knowledge demand drivers • Co-ordination of knowledge demands • Monitoring of demand fulfilment	• Quality and excellence of knowledge production • Exploitability of knowledge production	• Knowledge circulation between university, PRO and business sectors • International knowledge access • Absorptive capacity

On the *second* level, the analysis within each domain is guided by a set of generic "challenges" common to all research systems that reflect conceptions of possible bottlenecks, system failures and market failures (see figure 1). The way in which a specific research system responds to these generic challenges is an important guide for government action. The analytical focus on processes instead of structures is conducive to a dynamic perspective, helps to deal with the considerable institutional diversity observed, and eases the transition from analysis to assessment. Actors, institutions and the interplay between them enter the analysis in terms of how they contribute to system performance in the four domains.

Based on this framework, analysis in each domain proceeds in the following five steps. The first step is to analyse the current situation of the research system with regard to the challenges. The second step in the analysis aims at an evidence-based assessment of the strengths and weaknesses with regard to the challenges. The third step is to analyse recent changes in policy and governance in perspective of the results of the strengths and weaknesses part of the analysis. The fourth step focuses on an evidence-based assessment of policy-related risks and opportunities with respect to the analysis under 3) and in the light of Integrated Guideline 7; and finally the fifth step aims at a brief analysis of the role of the ERA dimension.

This report is based on a synthesis of information from the European Commission's ERAWATCH Research Inventory[1] and other important publicly available information sources. In order to enable a proper understanding of the research system, the approach taken is mainly qualitative. Quantitative information and indicators are used, where appropriate, to support the analysis.

After an introductory overview of the structure of the national research system and its governance, chapter 2 analyses resource mobilisation for R&D. Chapter 3 looks at knowledge demand. Chapter 4 focuses on knowledge production and chapter 5 deals with knowledge circulation. Each of these chapters contains five main subsections in correspondence with the five steps of the analysis. The report concludes in chapter 6 with an overall assessment of strengths and weaknesses of the research system and governance and policy dynamics, opportunities and risks across all four domains in the light of the Lisbon Strategy's goals.

[1] ERAWATCH is a cooperative undertaking between DG Research and DG Joint Research Centre and is implemented by the IPTS. The ERAWATCH Research Inventory is accessible at http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home. Other sources are explicitly referenced.

1.2 Overview of the structure of the national research system and its governance

Ireland is one of the smallest EU Member States accounting for less than 1% of the population of the EU-25. Despite its small size, Ireland's GDP per capita at current market prices amounted to €41,100 in 2006 which was substantially higher than the EU-27 figure of €23,500 but well below the figure for Luxembourg of €71,000. However, Gross National Income per capita data for 2006 compiled by the World Bank places Ireland in sixth place, ahead of the US.

The Irish national research system is relatively new and is in a state of ongoing development. The main research players in Ireland in 2006 were the private sector (67% of GERD) followed by higher education sector (25.8% of GERD) and the government sector (7.3% of GERD).

Research funding has increased significantly since the publication of the White Paper on Science, Technology and Innovation in 1996. The White Paper acknowledged that for much of the period since the foundation of the State in 1922, science and technology (S&T) had been very much ignored and neglected. The Government allocated €0.5b for research funding during the first National Development Plan covering the period 1994–1999.

Funding on research grew significantly during the period of the National Development Plan 2000–2006 when the Government spent €2.48b on R&D. The Government has committed a total of €8.2b for research and innovation under the National Development Plan (NDP) 2007–2013 to achieve the goals set out in the Strategy for Science, Technology and Innovation 2006–2013 to make Ireland a leading knowledge economy.

The two main STI funding ministries are the Department of Enterprise, Trade and Employment and the Department of Education and Science. Other ministries with a significant research budget include the Department of Agriculture and Food and the Department of Communications, Energy and Natural Resources.

The growth in research funding has led to the development of new governance structures. At the apex is the Cabinet Sub-Committee on Science and Technology which includes the Taoiseach (prime minister), Tánaiste (deputy prime minister) and ministers from the ministries having a significant research agenda.

The Chief Scientific Adviser reports to the Cabinet Sub-Committee and has a remit to provide independent expert advice on any aspect of science, technology and innovation as requested by the Government.

The Inter Departmental Committee on Science and Technology (IDC) which is chaired by the Minister for Enterprise, Trade and Employment and consists of senior civil servants from the main research spending ministries and the Chief Scientific Adviser is responsible for implementing decisions made by the Cabinet Sub-Committee. The IDC plays an important role in assisting the prioritisation of science, technology and innovation expenditure across ministries and ensuring a "joined-up Government" approach to science and technology.

The Advisory Council for Science, Technology and Innovation consists of twelve members drawn from industry and academia and replaces the former Irish Council for Science, Technology and Innovation. Its functions are to act as the primary interface between stakeholders and policy-makers in the Science, Technology and

Innovation (STI) arena, contributing to the development and delivery of a coherent and effective national strategy on STI and to provide advice to Government on medium and longer-term policy for STI and related matters.

The Office of Science, Technology and Innovation within the Department of Enterprise, Trade and Employment is responsible for the development, promotion and national co-ordination of science, technology and innovation policy. It is responsible for the science and technology budget, including EU funding, promoting research and technological development in industry and developing and coordinating Ireland's policy in international research activities.

Forfás, the national economic development authority and advisory board, provides the Department of Enterprise, Trade and Employment (DETE) and other stakeholders with analysis, advice and support on issues related to enterprise, trade, science, technology and innovation.

Science Foundation Ireland is responsible for managing Ireland's technology foresight investment in biotechnology and ICT. In 2008, the Government extended SFI's responsibilities to cover sustainable energy and energy-efficient technologies.

The Higher Education Authority (HEA) which is under the aegis of the Department of Education and Science is the funder of the HEA Block Grant which provides the necessary floor for research funding in the third level sector and the Programme for Research in Third Level Institutions which provides support for institutional strategies, inter-institutional collaboration, large-scale research programmes and infrastructure.

The HEA also administers the Strategic Innovation Fund which aims to support universities in increasing their capacity to produce high quality 3rd and 4th level outputs.

Two research councils were established in 2001 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 Councils provide direct financial support to address individual research funding needs at Masters, Doctoral and Post-doctoral levels.

The Government has recently established the Research Funders Group under the chair of the Chief Scientific Adviser. This Group comprises the main research funding and advisory bodies and is intended to assist in the co-ordination and implementation of research funding.

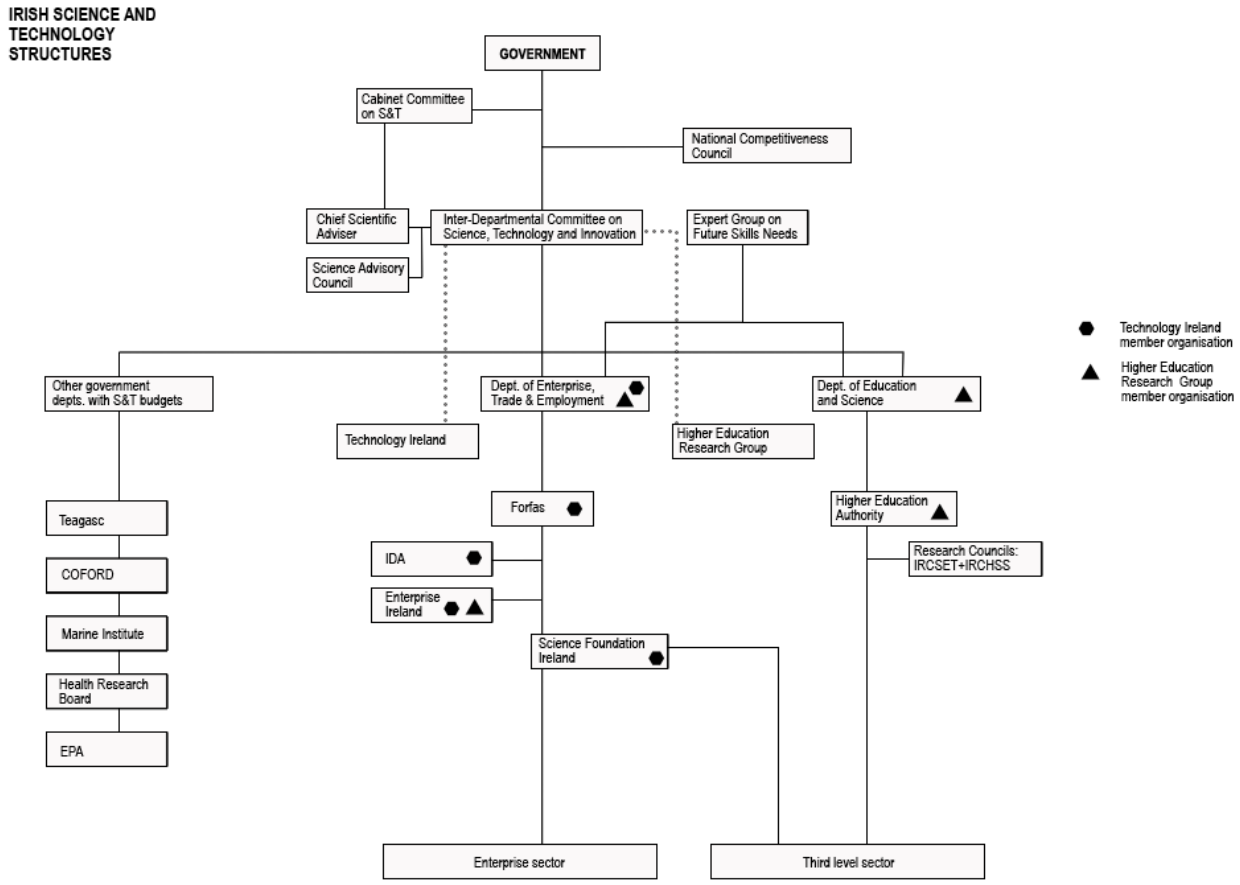
The Strategy for Science, Technology and Innovation 2006-2013 indicated the Government's intention to establish two new structures for ensuring the successful implementation of the strategy:

1. Technology Ireland: this group of senior executives from Enterprise Ireland, IDA Ireland, Science Foundation Ireland and Forfás under the aegis of the Office of Science, Technology and Innovation at the Department of Enterprise, Trade and Employment has been charged with overseeing the implementation of required actions to achieve the targets set for enterprise R&D performance;
2. The Higher Education Research Group (HERG) comprises representatives from the main Government Departments responsible for funding Higher Education-based research (the Departments of Education and Science, Enterprise, Trade and Employment and Finance) along with senior executives from the funding agencies of those Departments. The role of the HERG is to ensure coherence

among key funding initiatives and the funding awards schemes of the relevant agencies and councils.

The cross-border body, InterTradeIreland, which was set up under the Good Friday agreement, plays an important role in enhancing the global competitiveness of the all-island economy to the mutual benefit of Ireland and Northern Ireland through measures such as the creation of knowledge-intensive all-island trade and business development networks and the implementation of all-island trade and business development programmes.

Figure 2: Structure of the Irish research system



Source: ERAWATCH Research Inventory 2008, Structure of the Research System

2 - Resource mobilisation

The purpose of this chapter is to analyse and assess how challenges related to the provision of inputs for research activities are addressed by the national research system. Its actors have to ensure and justify that adequate financial and human resources are most appropriately mobilised for the operation of the system. A central issue in this domain is the long time horizon required until the effects of the mobilisation become visible. Increasing system performance in this domain is a focal point of the Lisbon Strategy, with the Barcelona EU overall objective of a R&D investment of 3% of GDP and an appropriate public/private split as orientation, but also highlighting the need for a sufficient supply of qualified researchers.

Four different challenges in the domain of resource mobilisation for research which need to be addressed appropriately by the research system can be distinguished:

- Justifying resource provision for research activities;
- Securing long term investment in research;
- Dealing with uncertain returns and other barriers to private R&D investment; and
- Providing qualified human resources.

2.1 Analysis of system characteristics

2.1.1 Justifying resource provision for research activities

Positioning Ireland as a leading knowledge economy is a key Government objective and in furtherance of this objective, as set out in the Strategy for Science, Technology and Innovation 2006–2013.

As part of the Lisbon Strategy, the European Council set a target that 3% of EU GDP would be spent on R&D by 2010. The Irish 3% Action Plan envisages Ireland reaching 2.5% of GNP by 2010, though the National Reform Programme (Department of the Taoiseach, 2005), sets 2013 as the date for achieving the 2.5% target. It should be noted that in Ireland, Gross National Product (GNP) is the more relevant measure for calculating economic activity in Ireland as it excludes the large profit repatriations from multi-national firms and other net foreign income flows from the total measure of activity (Gross Domestic Product). Data from the Central Statistics Office show that GDP measure of economic activity is 19% higher than the GNP measure of economic activity.

A consequence of the consensus across the political and economic spectrum of the need to position Ireland further up the value-added chain has been that there has been little public debate on the Government's target of achieving an R&D expenditure of 2.5% of GNP by 2013.

Total R&D spending in Ireland across all sectors of the economy reached €2.33b in 2006, an increase of over 14% on 2005. As a result, the overall GERD/economic activity intensity ratio rose to 1.56% of GNP compared to 1.48% in 2004.

Figures produced by Forfás indicate that R&D spending by the Irish Government has more than quadrupled from €221m in 1997 to nearly €1b in 2007. The average growth rate in GBAORD in the last 10 years has been 16%, among the top performances across OECD countries. GBAORD as a percentage of GNP has increased from 0.37% in 1997 to 0.62% in 2007.

A comparison of Civil GBAORD data (i.e. GBAORD excluding the defence portion of a country's R&D budget) shows that in 2007 Ireland achieved a Civil GBAORD performance of 0.62% of GNP, just slightly below the EU-25% average of 0.65%.

Irish gross expenditure on research and development (GERD) increased by over 26% in nominal terms between 2004 and 2006.

The increase in R&D spending in the business sector (BERD) was not quite as pronounced. It rose by almost 10% from 2004 to 2005 and is estimated to have increased by a further 17.3% in 2006 to reach €1.56b. BERD intensity as a % of GNP also grew: from 0.82% in 2004 to 0.90% in 2006. Multinational companies based in Ireland account for a significant proportion of BERD.

2.1.2 Securing long term investment in research

As evidenced in a number of recent policy documents, the Government has established a mission statement which advocates 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."

Underlining the Government's commitment to research is the recognition that Ireland needs to move up the value chain to counter the threat of lower cost manufacturing locations in Eastern Europe and the Far East. Ireland had, to a large extent, relied in the past on a range of factors including a lower cost structure to attract Foreign Direct Investment (FDI), particularly US companies seeking to gain a foothold in Europe. As the more basic types of manufacturing migrate to lower-cost locations, it is necessary to attract those jobs using the latest technologies, in state of the art facilities and at the cutting edge of innovation, research and applied development. As a consequence, Ireland is re-orienting its industrial development policies towards the development of value-added innovative products and services.

Thus, the overall thrust of Irish policy focus is to increase and improve the levels of activity in research and development in the public and private sectors and to facilitate greater levels of creativity and innovation, through greater investment in human resources.

Over the course of the current National Development Plan 2007–2013, the Government is planning to commit €8.2b for science, technology and innovation. This represents a substantial increase over the €2.48b allocated for STI in the previous National Development Plan covering the period 2000–2006 which in turn was a fivefold increase over the €0.5b provided in the National Development Plan 1994–1999.

The Strategy for Science, Technology and Innovation 2006–2013 (SSTI) which was published in 2006 provides the overall framework for national STI policy and investment over the next seven years.

The strategy provides for the continued development of a world-class research system underpinned by the essential physical and human infrastructure, doubling the number of PhD graduates over its lifespan. The SSTI document envisages that top-level researchers will be drawn from both home-grown talent and highly qualified overseas researchers. The strategy also proposes mechanisms to 1) ensure that the investment in research is turned into commercial value to the greatest extent possible, and 2) in regard to enterprise, the strategy will set out structures and mechanisms to enhance supports to industry and encourage firms to become more engaged in R&D activity.

The key SSTI objectives are to:

- Accelerate the rate of human capital development in the country, through increased investment in research by teams of excellence that will produce the skills and graduates required for the enterprise sector of the future and for economic and social well-being;
- Proactively support and encourage much greater commercialisation of the output of research through more timely and efficient technology transfer to the enterprise sector and a higher level of technology based start-up enterprises;
- Increase significantly the capacity to absorb technology and the R&D performance of enterprises in Ireland, so as to secure the current employment base, create new jobs and wealth and increase productivity.

The SSTI forms a key element of the competitiveness and innovation chapter of the Programme for Government agreed by the three coalition government partners following the General Election in 2007.

The SSTI advocates greater Irish participation in EU Framework Programmes — including on an all-island collaborative basis. Initial indications are that Ireland's performance in FP6 has been mixed: the overall national funding drawdown has increased but the drawdown by the private sector has fallen.

2.1.3 Dealing with uncertain returns and other barriers to business R&D investment

A significant element of Ireland's economic development policy has been on encouraging Foreign Direct Investment, particularly from US companies seeking to gain a foothold in the EU. Increasingly and in line with its strategy of positioning Ireland as a leading knowledge economy, the government is focusing on targeting FDI projects with an R&D component.

Foreign companies based in Ireland play a major role in R&D; in 2006, over 70% of €1.33b in BERD was performed by the multinational sector.

R&D expenditure by foreign-owned firms amounted to €939m in 2006, with spending by Irish-owned firms totalling €390m. Spending growth of 10% per annum in foreign-owned firms slightly outpaced the overall 9% annual average increase for Irish-owned firms.

The largest performing sector for business R&D in Ireland continued to be the software/computer-related areas accounting for 30.4% of all R&D investments in 2005. However, R&D spending growth in this sector was a relatively sluggish 6.8% between 2003 and 2005. R&D performed by business in the pharmaceuticals sector

increased by 40.4% between 2003 and 2005. This sector now accounts for 20.1% of total business R&D.

The Government introduced in its 2004 Budget a 20% tax credit for companies engaging in incremental R&D activities in order to enhance Ireland's competitiveness as a location for new internationally mobile research-related investment, and to encourage existing indigenous and overseas firms to add research functions to their operations in Ireland or to increase their level of research activity.

The weak performance of indigenous companies in terms of R&D performance is being addressed by a number of existing and new support measures. The Government is targeting indigenous enterprises, with the aim of increasing the number of firms engaging in meaningful R&D (€100,000 per annum) from 462 in 2003 to 1,050 by 2013.

An example of one of the Government's new support measure in this area is the industry-led and research-driven Competence Centres initiative. This initiative which is being jointly promoted by IDA Ireland and Enterprise Ireland involves the establishment of collaborative entities led by industry and resourced by highly-qualified researchers associated with research institutions who are empowered to undertake market focused strategic research for the benefit of industry. The objective of the Competence Centre initiative is to achieve competitive advantage for industry in Ireland by accessing the innovative capacity of the research community.

The availability of seed capital has also been a focus of enterprise development policy and a number of reports such as the report of the Small Business Forum have noted the difficulties faced by SMEs in obtaining sufficient finance for start-up and growth. The Government has recently announced improvements and enhancements to two schemes aimed at improving the ability of SMEs to access finance. The changes relate to the Business Expansion Scheme (BES) and the Seed Capital Scheme (SCS) and include the extension of the life-time of both schemes, an increase in the tax relief that an investor could obtain, an increase in the amount of funding that a company could raise and an extension of the schemes to additional industry sectors such as recycling.

Additionally, Enterprise Ireland has launched its Seed and Venture Capital Programme 2007–2012 in which it partners with private sector venture capital funds provider to provide start-ups and high technology enterprises with seed/venture capital.

2.1.4 Providing qualified human resources

The Strategy for Science, Technology and Innovation 2006–2013 (SSTI) envisages a doubling of postgraduate researchers, and the expectation is that significant numbers of these will eventually take up employment in the enterprise sector.

The SSTI projects that the numbers of PhD graduates in science, engineering and technology would grow from 543 in 2005 to 997 by 2013.

The Strategy also notes the need for a more structured approach to postgraduate formation to ensure effective development of researchers, shorter PhD duration and increased completion rates.

The Higher Education Authority (HEA) has announced that the number of PhDs awarded in Ireland in 2008 is expected to top the 1,000 mark for the first time and marks significant progress towards Ireland's goal to be to the fore as a global centre for research. This total compares favourably with the 1998 total of 514 students graduated from higher education institutions with a PhD. Greatly increasing the number of PhD graduates was identified by the Government as essential to meeting the strategic goal of making Ireland a knowledge economy and a world centre for learning and research.

In light of the proposed increases in PhD numbers under the SSTI and the aim to see a significant movement of advanced researchers to the enterprise sector, the Government is reviewing a more structured approach to supporting the quantity and quality of PhDs. The Government believes that a more structured approach to postgraduate formation has the potential to reduce the time taken to complete a PhD and increase the completion rates of entrants to doctoral programmes, thus delivering both quality and improved value for money for the resources invested in PhD training.

As part of a concerted effort to achieve the PhD target set out in the SSTI, the Advisory Science Council has undertaken a study of researcher career paths and the operation of the Researchers' Mobility Portal and Centre.

Ireland has transposed the EU Directive on Mobility of Researchers from Third Countries which was adopted under Ireland's EU presidency in 2004. The directive provides for a specific procedure for admitting third-country nationals for the purposes of scientific research.

2.2 Assessment of strengths and weaknesses

The Strategy for Science, Technology and Innovation 2006–2013 is clear evidence of the Government's commitment to position Ireland to the forefront in generating and using new knowledge for economic and social progress, within an innovation-driven culture. The Government plans to back this goal with a significant amount of STI funding over the lifetime of the National Development Plan 2007–2013.

Expenditure on research and development has been increasing in the government, higher education and industry sectors. However, the performance of these sectors is still lagging behind the EU and OECD averages. Business expenditure on R&D is largely concentrated among foreign owned multinational companies while the R&D performance of indigenous SMEs — although improving — is a cause for concern.

Though the Government endorses the Barcelona target of 3% of GDP the Irish 3% Action Plan envisaged a lower target of 2.5% of GNP by 2010, subsequently modified by National Reform Programme to 2013. This means that though the SSTI aims to position Ireland as an international centre for research excellence, the actual amount of expenditure on research and development will be less than its international competitors.

One of the weaknesses that the current SSTI is trying to address is that Ireland is starting from a lower base in terms of its STI infrastructure. The projected expenditure on STI in the current National Development Plan (NDP) is a more than a three-fold increase (from €2.48b to €8.2b) over the previous NDP (2000–2006) which in turn was almost a five times that of the previous NDP (1994–1999) where the STI

spend was €0.5b. What these expenditure figures indicate is that while STI expenditure has been increasing it is from a low initial base.

Ireland lacks some elements of national research infrastructure found in larger EU Member States. For example, there are no specialists or sector-based research institutes in Ireland which in other countries play a major role in assisting SMEs to source and utilise knowledge produced in the higher education or public research sectors. Thus in the case of Ireland, other actors within the system such as higher education institutes must be persuaded to take on this role.

Main strengths	Main weaknesses
• Long term government commitment to increasing expenditure on R&D • Expenditure on R&D by public sector has increased since 1996 • Commitment to developed fourth (postgraduate) level education • Number of PhDs in science, engineering and technology is increasing	• R&D infrastructures have only recently been developed — Ireland is playing "catch-up" relative to other EU Member States • Business expenditure on R&D largely concentrated among multinational companies • Irish participation in recent EU Framework Programmes has declined from earlier FPs Ireland's R&D performance still lagging EU average

2.3 Analysis of recent policy changes

There is a consensus among Government of the need to position Ireland as a leading edge knowledge-based economy. The Programme for Government, signed by the three coalition parties on accession into office following the General Election in 2007, stresses the necessity to invest significantly in science and technology over the lifetime of the National Development Plan 2007–2013 in order to transform the type of R&D and innovation taking place across the enterprise sector.

Challenges	Main policy changes
Justifying resource provision for research activities	• National Development Plan 2007–2013 underpins the goals set out by the Government in its Strategy for Science, Technology and Innovation 2006–2013 to make Ireland a leading knowledge economy
Securing long term investments in research	• Provision of €8.2b in funding for R&D in the current National Development Plan for the period 2007–2013
Dealing with uncertain returns and other barriers to business R&D investments	• Development of new initiatives to encourage applied research
Providing qualified human resources	• Consideration of provision of structured PhD education training

After a decade of almost continuous high levels of economic growth, the Irish economy has deteriorated sharply due, inter alia, to a slowdown in the construction sector. This is putting considerable pressure on Government finances and the budget deficit is expected to reach 6% of GDP by 2009.

2.4 Assessment of policy opportunities and risks

The main policy opportunities and risks in relation to resource mobilisation are shown in the table below.

The majority opinion within political and economic circles is that Ireland needs to enhance its RTDI performance in order to maintain its competitiveness in international markets. Thus, there is broad support for the policy objectives set out in the Strategy for Science, Technology and Innovation 2006–2013 to develop Ireland as a leading knowledge economy. The recent downturn in the Irish economy may act to curb Government expenditure though capital expenditures outlined in the National Development Plan 2007–2013 may not be affected.

A number of new RTDI policy initiatives are underway; these include the establishment of a Services Strategy Group charged with developing a national services strategy that will address services innovation.

The very significant increases in research funding under the Technology Foresight Investment Programme for biotechnology and ICT combined with weak higher education-industry linkages poses a challenge for policy-makers in ensuring an adequate return for society and the economy on this investment.

Main policy opportunities	Main policy-related risks
• Political support to develop Ireland as leading knowledge-intensive performer • Opportunity to position Ireland as an attractive location for FDI R&D projects • Increasing public policy interest in services innovation	• Weak higher education-industry linkages may dissipate the returns from Ireland's technology foresight investment in biotechnology and ICT • Presence of some gaps between R&D and innovation policies • Ireland is still lagging behind 3% targets; the Irish National Reform Programme sets a target of 2.5% of GNP by 2013

2.5 Summary of the role of the ERA dimension

Overall, Ireland is supportive of the Commission's efforts to re-energise debate on the European Research Area and welcomed the Green Paper. There is a high level of complementarity between the ERA vision and Ireland's Strategy for Science, Technology and Innovation.

There are strong parallels in terms of the priorities identified at the national and European level (e.g. researcher careers, research infrastructures, industry-academic linkages, international cooperation, etc.). In many areas, the activities at European level will contribute towards the achievement of goals set out in Ireland's SSTI. Likewise, in implementing the national strategy, Ireland will be contributing towards the achievement of broader European goals.

Irish institutions participate in 24 ERA-NET funded projects though the SSTI notes the need to enhance Ireland's performance in the ERA-NET scheme and the new ERA-NETS+ programme as a means of linking Irish programmes to national programmes in other EU Member States.

3 - Knowledge demand

The purpose of this chapter is to analyse and assess how research related knowledge demand contributes to the performance of the national research system. It is concerned with the mechanisms to determine the most appropriate use of and targets for resource inputs.

The setting and implementation of priorities can lead to co-ordination problems. Monitoring processes identifying the extent to which demand requirements are met are necessary but difficult to effectively implement due to the characteristics of knowledge outputs. Main challenges in this domain are therefore:

- Identifying the drivers of knowledge demand;
- Co-ordinating and channelling knowledge demands; and
- Monitoring demand fulfilment

Responses to these challenges are of key importance for the more effective and efficient public expenditure on R&D targeted in IG7 of the Lisbon Strategy.

3.1 Analysis of system characteristics

3.1.1 Identifying the drivers of knowledge demands

Structure of knowledge demand

The main sources of funding for research and development in Ireland come from the private sector. In 2006, it was estimated that the private sector contributed €1,525m for research and development while the public sector (including the EU) accounted for €764m and other sources accounted for €40m. The Ireland specialisation report indicates that no major changes in funding sources took place during the period 1993–2003.

The private sector was the largest performer of R&D and in 2006 accounted for €1,560m in gross expenditure (in 2004, 87% of BERD was funded by business with the balance coming from government and overseas sources). The higher education sector accounted for €600m in gross expenditure on R&D with the government sector accounting for €169m. The Ireland specialisation report (ERAWATCH Network, 2007) reveals that in 2004, the Government was the source of 83% of HERD funding with 8% coming from abroad). In terms of GOVERD, 94% of funding in 2004 came from the Government.

Strong increases in business R&D spending and the level of BERD intensity has allowed for a narrowing of the gap between Ireland and the EU/OECD averages, which stood at 1.14% and 1.54% of GDP respectively in 2005.

R&D expenditure by foreign-owned firms rose to €939m in 2005, with spending by Irish-owned firms increasing to €390m. Spending growth of 10% per annum in foreign-owned firms slightly outpaced the overall 9% annual average increase for Irish-owned firms.

The largest performing sector for business R&D in Ireland continued to be the software/computer-related areas accounting for 30.4% of all R&D investments in 2005. However, R&D spending growth in this sector was a relatively sluggish 6.8% between 2003 and 2005. R&D performed by business in the pharmaceuticals sector increased by 40.4% between 2003 and 2005. This sector now accounts for 20.1% of total business R&D.

The Ireland specialisation report noted that in terms of economic specialisation Ireland presented a dynamic profile, particularly in medium to high R&D intensive manufacturing sectors such as instrumentation, electronic equipment,

pharmaceuticals and chemicals, while it is also specialised in terms of value added and, to a lesser extent, in employment in selected service sectors such as ICT and business services.

The report pointed out that over the period 2001–2003, Ireland's specialisation was limited to a number of economic sectors, such as the community and IT services, instruments, electronic equipment and the food industry. There was a loss in specialisation over the period 1993–2003 in a number of sectors including telecommunications, financial intermediation, plastics and pharmaceuticals.

The report's examination of GERD by type of research carried out in Ireland indicates a decrease in the share of experimental development by 6 percentage points over the 1993–2003 time period, while simultaneously the share of basic research grew significantly and rose to 22.5% of GERD during 2003. Despite the relative decline of experimental research, it still constitutes the single most important component of GERD with a 46.1% share in 2003.

An analysis of government expenditure on R&D undertaken by Forfás (Forfás, 2007) indicates that applied research accounted for 80% of GOVERD in 2007 followed by basic research (11%) and experimental research (9%).

From a GBAORD perspective, Ireland exhibits a high level of specialisation in a small number of socio-economic objectives, namely industrial research, exploitation of earth, agriculture and, to a lesser extent, in General University Funds. An analysis of R&D expenditure within the higher education sector indicates that natural sciences, social sciences, engineering and medical sciences received 87.7% of total funding during 2003, with the latter two increasing their shares over the 1993–2003 period.

Process for identifying the drivers of knowledge demand

As science, technology and innovation is a relatively new sphere of economic policy, the system for identifying drivers of knowledge demand is still evolving. At the apex is the Cabinet Sub-Committee on Science, Technology and Innovation which is responsible for development of STI policy and to which the Chief Scientific Officer reports.

The implementation of the STI policy is delegated to the Inter Departmental Committee on Science and Technology which is chaired by the Minister for Enterprise, Trade and Employment and comprises the ministries with large R&D budgets.

There are a number of agencies such as the Advisory Science Council which can assist in the process of identifying the drivers of demand. The predecessor to the Advisory Science Council, the Irish Council for Science, Technology and Innovation (ICSTI), was responsible for publishing the Technology Foresight report in 1999 which highlighted the need for Ireland to develop a fourth level of education if Ireland was to stay competitive as a fast-evolving global knowledge economy. The report pointed to the need to develop researchers in the scientific areas underpinning biotechnology and Information and Communications Technology (ICT). The rationale was to accelerate the development of an internationally competitive research base and ensure a stock of highly trained PhDs and post-doctoral researchers.

The ICSTI technology foresight project undertaken in 1998–1999 was a major undertaking and has not since been repeated. There have, however, been a number of smaller, sectorally-focused foresight initiatives. The Marine Institute undertook a

foresight exercise and extensive stakeholder consultation in the development of its Marine Knowledge, Research and Innovation Strategy 2007–2013.

Forfás, the national economic development authority and advisory board, has undertaken a pilot technology assessment project in relation to nanotechnology.

The Department of Enterprise, Trade and Employment as part of background work for its Innovation Policy Statement commenced a mapping exercise in 2007 to identify the current supports for innovation in Ireland, to explore specific areas where innovation can be better exploited and to look towards future innovation support arrangements.

The fact remains that most R&D undertaken in Ireland takes place within the private sector in which multinational companies are the significant R&D performers. Thus while business expenditure on R&D is related to a myriad of factors both internal and external to individual enterprises, the Government has sought to increase the attractiveness of Ireland as a location for mobile R&D inward investment. The 2004 Budget introduced a 20% tax credit for companies engaging in incremental R&D activities.

3.1.2 Co-ordinating and channelling knowledge demands

The coordination of national knowledge demand priorities at a political level is undertaken by the Cabinet Subcommittee on Science, Technology and Innovation. The Subcommittee can call on the inputs of a number of supporting bodies including the Office of the Chief Scientific Adviser and the Inter Departmental Committee on Science and Technology, on which all the government departments (ministries) with significant research budgets are represented.

Additionally, the Government in prioritising knowledge demands can also have recourse to the Advisory Science Council which is its high-level advisory body on Science, Technology and Innovation policy issues. The Council whose members are drawn from the public, higher education and industry sectors serves as the primary interface between policymakers and stakeholders on STI issues.

The Government recognises that public procurement can play a major role in stimulating innovation. In its recent Innovation Policy Statement (Department of Enterprise, Trade and Employment, 2008), the Department of Enterprise, Trade and Employment highlights the need to exploit opportunities for imaginative procurement practices that promote innovation in the enterprise sector while at the same time delivering better and more efficient public services.

The Statement notes that public procurement in Ireland is conducted within EU regulations that require transparency, competitive tendering and equal treatment of economic operators. Within that framework, contracts are most often awarded on the basis of ‘most economically advantageous tender’, rather than simply on the lowest price. Selection criteria can encompass ‘non-economic’ areas of public policy, such as environmental issues, social issues and sustainability. Public bodies can request tenders that provide innovative solutions rather than just basic products or services.

Selling to the public sector can represent an opportunity for enterprises, particularly SMEs, to demonstrate their capabilities, establish their credibility and prove the viability of new products or services. In this way, innovation in public procurement can stimulate long-term export success by showcasing emerging and innovative products and services and providing authoritative reference clients for Irish

companies. Pre-commercial procurement — where the risks are shared between public procurers and firms — can be used to promote innovation while respecting State Aid rules.

A procurement innovation group, established by the Department of Enterprise, Trade and Employment, is investigating ways of linking public R&D funding, development agencies and public procurement. In particular, the group will explore how analysis of the public procurement market could help entrepreneurs more easily identify areas where there may be significant opportunities for innovation.

The Department of Finance has developed a National Public Procurement Policy Framework to encourage public bodies to take a strategic approach to procurement. This enables public bodies to improve their procurement processes and to use procurement as an instrument for implementing other Government policies. We are actively seeking ways to improve SME participation in public procurement, as the size, agility and adaptability of such enterprises often enables them to develop new and more cost-effective solutions.

3.1.3 Monitoring demand fulfilment

Ireland through its involvement in EU funding programmes such as the Structural Funds and the Framework Programmes has developed a competence in programme evaluation. All of the major Community Support Framework documents agreed between the Irish Government and the European Commission provide for monitoring, evaluation and control systems. The National Development Plans, which form the basis for negotiations in relation to the Community Support Framework, are subject to ex-ante, mid-term and ex-post evaluations.

In addition to the reviews undertaken in relation to the National Development Plan, a major review of Ireland's STI infrastructure was undertaken in the context of preparing Ireland's 3% Action Plan, Building Ireland's Knowledge Economy. The Minister for Enterprise, Trade and Employment established a High Level Steering Group in 2003 to undertake the review. The Group undertook a wide-ranging consultation with all the stakeholders in the national innovation system, in-depth analysis of current public and private investment in R&D and assessed the business environment for R&D in Ireland.

There have been reviews of major elements within the STI system including the evaluation of Science Foundation Ireland and the review of the performance of the Programme for Research in Third Level Institutions. The Higher Education Authority has commissioned a review of the goals and objectives of the Irish Research Council for Science, Engineering and Technology (IRCSET). At lower levels within the STI system, ad-hoc evaluations are undertaken of specific support measures.

The Strategy for Science, Technology and Innovation 2006–2013 highlighted the need for technology assessment and portfolio analysis to provide the basis for a clear industrial input into the overall research agenda.

The SSTI document also stressed the importance of gaining a better understanding of how the balance between individual researcher excellence and the development of coherence/critical mass is evolving. The Government has committed itself to taking a portfolio overview of existing and planned research investments. This portfolio overview process would take into account for each research investment the quality

and critical mass of the research project, its time horizon and its relevance to Ireland's existing and future socio-economic development.

The portfolio analysis approach will be supplemented during the lifetime of the Strategy for Science, Technology and Innovation by more detailed review projects focusing on specific areas of science and technology. For example, a pilot technology assessment project has been undertaken in nanotechnology.

The SSTI envisages an important role for the Inter Departmental Committee on Science, Technology and Innovation (IDC) in overseeing the development of expertise in portfolio analysis and technology assessment and notes that this expertise developmental process will be supported by the Advisory Science Council and the Chief Scientific Adviser.

Irish policy-makers actively participate in CREST, the European Union Scientific and Technical Research Committee, as a means of improving the design and implementation of national STI policies and sharing good practice.

3.2 Assessment of strengths and weaknesses

The main strengths and weaknesses in terms of the Irish research system with regard to knowledge demand are shown below.

One of the strengths of the Irish research system is the importance attached to institutionalising an integrated, Government-wide approach to setting and implementing knowledge demand priorities. New RTDI advisory and review structures have been put in place to assist in the Government is setting priorities and policies.

Though Irish policymakers have made extensive use of strategic policy intelligence tools such as technology foresight and technology assessment, these tools are not used in a systematic manner within the RTDI policy development cycle.

The Government has only recently begun to focus on the potential use of public procurement as a driver of innovation.

Main strengths	**Main weaknesses**
• Evidence of "joined up" approach within government to science, technology and innovation policies • New governance and review structures have been developed and are being put in place • Mission statement to position Ireland as a leading generator and consumer of knowledge • New initiatives to stimulate demand among industry for knowledge generated by higher education and public research sectors	• Public procurement underutilised as a driver of innovation • No recent system-wide evaluation of national innovation system • Lack of systemic approach to the use of strategic policy intelligence tools such as foresight in RTDI policy-making • New and untested STI oversight structures

3.3 Analysis of recent policy changes

Challenges	Main policy changes
Identifying the drivers of knowledge demand	• Strategy for Science, Technology and Innovation 2006–2013 highlights role of Inter Departmental Committee on Science, Technology and Innovation in portfolio analysis and technology assessment
Co-ordinating and channelling knowledge demands	• Re-structuring of the higher education sector to assist with the achievement of national priorities of developing Ireland as a world-leading knowledge economy
Monitoring demand fulfilment	• New governance and review structures have been developed and are being put in place

The key Irish policy document in terms of knowledge demand is the Strategy for Science, Technology and Innovation 2006–2013 which highlights the key role to be played by the Inter Departmental Committee on Science and Technology in co-ordinating and monitoring knowledge demands.

3.4 Assessment of policy opportunities and risks

The Strategy for Science, Technology and Innovation 2006–2013 highlighted the need for technology assessment and portfolio analysis to provide the basis for a clear industrial input into the overall research agenda. The SSTI envisages that the Inter Departmental Committee on Science and Technology will play a key role in undertaking the proposed portfolio analysis particularly in terms of gaining a better understanding of how the balance between individual researcher excellence and the development of critical mass is evolving. Since the SSTI was only launched in 2006, it is not yet clear how this will be achieved.

Additionally, while a number of recent major evaluation and review studies have provided important contributions to the policy development process, the lack of a system-wide evaluation of the Irish research system points to a potential weakness in the formation of future STI policies.

There are pockets of expertise within the public sector in relation to the use of strategic policy intelligence tools such as evaluation, technology assessment, foresight, etc. This expertise is dispersed within the policy-making sector and additionally these tools are not used in a structured or systematic way. These factors may contribute to the less than optimal use of methods for assessing knowledge demand.

Main policy opportunities	Main policy-related risks
• New structures outlined in SSTI may lead to greater oversight co-ordination between research and innovation policies	• Lack of systematic use of strategic policy intelligence tools in RTDI policy-making

3.5 Summary of the role of the ERA dimension

Throughout the 1980s and 1990s, there was little scope to carry out high quality research in the higher education sector in Ireland due to a lack of research infrastructure and a lack of funding to support researchers. The EU Framework

Programmes (FP) were the only substantial source of funding available to Irish researchers in that period.

A number of recent policy documents have stressed the need for Irish researchers to become more involved in FP-funded projects. Policy-makers believe that transnational research brings real benefits to Ireland by promoting excellence and avoiding unnecessary duplication.

A number of the thematic areas addressed in FP7 such as ICT and biotechnology overlap with key Irish STI priorities. The difficulty is, however, that Ireland's participation in Framework Programmes has been relatively static, particularly in relation to the involvement of enterprises.

EU guidelines on innovative approaches to public procurement have been welcomed in the recent Innovation Policy Statement published by the Department of Enterprise, Trade and Employment. The Department has established a procurement innovation group to investigate mechanisms for linking public R&D funding, development agencies and public procurement.

4 - Knowledge production

The purpose of this chapter is to analyse and assess how the research system fulfils its fundamental role to create and develop excellent and useful scientific and technological knowledge. A response to knowledge demand has to balance two main generic challenges:

- On the one hand, ensuring knowledge quality and excellence is the basis for scientific and technological advance. It requires considerable prior knowledge accumulation and specialisation as well as openness to new scientific opportunities which often emerge at the frontiers of scientific disciplines. Quality assurance processes are here mainly the task of scientific actors due to the expertise required, but subject to corresponding institutional rigidities.
- On the other hand there is a high interest in producing new knowledge which is useful for economic and other problem solving purposes. Spillovers which are non-appropriable for economic knowledge producers as well as the lack of possibilities and incentives for scientific actors to link to societal demands lead to a corresponding exploitability challenge.

Both challenges are addressed in the research-related Integrated Guideline and in the ERA green paper.

4.1 Analysis of system characteristics

4.1.1 Improving quality and excellence of knowledge production

The higher education sector followed by the public research organisations is the main knowledge producer in Ireland.

A key focus of current government policy is to develop Ireland as a high quality knowledge economy based on the excellence of its researchers. There is a recognition among policy needs that Ireland as a small country needs to place a

particular emphasis on quality — both in terms of the research work itself and also by achieving the critical mass of people and infrastructure to support that research.

One of the main research funding channels is Science Foundation Ireland (SFI) which was established in 2000 to oversee Ireland's technology foresight investment in biotechnology and Information and Communications Technology. The Technology Foresight Advisory Group on Implementation of SFI specified that SFI should invest in funding research that:

- Is of intrinsic excellence and acknowledged internationally;
- Is of a sufficient scale and critical mass to facilitate, promote and sustain intellectual interchange and discourse amongst those engaged in the research in Ireland and top-class researchers internationally;
- Strengthens the scientific foundations on which to develop high-productivity, high-technology, market-driven, knowledge-intensive investments, including start-ups, in Ireland's industrial and services sectors.

Consequently, a key element of SFI's funding strategy is the use of international peer review to assess research proposals and the track record of applicants. This review process provides both a recognised metric of excellence and valuable feedback to the research community.

Studies undertaken in connection with the evaluation of Science Foundation Ireland in 2005 provide an indication of the extent to which research quality in Ireland has improved since 2001. An analysis of the publication records of SFI-funded researchers, both before receipt of SFI awards and after such awards, indicates that their research performance is well in advance of average performance levels in Ireland in the past and is indicative of the success of government investment in upgrading the research base in a comparative international context.

Output performance indicators for new Irish knowledge production are expected to move towards the overall OECD average as a result of the increased investment in research funding contained in the National Development Plan 2007–2013. Standard indicators of knowledge output from the research system include publications in refereed journals and levels at which these publications are accessed by other researchers in their own publications.

In terms of gross output of publications, Ireland was just below the EU average in 2002 and well behind the leading countries. Data on citations suggests that Ireland performs relatively better, but such data is distorted by lower citation rates for non-English speaking countries. Using the more reliable comparator of US citations, Ireland's rate is 1.05 versus 1.64 for the US.

Ireland currently ranks 12th in a table prepared by the European Commission (Key Figures 2005) showing the number of scientific publications per million population in 2003. The top six countries were Sweden, Denmark, Finland, Netherlands, UK and Belgium.

The relative frequency with which scientific publications are cited by scientific peers is a universally accepted measure of the quality of scientific output. The US National Science Foundation produces annual data on this indicator. The indicator measures citation performance in relation to the number of publications, providing a relative measure independent of country size. For 2003 the top performers were Switzerland, US and The Netherlands, with scores around 1.0. Denmark, UK and Sweden were

next. Ireland ranked 12th (out of 45) with a score of 0.76. In a number of fields the Irish performance was even better (Ireland ranked 10th in Clinical Medicine and 4th in Engineering and Technology with a score of 0.92).

4.1.2 Improving exploitability of knowledge production

The transfer of knowledge and technology, encompassing intellectual property, from the higher education and public research sectors into the market place is recognised as being of crucial importance in the establishment of a strong research environment and a knowledge-based economy, as are robust linkages between the higher education and enterprise sectors. The development of linkages between the two sectors is regarded as a key outcome of the Strategy for Science, Technology and Innovation.

However, the extent of linkages between the higher education sector and the enterprise sector in Ireland is low. The Irish 3% Action Plan, Building Ireland's Knowledge Economy, noted the low levels of companies that have active R&D collaboration with the third level sector. Only 17% of indigenous active R&D companies had a collaborative link with an Irish higher education institution compared to 27% of multinational R&D active companies based in Ireland. The Action Plan noted that a step change in the levels of collaboration was essential and this would require a broad-based approach to develop networks and reinforce clusters through linking enterprise and applied research competencies in the research base.

The Department of Enterprise, Trade and Employment's Innovation Policy Statement pointed out that a key goal of Irish innovation strategy would be to strengthen the link between the quality of Ireland's public research infrastructure and industry.

The Innovation Policy Statement provided details of a number of existing initiatives to facilitate the increase in academia-industry linkages such as SFI's Centres for Science, Engineering and Technology and the SFI Strategic Research Clusters Programme and new support measures as Technology Transfer Offices, Research and Development Fund and Innovation Vouchers.

The Innovation Policy Statement also profiled initiatives been undertaken in relation to workforce skills development, workplace innovation, intellectual property management and services innovation.

4.2 Assessment of strengths and weaknesses

The table below provides an indication of Ireland's strengths and weaknesses with regard to knowledge production.

Main strengths	Main weaknesses
• Continuation of strategy to establish a quality research base by supporting excellence, as measured by international peer review	• Concern that focus on SSTI targets in relation to PhD numbers will sacrifice quality for quantity • Development of critical mass of research teams may be difficult

One of Ireland's key strengths in knowledge production is its commitment to research excellence. This is exemplified by Science Foundation Ireland's use of international peer review to assess research funding proposals and the track record of applicants.

The Government has pledged to continue this model of competitive excellence in the National Development Plan 2007–2013.

One of the key targets in the Strategy for Science, Technology and Innovation 2006–2013 is for a doubling of PhD graduates in the science, engineering and technology disciplines to almost a 1,000 per year. There is concern among some key informants that efforts to achieve this goal may result in the diminution of researcher quality.

Another potential weakness in Ireland's knowledge production which stems from the relatively small scale and early stage of development of the Irish research sector is that the formation of research teams of a critical mass may be impeded. Consequently, the returns on investment on Ireland's significant technology investment in biotechnology and ICT may be sub-optimal.

4.3 Analysis of recent policy changes

Challenges	Main policy changes
Improving quality and excellence of knowledge production	• Research policies have moved centre-stage in terms of national economic priorities and they focus on the development of research infrastructures built on quality
Ensuring exploitability of knowledge production	• New measures to encourage higher education-industry linkages

The Strategy for Science, Technology and Innovation 2006–2013 is explicit in its commitment to making the goal of making Ireland a knowledge society, built on excellence in science, technology and innovation, a reality. The strategy re-affirms the use of the model of competitive excellence adopted by Science Foundation Ireland as being a necessary requisite to develop a world-class research system.

In addition to acknowledging the need to foster research excellence, the SSTI articulates the need for a more structured approach to postgraduate formation to ensure effective development of researchers, shorter PhD duration and increased completion rates.

4.4 Assessment of policy opportunities and risks

The main policy opportunities and risks in relation to knowledge production are presented below.

Main policy opportunities	Main policy-related risks
• Continued focus on development of research excellence could lead to a source of competitive international advantage	• Potential mismatch between focus of basic research in the higher education sector and the capabilities/requirements of the enterprise sector • Danger of sub-optimal return on State funding for R&D through inability to achieve critical mass in relation to research teams

The Strategy for Science, Technology and Innovation 2006–2013 recognises that the focus on pursuing individual researcher excellence may be at the expense of the building a critical mass in research teams.

4.5 Summary of the role of the ERA dimension

Irish policy documents are silent on the issue of the ERA dimension in relation to knowledge production. It is likely though, that Irish policies would complement EU policies in this regard given that as a small and open economy, Ireland's future prosperity is intrinsically linked to the success of the Lisbon Strategy.

The SSTI acknowledges, for example, that encouraging Irish involvement in international competition for R&D funds can help promote scientific excellence nationally as competitive scientific research can be undertaken in an efficient, cost effective and successful manner.

The SSTI also recognises that successful participation in research-related programmes can help ensure that Irish research efforts meet the most demanding international standards and additionally that national priorities can often be more effectively addressed on a transnational basis.

The ERA dimension is echoed in the Government's emphasis to market Ireland as a location for internationally mobile R&D investment projects.

5 - Knowledge circulation

The purpose of this chapter is to analyse and assess how the research system ensures appropriate flows and sharing of the knowledge produced. This is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production. Knowledge circulation is expected to happen naturally to some extent, due to the mobility of knowledge holders, e.g. university graduates who continue working in industry, and the comparatively low cost of the reproduction of knowledge once it is codified. However, there remain three challenges related to specific barriers to this circulation which need to be addressed by the research system in this domain:

- Facilitating knowledge circulation between university, PRO and business sectors to overcome institutional barriers;
- Profiting from access to international knowledge by reducing barriers and increasing openness; and
- Enhancing absorptive capacity of knowledge users to mediate limited firm expertise and learning capabilities.

Effective knowledge sharing is one of the main axes of the ERA green paper and significant elements of IGL 7 relate to knowledge circulation. To be effectively addressed, these require a good knowledge of the system responses to these challenges.

5.1 Analysis of system characteristics

5.1.1 Facilitating knowledge circulation between university, PRO and business sectors

The development of linkages between the knowledge producing sectors (the higher education sector and the public research organisations) is a major focus of recent

Irish policy documents. The attention in the past has been (and continues to be) the development of the foundation blocks of a national system of innovation. Policy-makers are increasingly turning their attention to facilitating the transfer of knowledge within the publicly funded research sector to the business sector.

The Strategy for Science, Technology and Innovation 2006–2013 includes an objective in relation to the strengthening of the national RTDI system across its many dimensions, particularly with regard to forging more effective linkages and interactions among the different parts of the system.

The higher education sector plays a dual role in the transfer of knowledge. Firstly, through the education and training of high quality researchers, many of whom are likely to work in industry. Secondly, the higher education institutions are heavily involved in basic research the outputs of which can result in commercialisation through a timely and efficient technology transfer to the enterprise sector.

A 2007 Forfás Report outlined the significant roles of the fourteen Institutes of Technology (IoTs) in Irish enterprise. Primarily focused on education and training, they also are growing their R&D capabilities and spin-off activities. In 2006, new legislation brought the IoTs under the aegis of the Higher Education Authority (HEA). It is expected that this will encourage greater inter-institutional collaboration and grow their modest share of HERD (6% of the total in 2004). The Forfás Report acknowledged the specific institutional context of each IoT, but recognised the potential for more engagement with both the enterprise development agencies and enterprises themselves.

While smaller than many other EU Member States, Ireland's PRO sector also plays a role in knowledge transfer. Teagasc, the agriculture advisory and research organisation, has forged close links with the mainly indigenous-owned food-processing sector.

Enterprise Ireland (EI), the national agency for the development of indigenous industry, has initiated a number of support measures at encouraging the transfer of knowledge from the publicly funded research sector to the industrial sector. A number of these new measures include a focus on industry-led research networks.

The new EI measures include the Competency Centre support measure which seeks to develop collaborative entities established and led by industry and resourced by highly-qualified researchers associated with research institutions who are empowered to undertake market-focused strategic research projects for the benefit of industry. The aim of the Competence Centre initiative is to achieve competitive advantage for industry in Ireland by accessing the innovative capacity of the research community.

Another support measure is the Industry-led Research Networks initiative, which is being 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.

The body responsible for managing Ireland's technology foresight investment in biotechnology and ICT, Science Foundation Ireland, has two major funding measures directed at increasing the flow of knowledge from the higher education sector to the enterprise sector: the Centres for Science, Engineering and Technology (CSET) initiative and the Strategic Research Clusters initiative.

The Strategy for Science, Technology and Innovation 2006–2013 attaches importance to higher education to industry linkages not only within Ireland but also within the context of the Island of Ireland. The all-island support measure, FUSION, is an all-island technology transfer initiative that gives companies access to the expertise and facilities in universities and colleges across the island of Ireland, allowing them to make strategic advances in innovation and capability. InterTradeIreland which is responsible for promoting trade between the two parts of Ireland is responsible for managing the FUSION initiative.

Another InterTradeIreland initiative, INNOVA, is a pilot programme aimed at promoting firm-to-firm collaboration and the diffusion of technology within the island of Ireland with support by research institutions where necessary.

The Innovation Policy Statement and the report of the Enterprise Strategy Group, Ahead of the Curve, both emphasise the role that networks and clusters can play in facilitating knowledge transfer.

5.1.2 Profiting from access to international knowledge

The Government's key RTDI strategy document, the Strategy for Science, Technology and Innovation 2006–2013, emphasises the need for effective linkages of researchers and companies in Ireland with technology networks, centres of excellence and scientific infrastructures on the island of Ireland, in Europe, the US and elsewhere.

As the Strategy aims to double the number of PhD graduates in science, engineering and technology by 2013 to nearly one thousand per annum, there is a recognition that this target cannot be achieved by the Irish education system alone.

Researchers will need, therefore, to be attracted to Ireland in greater numbers than before. In 2006, 15.5 percent of Ireland's science and technology employees aged between 25 and 64 were born outside Ireland, compared with an EU27 average of 9.7 percent. Much has already been achieved to remove the regulatory barriers for incoming researchers. However, the SSTI acknowledges the need to pro-actively attract overseas researchers to join companies and research institutions within Ireland. A number of steps are being taken under the SSTI to provide the required number of researchers, such as the funding programmes of Science Foundation Ireland, the Advisory Science Council study on researcher career paths and the operation of the Researchers' Mobility Portal (researchcareersireland) and Centre. The Advisory Science Council study is expected to assist in identifying any further measures that may be required. In parallel the review of the European Research Area addresses the issue of researcher mobility in Europe and may also lead to initiatives in this field.

Ireland's share of EU Framework Programme funding has remained static despite the Government exhortations for researchers in Ireland to make greater use of this source of finance and as a means to increase Ireland's international research linkages.

The Government has acknowledged the need to review the current National Support Structures for promoting the Framework Programme in order to facilitate maximum participation in the Programme. The higher education sector in Ireland, which continues to increase its participation, needs to develop a more proactive approach to encourage Irish industry to join international research networks. National research

funders such as Science Foundation Ireland need to stimulate research teams in the higher education sector to leverage funding from international sources and to leverage Irish enterprise participation (an analysis has shown that Irish private sector participation in EU Framework Programmes has declined). Forfás, the national economic development authority and advisory board, is currently reviewing Ireland's performance in FP7.

The share of higher education research (HERD) funded by foreign sources (including the Framework Programme) is a useful proxy for the internationalisation of the research system. Between 1998 and 2004 the level of foreign funding remained roughly constant in money terms, declining as a percentage of HERD from 19% in 1998 to 10% in 2004. The Department of Enterprise, Trade and Employment's recent Innovation Policy Statements indicates that the Government is seeking a share of HERD funded from foreign sources of 20% by 2013.

Ireland has benefited from the transfer of knowledge and technology associated with the attraction of foreign direct investment. Increasingly, IDA Ireland, the agency responsible for inward investment promotion, is pursuing a strategy to attract FDI projects with an R&D component and to encourage existing overseas companies in Ireland to develop an R&D function. In the case of the latter, this is viewed as a mechanism for strengthening their roots in Ireland.

5.1.3 Absorptive capacity of knowledge users

The lack of absorptive capacity of the business sector in Ireland — particularly the indigenous SME sector — has been a concern for policy-makers for some time. There is a danger that the substantial investment that the Government has made in developing the research infrastructure within the higher education sector will not achieve its full economic potential if the business sector is unable to absorb or make use of the knowledge created.

Forfás commissioned Technopolis in 2005 to carry out a study examining the capacity of Irish SMEs to absorb and use knowledge from outside the firm. The focus of the study was to identify areas which require strengthening, ensuring that these firms have such 'absorptive capacity' and enable them to play a key role in developing the Irish economy. The report noted that Ireland required the formulation of enhanced policies to further develop the absorptive capacity of enterprises across a range of industry sectors. It pointed out that existing policy measures were limited in this area. There was little help for firms, which needed to become more adventurous in their innovative activities, without at the same time going so far as to become involved with 'science push' activities. The report highlighted that Ireland was deficient not only in knowledge absorption schemes but also in the knowledge infrastructure. The higher education sector did not view intermediate knowledge development as being their core mission which in other Member States is carried out by specialist research institutes.

The Strategy for Science, Technology and Innovation 2006–2013 pointed out that a key step for many enterprises that do not engage in R&D or are low R&D performers is to increase their scientific and technological capabilities. The SSTI document indicated that there were two major requirements: upgrading existing company skills and assisting companies to bring in new talent in science and technology.

Enterprise Ireland has launched a number of support measures to assist the development of indigenous companies. One such initiative is the Research and Development Stimulation Grants scheme which is intended to enable the development of innovation capability and absorptive capacity of small companies. These one-off grants of up to €50,000 available for R&D planning, consultancy/mentor support, R&D training, market research, etc. Another EI support measure is the Enterprise Innovation Networks scheme which was launched in March 2008. This programme aims to provide funds (up to €200,000 per annum for 3 years) to industry representative organisations to enable them to promote thematic research and innovation among their membership.

Another new higher education-linkage support measure is Innovation Vouchers which permit SMEs with limited experience of R&D to collaborate with any one of twenty-two Higher Education 'knowledge providers' to obtain an innovation solution to an enterprise need. These vouchers offer SMEs the opportunity to forge new relationships with higher education institutions and ultimately to develop new products and services.

The Department of Enterprise, Trade and Employment is funding the development of a network of 25 Technology Transfer Offices (TTOs) to improve the knowledge flows between higher education institutes and industry. The TTO initiative is aimed is ensuring better economic returns from R&D investment, through the development of improved systems, procedures and expertise in Technology Transfer Offices.

5.2 Assessment of strengths and weaknesses

The assessment of the Irish strengths and weaknesses in relation to knowledge circulation are summarised below:

Main strengths	Main weaknesses
• New initiatives to facilitate higher education-industry linkages • Evidence of increased inter-institutional collaboration • Strategic focus on enhancing human capital to increase knowledge users' absorptive capacity	• Weak linkages between the higher education and PRO sectors and the business sector • Low research absorption capacity of indigenous industry • Declining number of Irish private sector participants in Framework Programmes

The low capacity of indigenous SMEs to absorb the knowledge produced within the higher education and public research sectors is recognised as a major weakness within the Irish national innovation system.

Ireland's late start in terms of STI policies and infrastructure relative to leading EU Member States has meant that it has a lot of ground to catch up on. This is particularly evident in relation to the transfer of knowledge from the research system to SMEs. Ireland lacks some of the key elements that are found in other countries such as specialist research institutes which assist enterprises to absorb the knowledge generated in the research system. Additionally, there was a dearth of support measures to assist SMEs to develop their knowledge absorption capacity.

While Irish policies aspired towards increased Irish participation in EU Framework Programmes, the reality has been less encouraging particularly in terms of the participation of enterprises.

A key strength of the Irish system has been its focus on education and the development of a qualified work force. The SSTI's mission statement is that by 2013 Ireland will be internationally renowned for the excellence of its research.

5.3 Analysis of recent policy changes

The Table below indicates some of the recent policy changes in relation to knowledge circulation.

There is recognition among policy-makers that the exploitation of research and technology developed abroad will continue to be a key driver of economic growth and productivity. This requires that indigenous enterprises are able to identify such knowledge and the capacity to absorb it.

It also necessitates that the Government increases its marketing of Ireland as a location for mobile R&D investment so as to maximise the potential for spillovers to SMEs.

Both the Strategy for Science, Technology and Innovation 2006–2013 and the Innovation Policy Statement articulate the policy measures that the Government intends putting in place to address knowledge circulation issues.

Challenges	Main policy changes
Facilitating knowledge circulation between university, PRO and business sectors	• New initiatives to foster higher education-industry linkages
Profiting from access to international knowledge	• Focus on attracting FDI investment with a R&D component • Review of National Support Structures to encourage greater participation in Framework Programmes
Absorptive capacity of knowledge users	• New measures to improve absorptive capacity of indigenous companies

5.4 Assessment of policy opportunities and risks

The main policy opportunities and risks in relation to knowledge circulation are presented below.

The quality of post-graduate education is central to the efficient circulation of knowledge as indigenous enterprises will need qualified personnel to absorb and optimise international technology flows. The quality of graduate and researcher output from the Irish higher education sector will be important in terms of promoting Ireland to multinational companies as a location for mobile R&D investment.

The challenge facing policymakers is to increase the numbers of young people studying science, engineering and technology courses at third level.

Main policy opportunities	Main policy-related risks
• Emphasis on development of quality scientific research base facilitate knowledge circulation and to underpin applied research	• Student participation rates in science, engineering and technology disciplines are static

5.5 Summary of the role of the ERA dimension

Overall, Ireland is supportive of the Commission's efforts to re-energise debate on the European Research Area and welcomed the Green Paper. There is a high level of complementarity between the ERA vision and Ireland's Strategy for Science, Technology and Innovation. There are strong parallels in terms of the priorities identified at the national and European level (e.g. researcher careers, research infrastructures, industry-academic linkages, international cooperation, etc.). In many areas, the activities at European level will contribute towards the achievement of goals set out in Ireland's SSTI. Likewise, in implementing the national strategy, Ireland will be contributing towards the achievement of broader European goals.

6 - Overall assessment and conclusions

6.1 Strengths and weaknesses of research system and governance

Policy attention in relation to the Irish research system is of relatively recent origin; the first policy paper in this area was the White Paper on Science and Technology in 1996. Since then the Government has successively increased expenditure on research and development in each of the three National Development Plans culminating in the allocation of €8.2b for STI in the current National Development Plan 2007–2013.

Though the Government has set as a mission statement 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 reality is that Ireland in terms of its national research infrastructure is playing catch-up with larger EU Member States. Ireland lacks some of the institutional elements found in other countries such as specialist/sector-specific research institutes which often play a crucial intermediation role between knowledge producers and knowledge users.

The Government faces a number of challenges arising from Ireland's recent developed research system. The first is to continue to build a research infrastructure based on researcher quality and to address remaining infrastructural weaknesses. The second challenge is to encourage the enterprise sector to increase its R&D performance in the context that 70% of BERD in Ireland is undertaken by affiliates of multinational companies. Increasing the linkages between the main knowledge producers, the higher education sector, and industry is also a task that the Government must address. The SSTI set ambitious targets for increasing the number of science, engineering and technology-related PhDs and achieving this target will require significant inputs.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Long term government commitment to increasing expenditure on R&D
	Securing long term investment in research	Expenditure on R&D by public sector has increased since 1996
	Dealing with barriers to private R&D investment	Development of new initiatives to encourage applied research
	Providing qualified human resources	Commitment to develop fourth level education (the provision of advanced post-graduate study and development education)
Knowledge demand	Identifying the drivers of knowledge demand	Evidence of "joined up" approach within government to science, technology and innovation policies
	Co-ordination and channelling knowledge demands	New oversight and review structures have been developed and are being put in place
	Monitoring of demand fulfilment	New initiatives to stimulate demand among industry for knowledge generated by higher education and public research sectors
Knowledge production	Ensuring quality and excellence of knowledge production	Continuation of strategy to establish a quality research base by supporting excellence, as measured by international peer review
	Ensuring exploitability of knowledge	New support measures to increase the absorption capacity of indigenous SMEs
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	New initiatives to facilitate higher education-industry linkages
	Profiting from international knowledge	Declining number of Irish participants in Framework Programmes
	Enhancing absorptive capacity of knowledge users	Strategic focus on enhancing human capital to increase knowledge users' absorptive capacity

6.2 Policy dynamics, opportunities and risks from the perspective of the Lisbon agenda

The following table summaries the main policy opportunities and risks under the four main domain headings of resource mobilisation, knowledge demand, knowledge production and knowledge circulation.

The rapid growth in government funding for R&D, the development of new STI policy development and implementation structures and the publication of a new and comprehensive Strategy for Science, Technology and Innovation covering the period 2006–2013 are characteristics of increased policy focus on the Irish research system and its oversight/review mechanisms.

The significant performance improvements in Ireland's R&D expenditure notwithstanding, Ireland is still lagging vis-à-vis the EU. While the Government endorses the Lisbon agenda and the 3% GDP target, the Irish National Reform Programme sets a lower target of 2.5% of GNP by 2013, extending by three years the target set in the Irish 3% Action Plan.

There is widespread political support for the objective to make Ireland internationally renowned for the excellence of its research and in this regard the SSTI emphasises the need for continued use of international peer review to assess proposals for

research funding. The focus on research excellence could be an important selling tool for attracting mobile R&D investment.

The key risks are that the small size of the Irish research system made jeopardise the development of a critical mass in terms of research teams/clusters and the weak linkages between the higher education sector and industry may hamper the transfer of knowledge.

The recently published Innovation Policy Statement identifies a number of key policy areas where improvements could be made in relation to innovation supports to enterprise and the knowledge economy, and closer linkages with research policy.

A new strategy for the services sector, Catching the Wave: A Services Strategy for Ireland (Forfás, 2008), has recommended the development of new support measures to promote R&D and innovative capability in service companies and the provision of structured supports to develop an institutional capacity of R&D in services.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	Political support to develop Ireland as leading knowledge-intensive performer Opportunity to position Ireland as an attractive location for FDI R&D projects Increasing public policy interest in services innovation	Weak higher education-industry linkages may dissipate the returns from Ireland's technology foresight investment in biotechnology, ICT and energy Presence of some gaps between R&D and innovation policies Ireland is still lagging behind 3% targets; the Irish National Reform Programme sets a target of 2.5% of GNP by 2013
Knowledge demand	New structures outlined in SSTI may lead to greater oversight co-ordination between research and innovation policies	Lack of systematic use of strategic policy intelligence tools in RTDI policy-making
Knowledge production	Continued focus on development of research excellence could lead to a source of competitive international advantage	Potential mismatch between focus of basic research in the higher education sector and the capabilities/requirements of the enterprise sector Danger of sub-optimal return on State funding for R&D through inability to achieve critical mass in relation to research teams
Knowledge circulation	Emphasis on development of quality scientific research base to underpin applied research	Student participation rates in science, engineering and technology disciplines are static

6.3 System and policy dynamics from the perspective of the ERA

In the context of an Island of Ireland approach, the Irish Government along with its UK counterpart has expressed support for the central ambition of the Lisbon Strategy to promote economic growth and employment, in order to ensure that Europe remains dynamic and competitive in the global economy and to help achieve wider social and environmental objectives.

The Irish National Reform Programme notes that as a small and open economy, Ireland's future success is intrinsically linked to the success of the Lisbon Strategy to develop Europe as a more competitive and attractive place for businesses and knowledge workers.

There is complementarity between the broad goals of EU's Lisbon strategy and of the Irish Government's Strategy for Science, Technology and Innovation 2006–2013. Additionally, there are overlaps between the two in terms of key priorities such as the development of research infrastructures and higher education-industry linkages.

The creation of an internal market for research to allow researchers to move freely has particular importance to Ireland in the context of the SSTI goals to double the numbers of science, engineering and technology PhDs by 2013, given that this target is unlikely to be achieved alone by domestic graduates.

The development of international linkages is a key area of research policy focus and the Government has prioritised actions to encourage Irish participation in EU Framework Programmes. Participation in the EU ERANETS programme and the new ERANETS+ programme is regarded as important learning platforms for managers of national support measures.

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List of Abbreviations

BERD	Business Expenditure on Research and Development
BMW	Border, Midland and Western Region
CSF	Community Support Framework
CSO	Central Statistics Office
DES	Department of Education and Science
DETE	Department of Enterprise, Trade and Employment
EI	Enterprise Ireland
ERA	European Research Area
ERDF	European Regional Development Fund
ESF	European Social Fund
FDI	Foreign Direct Investment
GBAORD	Government Budget Outlays or Appropriations of R&D
GERD	Gross Expenditure on Research and Development
GOVERD	Government sector performed R&D
HEA	Higher Education Authority
HERD	Higher Education Expenditure on Research and Development
HERG	Higher Education Research Group
HRB	Health Research Board
ICT	Information and Communications Technology
IDA	Industrial Development Authority
NDP	National Development Plan
NESDO	National Economic and Social Development Office
OP	Operational Programme
OST	Office of Science and Technology
R&D	Research and Development
RDI	Research, Development and Innovation
RTDI	Research, Technological Development and Innovation
S&E	Southern and Eastern Region
SFI	Science Foundation Ireland
SSTI	Strategy for Science, Technology and Innovation 2006–2013

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Abstract

The main objective of ERAWATCH country reports 2008 is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. The reports are produced for each EU Member State to support the mutual learning process and the monitoring of Member States' efforts by DG Research in the context of the Lisbon Strategy and the European Research Area. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The reports are based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.
This report encompasses an analysis of the research system and policies in Ireland.

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