



JRC SCIENCE AND POLICY REPORT

RIO Country Report Ireland 2014

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2015



European Commission
Joint Research Centre
Institute for Prospective Technological Studies

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JRC 96573

EUR 27331 EN

ISBN 978-92-79-49241-9 (PDF)

ISSN 1831-9424 (online)

doi:10.2791/13125

Luxembourg: Publications Office of the European Union, 2015

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Abstract

The report offers an analysis of the R&I system in Ireland for 2014, including relevant policies and funding, with particular focus on topics critical for two EU policies: the European Research Area and the Innovation Union. The report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The report identifies the structural challenges of the Irish research and innovation system and assesses the match between the national priorities and those challenges, highlighting the latest policy developments, their dynamics and impact in the overall national context.

Acknowledgments

The report draft has benefited from comments and suggestions of Siobhán Fitzpatrick from the Department of Jobs, Enterprise and Innovation and of Giovanni La Placa from JRC-IPTS. The contributions and comments from DG RTD and JRC-IPTS are also gratefully acknowledged.

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Executive summary

According to the 2011 Census, Ireland has a population of 4.6m in a total area of 68,825 Sq. Km.

Total employment in the first quarter of 2014 was 1.89m out of a total labour force of 2.2m. The Central Statistics Office (CSO), the Irish national statistical agency, calculated the standardised unemployment rate at 11.1% in September 2014, a decline of 1.5 percentage points from the 2013 figure of 12.6%.

The Irish economy is estimated to have contracted in GNP terms by almost 18 per cent over the period 2007-2012 with significant adverse impacts on employment and incomes. Government debt increased from 25% GDP in 2007 to 125% in 2013, fourth highest ratio of government debt to GDP in the EU. The economic crisis necessitated the Irish Government in 2010 to officially request financial assistance from the EU, the euro area Member States and the International Monetary Fund (IMF). The agreed macroeconomic adjustment programme included a joint financing package of €85bn covering the period 2010-2013.

After successfully exiting the EU-IMF programme in December 2013, the Government has sought to maintain the reform momentum to achieve the goals of creating more jobs to enhance living standards and ultimately to achieve full employment.

GDP figures for the first three quarters of 2014 indicate a strong performance by the Irish economy: the increase in growth over the equivalent period in 2013 was 4.9% while GNP growth was 4.7%.

Ireland's Gross Expenditure on Research and Development (GERD) increased from €2,736m in 2009 to an estimated €2,888m in 2013. GERD expressed as a percentage of GDP increased from 1.63% in 2009 to an estimated 1.65% in 2013 but is below the EU28 average for 2013 of 2.02%. On the other hand, Ireland's estimated per capita GERD amounted to €628 in 2013, exceeding the EU28 average figure for 2013 of €539.

In 2013, the business sector performed 73% of GERD while the higher education and government research sectors performed 23% and 4% respectively.

Business expenditure on Research and Development (BERD) increased from €1,686m in 2009 to an estimated €2,099m in 2013, an increase of €413m or 24.5 per cent.

The main research performers within the business sector are the multinational companies who account for 71% of BERD. Within the higher education sector, the seven universities perform the bulk of the research while Teagasc, the agriculture and food development authority, is the main research performer in the government sector.

The higher education sector is undergoing fundamental change as a result of the implementation of the National Strategy for Higher Education to 2030 (DES, 2011) which has led to the introduction of a Higher Education System Performance Framework (DES, 2013) covering the period 2014–2016 against which individual HEIs will be assessed on their contribution to national objectives. One of the high level objectives underpinning the new HE framework is to maintain an open and excellent public research system focused on the Government's priority areas and the achievement of other societal objectives and to maximise research collaborations and knowledge exchange between and among public and private sector research actors.

A new national strategy for STI is currently in preparation and is expected to be published in 2015. The most important current STI policy document is the National Research Prioritisation Strategy (DJEI, 2012); other policy documents having a STI focus include the Action Plans for Jobs (published annually) (DJEI, 2014) and the Medium Term Economic Strategy 2014-2020 (MTES) (DOF, 2013).

The focus of current STI investment policy is two-fold: (a) to develop the science base (infrastructure, people and associated facilities) and (b) to provide support to the enterprise sector in order to build its capacity for research and development.

The current policy emphasis on the implementation of the national research prioritisation strategy has resulted in changes in the STI governance infrastructure. These changes include the high profile given to the Research Prioritisation Action Group (RPAG) which was established in 2013 to monitor the implementation of the national research prioritisation strategy and the dissolution of Forfás, the policy advisory board for Enterprise, Trade, Science and Innovation, whose policy advisory role has been incorporated into the Department of Jobs, Enterprise and Innovation. The RPAG which is chaired by the Minister for Skills, Research and Innovation comprises representatives of the major research funding government departments (ministries) and agencies, and reports to the Cabinet Committee on Economic Recovery and Jobs.

The legal remit of Science Foundation Ireland (SFI), one of the largest funders of research in the higher education sector, was extended in 2013 to include both oriented basic research and applied research. The extension of SFI's remit to include applied research will enable the outcome of oriented basic research funded by SFI to be taken closer to market, which in turn increases the potential of research to yield commercial opportunities and jobs as well as other societal benefits. SFI now has powers to fund research on a wider geographic basis, including supporting research teams and institutions in Northern Ireland. SFI can also, subject to the consent of the Minister for Jobs, Enterprise and Innovation, look to participate in collaborative funding programmes with countries of the European Economic Area or other countries. SFI's legal remit was also extended to enable it to provide funding to promote the study of, education in and awareness of, science, technology, engineering and mathematics.

In 2013, the Department of Jobs, Enterprise and Innovation published its strategy for Horizon 2020 (DJEI, 2013) in which it pointed out that the programme was an opportunity for Ireland to deepen its engagement in collaborative European and international research. The Government has stated that Ireland will target up to €1.25bn in research and technology funding under the new programme. An enhanced national support structure has been put in place to assist Irish organisations to participate in Horizon 2020.

The MTES noted that while Ireland offers a business environment that is regarded as being conducive to innovative firms, Ireland still lagged behind world leaders such as Singapore, Germany and the Netherlands. It also pointed out that innovation in Ireland was too concentrated in foreign owned enterprises. It concluded that Ireland must find ways to foster greater innovation in indigenous companies and in the delivery of public services.

The MTES pointed out that the 2014 Action Plan for Jobs would build on the State's investments in R&D infrastructures to further drive innovation by a number of actions including consolidating and building critical mass and international reputation in areas that underpin Ireland's enterprise base and enhancing collaborations between creative and design firms and other enterprises, academia and other public sector bodies to deliver

economic and social benefits. It would also identify ways to use Government procurement in a strategic way to stimulate collaborative efforts between the public sector, research institutes and firms that will deliver innovative solutions.

Ireland is classified by the Innovation Union Scoreboard 2014 as being an Innovation Follower, i.e. having an innovation performance above or close to that of the EU average.

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1. Overview of the R&I system

1.1 Ireland in the European RDI landscape

The main focus of R&I policy is on the implementation of the National Research Prioritisation Strategy/Smart Specialisation Strategy. The National Research Prioritisation Strategy was published in 2012 and its objective is to maximise the impact of Government investment in the research and innovation landscape.

The national research prioritisation strategy involves concentrating the majority of public STI funding over the next 5 years in 14 areas of opportunity¹ as well as the underpinning technologies and infrastructure to support these priority areas. The 14 priority areas were identified on the basis of existing strengths of the public research system, existing strengths of the enterprise base, opportunities that exist in terms of the global marketplace and those which are most likely to deliver economic and societal impact and employment. A new governance infrastructure has been put in place to monitor the implementation of the national research prioritisation strategy and includes the Research Prioritisation Action Group (RPAG).

The National Research Prioritisation Strategy forms the basis for the development and implementation of Ireland's national smart specialisation strategy for research and innovation (RIS3).

The Government published policy statements in 2014 on foreign direct investment and entrepreneurship.

Business expenditure on Research and Development (BERD) increased during 2009-2013 from €1,686m in 2009 to an estimated €2,099m in 2013. Overseas companies are the major research performers and in 2013 accounted for 71% of BERD.

The percentage of GERD performed by the enterprise sector is currently 73%, and the target for 2017 as expressed in the national research prioritisation strategy is 66.6% — the Government believes that maintaining a 2:1 ratio is important to ensure an appropriate balance between activity in the public and private sectors.

The first progress report of the RPAG states that the target for the total number of researchers in the enterprise sector by 2017 is 11,718; the achievement of this target will require an additional 1,100 research personnel over the 2011 figure of 10,618.

The national Research Prioritisation Strategy Steering Group took into account complementary developments at EU level (such as Horizon 2020) and other international initiatives.

Metrics developed as part of the implementation of the national research prioritisation strategy include the amount of drawdown of EU research funding for both indigenous and foreign owned companies.

¹ The 14 priority areas are: (1) Future Networks & Communications, (2) Data Analytics, Management, Security & Privacy, (3) Digital Platforms, Content & Applications, (4) Connected Health and Independent Living, (5) Medical Devices, (6) Diagnostics, (7) Therapeutics: Synthesis, Formulation, Processing and Drug Delivery, (8) Food for Health, (9) Sustainable Food Production and Processing, (10) Marine Renewable Energy, (11) Smart Grids & Smart Cities, (12) Manufacturing Competitiveness, (13) Processing Technologies and Novel Materials and (14) Innovation in Services and Business Processes.

The Innovation Union Scoreboard 2014 includes Ireland in a group of EU Member States that are classified as Innovation Followers, i.e. having an innovation performance above or close to that of the EU average. Ireland's performance relative to that of the EU has declined over time, from 115% in 2006 to 110% in 2013. On the other hand, Ireland held top positions on individual scoreboard dimensions such as human resources, innovators and economic effects (outputs).

The 2014 Scoreboard report states that Ireland performed well above the EU average on International scientific co-publications and License and patent revenues from abroad. The report pointed out that other strong performing indicators were Population with tertiary education, Employment in knowledge intensive-services and Knowledge-intensive services exports. Ireland had relative weaknesses in Community designs and Non-R&D innovation expenditures.

1.2 Main features of the R&I system

STI policy development in Ireland is highly centralised. The two key Government ministries involved in STI policy development and implementation are the Department of Jobs, Enterprise and Innovation and the Department of Education and Skills. The main research funders are Science Foundation Ireland, Enterprise Ireland, IDA Ireland, the Higher Education Authority, the Irish Research Council and the Health Research Board.

The main research performers are the enterprise sector (of which over 70% of research performing enterprises are foreign owned) and the higher education sector (of which the seven universities are the main players). The Public Research Organisation (PRO) sector is small by EU standards; the major research performer is Teagasc, the agriculture and food development authority.

Ireland comprises two NUTS² II regions: the South and Eastern Region (S&E) and the Border, Midlands and Western Region (BMW). The larger of the two regions, the S&E region includes 13 counties, five regional authority areas and four cities (including the capital, Dublin, and other main Irish cities of Cork, Limerick and Waterford). It accounts for more than 80% of Irish GDP and has six of the country's seven universities and nine of its 14 Institutes of Technology (IoT). The EU's Regional Innovation Scoreboard 2014³ classifies the S&E Region as an innovation leader even though as a country Ireland is categorised as an innovation follower.

1.3 Structure of the national research and innovation system and its governance

In August 2014, Forfás, the policy advisory board for Enterprise, Trade, Science and Innovation, was dissolved and its policy functions were integrated into the Department of Jobs, Enterprise and Innovation.

The membership of the Advisory Council on Science Technology and Innovation was stood down in September 2013. The future of the Council, which is a sub-board of Forfás (now

² Nomenclature of Territorial Units for Statistics/Nomenclature des unités territoriales statistiques (NUTS).

³ European Commission (2014): *Regional Innovation Scoreboard 2014*, Brussels, Belgium. Available at: http://ec.europa.eu/news/pdf/2014_regional_union_scoreboard_en.pdf (Accessed 16 February 2015).

dissolved), is being considered in the context of the integration of its parent body with the Department of Jobs, Enterprise and Innovation.

The Irish Universities Quality Board which had been established to promote a culture of quality in the university sector and independently evaluate the effectiveness of quality processes in the sector was amalgamated in 2012 with a number of other agencies such as the Higher Education and Training Awards Council to form Quality and Qualifications Ireland (QQI).

The Office of the Chief Scientific Adviser was abolished as a separate office in 2012; Professor Mark Ferguson of Science Foundation Ireland (SFI) was appointed Chief Scientific Adviser to the Government in addition to his role as Director General of SFI.

The Research Prioritisation Action Group (RPAG), which is responsible for overseeing the national research prioritisation strategy — considered as a key STI policy initiative by the current administration, issued its first progress report⁴ in July 2014. The RPAG which is chaired by the Minister for Skills, Research and Innovation and reports to the Cabinet Committee on Economic Recovery and Jobs comprises senior officials from ten State agencies and six Government departments with responsibility for funding research and innovation is charged with monitoring the implementation of Action Plans for each of the 14 identified priority areas⁵. The RPAG had been tasked with developing indicators to be used to measure the impact of implementation of research prioritisation in the 14 Priority Areas and more generally the impact of public STI investment. The Government accepted these indicators in 2013 and the RPAG progress report released in 2014 presented an update of the monitoring of these metrics.

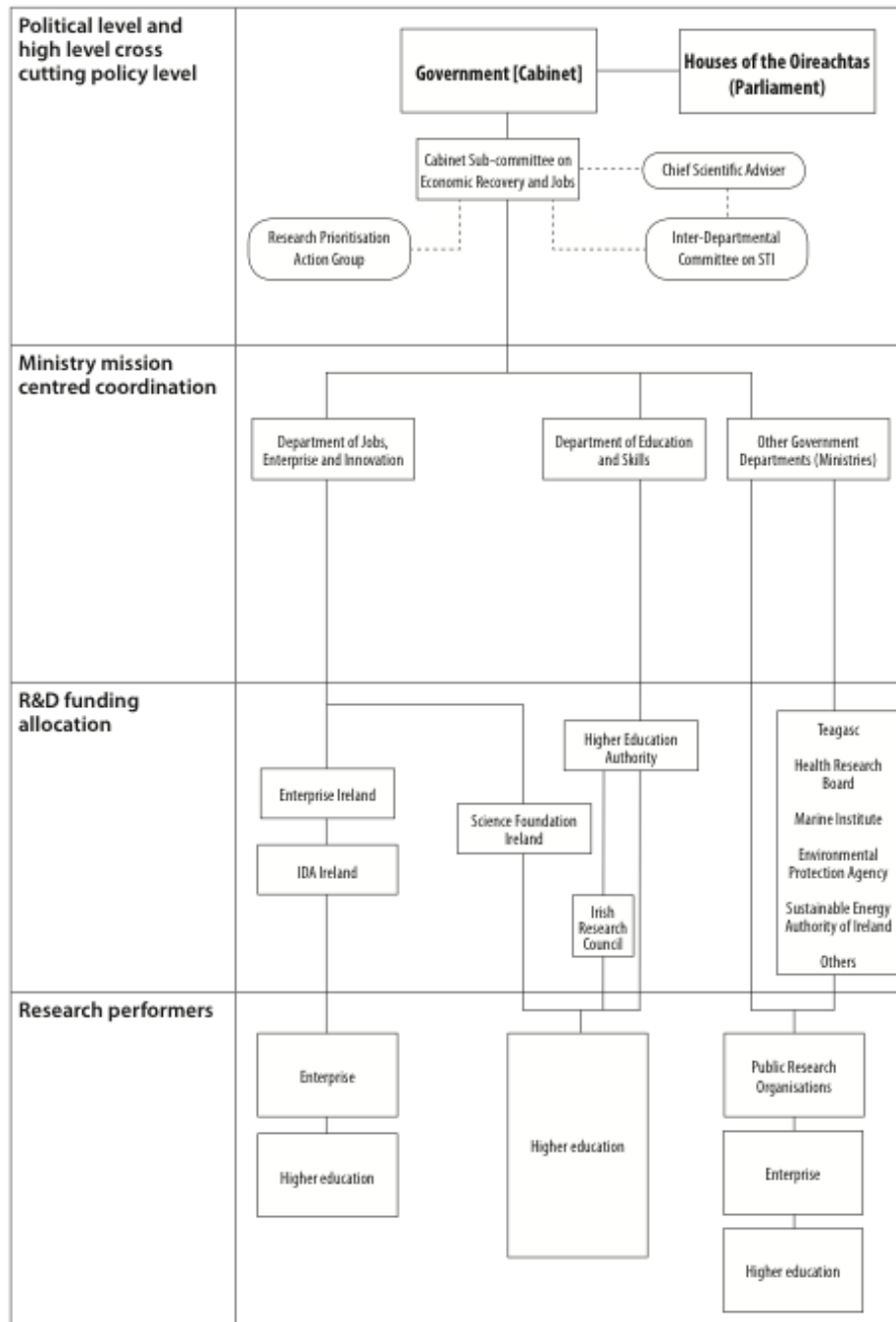
Another cross-government co-ordinating body in relation to STI policy issues is the Inter-Departmental Committee on Science, Technology and Innovation which is headed by a senior official from the Department of Jobs, Enterprise and Innovation. The IDC has not met for some time because of the focus within the STI system on research prioritisation. The IDC differs from RPAG in that its membership is comprised of Government Departments (ministries) i.e. it does not include funding agencies.

In 2014, the national structure to promote technology transfer in the higher education sector, the Central Technology Transfer Office (cTTO), was rebranded in 2014 as Knowledge Transfer Ireland.

⁴ Department of Jobs, Enterprise and Innovation (2014), *National Research Prioritisation Exercise: First Progress Report*, Dublin, Ireland. June 2014. Available at: http://www.djei.ie/publications/science/2014/NRPE_First_Progress_Report.pdf (accessed 25 February 2015).

⁵ The Plans contain a comprehensive set of actions to be taken by funding departments and agencies to re-align to majority of competitive public research funding around the priority areas over the next five years.

Figure 1. Ireland's RDI governance system



Main changes in 2010

The Government publishes the report of the Innovation Taskforce

The Department of Enterprise, Trade and Employment became the Department of Enterprise, Trade and Innovation while the Department of Education and Science became the Department of Education and Skills

Main Changes in 2011

Transfer of responsibility for the Programme for Research in Third Level Institutions from the Department of Education and Skills to the Department of Jobs, Enterprise and Innovation

Government publishes national strategy for the higher education sector, National Strategy for Higher Education to 2030

Main changes in 2012

Publication of the national research prioritisation strategy

Publication of IP Protocol

The Irish Research Council replaces the Irish Research Council for the Humanities and Social Sciences and the Irish Research Council for Science, Engineering and Technology

Main changes in 2013

Establishment of Knowledge Transfer Ireland (originally set up as cTTO in 2013, renamed as KTI in 2014)

Development of performance metrics by the Research Prioritisation Action Group

Publication of the Government's Horizon 2020 strategy document

Main changes in 2014

Dissolution of Forfás, the policy advisory board for Enterprise, Trade, Science and Innovation, and transfer of its policy functions into the Department of Jobs, Enterprise and Innovation

Publication of the National Policy Statement on Entrepreneurship in Ireland

Publication of Policy Statement on Foreign Direct Investment in Ireland

2. Recent Developments in Research and Innovation Policy and systems

2.1 National economic and political context

Ireland was subject to a macroeconomic adjustment programme involving the European Union, European Central Bank and the International Monetary Fund which it successfully exited in December 2013. The programme which was agreed in 2010 involved the provision of €85b in funding made up of €22.5b from the European Financial Stability Mechanism, €22.5b from the IMF, €22.5b from the European Financial Stability Facility, €17.5b from the Irish sovereign National Pension Reserve Fund and bilateral loans from the United Kingdom, Denmark and Sweden.

In 2014, the Government published its Medium Term Economic Strategy 2014-2020, A Strategy for Growth (MTES), which sets out its intentions to progress with its reform programme under the following three pillars:

- Ensuring Debt Sustainability;
- Financing Growth;
- Supporting Employment and Living Standards.

The MTES outlines the core components of the Government's strategy to continue the work of re-building the Irish economy, achieve sustainable economic growth, strong public finances and enduring job creation.

It points out that Ireland offers a business environment that is regarded as being conducive to innovative firms. However, it says that Ireland still lags behind world leaders (i.e. Singapore and the United States) and European leaders (i.e. Germany, Switzerland and the Netherlands) and that innovation in Ireland is too concentrated in foreign owned firms. The MTES document states that Ireland must find ways to foster greater innovation in domestically owned firms and in the delivery of public services.

Having built up a very strong science base in Ireland as a result of a prolonged period of incremental and substantial investment in research and innovation, the MTES document notes that the current strategy is focused on accelerating the economic and societal return on Ireland's STI investment, further strengthening enterprise engagement with public research and driving more commercialisation of research. It points out that Ireland is now focused on realising the economic benefits of its investments to date in R&D by delivering on the Action Plans which have evolved in response to the Report of the Research Prioritisation Steering Group, by strengthening its Intellectual Property (IP) framework, by brokering partnerships between firms and research institutes and by reducing barriers for SMEs to engage in research, development & innovation.

A new Minister of State for Skills, Research and Innovation, Mr. Damien English, was appointed following a cabinet re-shuffle in July 2014. He chairs the Research Prioritisation Action Group which monitors the implementation of the national research prioritisation strategy.

In September 2014, the Government, through the Department of Jobs, Enterprise and Innovation, published its long-awaited National Policy Statement on Entrepreneurship in

Ireland 2014⁶. The key target contained in the document is to double the jobs impact of start-ups in Ireland over the next five years, from 93,000 currently. The Entrepreneurship Statement also sets out actions to improve innovation in start-ups and in existing enterprises.

The Department of Jobs, Enterprise and Innovation also in 2014 published its Policy Statement on Foreign Direct Investment in Ireland (DJEI, 2014)⁷ in which it said that Ireland will seek to differentiate its offering in three key areas, one of which is connected world-leading research. One of the Statement's Policy Actions is to target FDI that can commercialise and exploit those areas that are prioritised for research investment.

Science Foundation Ireland has estimated that 72% of new jobs announced by IDA Ireland, the national FDI agency, in 2013 were in international companies that had a prior collaboration with an SFI-funded research group⁸.

Beginning in 2012, the Government has adopted and published annual Action Plans for Jobs. The 2014 Action Plan sets out how the Government will continue to work to build and sustain a competitive economy.

2.2 National R&I strategies and policies

Science, technology and innovation occupy a central position in national economic strategies and this is reflected in national structures that encompass a whole-of-government approach to STI policy development and implementation.

The main and current focus within the STI policy system is on the implementation of the National Research Prioritisation strategy which covers the period 2013-2017 and which involves the prioritisation of Government R&I funding in 14 priority areas. The body charged with monitoring its implementation, the Research Prioritisation Action Group (RPAG), is headed by the Minister of State for Skills, Research and Innovation who reports to the Cabinet Sub-Committee on Economic Recovery and Jobs. The Action Group comprises representatives from the main Government Departments (ministries) and their respective research funding agencies. While RPAG is primarily concerned with the implementation of the national research prioritisation strategy it also has responsibility for ensuring the implementation of a number of recommendations to improve the efficiency and effectiveness of the national innovation system. As an example, in response to one of the main systemic recommendations of the National Research Prioritisation Steering Group that the Government should develop a set of national indicators that would include indicators of economic impact, the RPAG in 2013 published a framework for monitoring the

⁶ Department of Jobs, Enterprise and Innovation (2014), *National Policy Statement on Entrepreneurship in Ireland 2014*, Dublin, Ireland. Available at: <http://www.enterprise.gov.ie/en/Publications/National%20Policy%20Statement%20on%20Entrepreneurship%20in%20Ireland.pdf> (accessed 25 February 2015).

⁷ Department of Jobs, Enterprise and Innovation (2014), *Policy Statement on Foreign Direct Investment in Ireland*, Dublin, Ireland. Available at: http://www.enterprise.gov.ie/en/Publications/Policy_Statement_on_Foreign_Direct_Investment_in_Ireland_PDF_689KB_.pdf (accessed 25 February 2015).

⁸ Science Foundation Ireland (2013), *Agenda 2020: 2013 Review*, Dublin, Ireland. Available at: <http://www.sfi.ie/assets/media/files/downloads/Publications/Organisation%20Publications/Agenda%202020%20Review%202013.pdf> (accessed 25 February 2015).

impact of STI investment, which outlines a range of metrics and targets at national, research funder and Priority Area level, supported by a suite of monitoring indicators.⁹

The National Research Prioritisation Steering Group which was tasked with the development of the national research prioritisation strategy took account of national, EU and international research priorities in addition to societal challenges, market demands and the capacity of the enterprise base in Ireland. Ireland is positioning the process it used for the development of its national research prioritisation strategy as the basis for its Research and Innovation Smart Specialisation Strategy (RIS3)¹⁰ which is a pre-requisite to apply for Structural Funds.

The implementation of the national research prioritisation strategy involves the provision of funding along the research spectrum from frontier research to applied research. There is also a greater emphasis on research funding agencies developing joint funding calls.

Ireland's Horizon 2020 strategy is also an important document within the national STI system; Ireland has set a target of achieving a drawdown of €1.25bn in H2020 research and technology funding. InterTradeIreland, the cross-border business development body, is preparing an Action Plan which will involve North-South co-operation in relation to securing Horizon 2020 funding.

With the ending of the Strategy for Science, Technology and Innovation 2006-2013¹¹, attention is now focusing within the Department of Jobs, Enterprise and Innovation on the development of a new STI strategic policy. This is expected to be published in 2015 and will cover the period 2015-2020. It is anticipated that the new strategic policy document will have a number of pillars, one of which will be research prioritisation/smart specialisation while others will focus on industry-HEI collaboration, knowledge transfer, human capital development and research infrastructures.

Ireland has an extensive range of RTDI funding programmes aimed, *inter alia*, at encouraging enterprises to invest in research and development and facilitating linkages between the enterprise base and the HEI/PRO sectors. The main research funding programmes which encompass frontier research and applied research are:

Enterprise Ireland (2013 figures):

- Technology Centres (€22.8m);
- Commercialisation Fund (€20.6m);
- Innovation Partners (€7.3m);
- Technology Gateways (€3.6m);
- Technology Transfer Strengthening (€3.9m);
- Innovation Vouchers (€3.1m).

⁹ Department of Jobs, Enterprise and Innovation and Forfás (2013), *Research Prioritisation: A Framework for Monitoring Public Investment in Science, Technology and Innovation*, Dublin, Ireland. Available at: http://www.djei.ie/science/technology/rpmaps/A_Framework_for_Monitoring_Public_Investment_in_STI.pdf (accessed 25 February 2015).

¹⁰ Department of Jobs, Enterprise and Innovation (2015), Ireland's Smart Specialisation Strategy for Research and Innovation. Available at: <http://www.djei.ie/science/technology/ris3.htm> (accessed 25 February 2015).

¹¹ Department of Jobs, Enterprise and Innovation (2006), *Strategy for Science, Technology and Innovation 2006-2013*, Dublin, Ireland. Available at: <http://www.djei.ie/publications/science/2006/sciencestrategy.pdf> (accessed 25 February 2015).

Science Foundation Ireland (2013 figures):

- SFI Research Centres (€48.2m);
- Investigators Programme (€37.8m);
- Centres for Science, Engineering and Technology (€19.0m);
- Strategic Research Centres (€10.7m);
- Technology Innovation Development Award*¹² (€8.7m);
- Research Frontiers Programme (€4.3m).

IDA Ireland (2013 figures):

- Research, Development & Innovation Support programme (€56.0m).

2.3 National Reform Programmes 2013 and 2014

The Irish National Reform Programme (NRP) 2014 update¹³ confirms that Ireland's Headline Target in relation to Research and Development is to raise combined public and private investment levels in this sector to 2.0% of GDP or 2.5% of GNP by 2020.¹⁴ The NRP indicates that this Headline Target is in line with the Europe 2020 R&D target.

The document outlines recent developments with respect to BERD, HERD, GOVERD and GERD and points to the strong science base that has been developed in Ireland.

The NRP highlights the importance of R&D-related FDI projects by pointing out that in 2013, of 164 foreign direct investments in Ireland, 27 were in research, development and innovation. It states that indigenous industry is also increasing its investment in R&D.

The National Reform Programme stresses the impact of STI policy initiatives in relation to increasing investment by the enterprise sector in R&D such as the R&D tax credit and supports for industry-higher education linkages.

The 2014 update says that the current strategy is focussed on accelerating the economic and societal return on STI investment, further strengthening enterprise engagement with public research and driving more commercialisation of publicly-performed research.

The NRP states that the two key principles underpinning current STI strategic investment policy are:

- Investing in people, infrastructure and associated facilities to build the science base;
- The provision of direct support to the enterprise sector in order to build its capacity for research and development, including support for the development of technology-based firms as well as encouraging innovative activities in other sectors.

The NRP emphasises the importance of the national research prioritisation strategy as a key initiative in driving the STI strategic agenda.

¹² This programme is jointly managed by Science Foundation Ireland and Enterprise Ireland.

¹³ Government of Ireland (2014), *National Reform Programme — Ireland — April 2014*, Dublin, Ireland. Available at:

http://www.taoiseach.gov.ie/eng/Work_Of_The_Department/Economic_International_Northern_Ireland/Economic/NRP/National_Reform_Programme_2014.pdf (accessed 25 February 2015).

¹⁴ GNP is regarded as a better indicator than GDP of the value added to accruing to the Irish residents because of the income flows to non-residents, especially profits and dividends of foreign direct investment enterprises.

The 2014 NRP also focuses on developments in Ireland's IP infrastructure and draws attention to the role of the Intellectual Property Protocol and the central Technology Transfer Office (now rebranded as Knowledge Transfer Ireland) as having the potential to provide an interface between the enterprise sector and the research sector (primarily the HEIs).

The importance to Ireland of attracting FDI projects with a R&D component is also addressed in the 2014 NRP and it identifies the close collaboration of development and regulatory agencies, industry and HEIs as a key tool in this regard.

The document provides an overview of the strategy utilised by Science Foundation Ireland to encourage participation in science, technology, engineering and mathematics (STEM) disciplines.

The 2014 NRP presents a synopsis of the Government's Horizon 2020 strategy in relation to Ireland's participation in the Horizon 2020 programme and its associated target of achieving €1.25bn in funding to Ireland over the lifetime of Horizon 2020.

It also highlights the importance of encouraging innovation not just in business but across society.

The 2014 EU Commission recommendations¹⁵ on Ireland focused on a range of issues including budget deficits, healthcare reforms and labour market policies and also highlighted the need to address problems experienced by SMEs in accessing credit.

2.4 Policy developments related to Council Country Specific Recommendations

Ireland successfully completed the EU-IMF financial assistance programme in 2013 and is now subject to post-programme surveillance (PPS) until at least 75% of the financial assistance received has been repaid and is expected to last until 2031. The objective of the post-programme surveillance is to measure Ireland's capacity to repay its outstanding loans.

In June 2014, the EU published its first PPS report¹⁶ which provided an assessment of Ireland's economic, fiscal and financial situation following the completion of the EU-IMF financial assistance programme. The report focused on recent economic developments and on policy issues relating to public finances, the financial sector and structural reforms.

The PPS report was silent on issues relating to science, technology and innovation.

¹⁵ European Commission (2014), *Council Recommendation of 8 July 2014 on the National Reform Programme 2014 of Ireland and delivering a Council opinion on the Stability Programme of Ireland, 2014*, Official Journal of the European Union, (2014/C 247/07), Brussels, Belgium. Available at: http://ec.europa.eu/europe2020/pdf/csr2014/csr2014_council_ireland_en.pdf (accessed 25 February 2015).

¹⁶ European Commission, Directorate-General for Economic and Financial Affairs (2014), *European Economy: Post-Programme Surveillance for Ireland — Spring 2014 Report*, Brussels, Belgium. Available at: http://ec.europa.eu/economy_finance/publications/occasional_paper/2014/pdf/ocp195_en.pdf (accessed 25 February 2015).

2.5 Funding trends

As a result of the economic recession, Gross Expenditure on Research and Development (GERD) fell slightly from €2,736m in 2009 to €2,723m in 2012; however, it increased to an estimated €2,888m in 2013. Business expenditure on Research and Development (BERD) increased — albeit slowly — between 2009 and 2013 to reach an estimated €2,099m.

2.5.1 Funding flows

As shown in Table 1 below, the latest Eurostat and national data indicate that Ireland's GERD as a percentage of GDP was 1.65% in 2013 (1.63% in 2009) which is below the EU-28 average of 2.02%. On a per capita basis, GERD in Ireland amounted to €605 in 2009 but this increased to an estimated €628 in 2013, though still well above the EU-28 average of €539.

GBAORD has fallen from a high of €898m in 2009 to an estimated €732m in 2013. GBAORD as a percentage of GDP declined from 0.53% in 2009 to an estimated 0.42% in 2013 (0.52% as a percentage of GNP).

The amount of R&D funded by the enterprise sector as a percentage of GDP declined from 0.85% in 2009 to 0.79% in 2012.

The percentage share of research performed by the three sectors (enterprise, HEIs and Government) has changed during the period 2009-2013 with the enterprise sector increasing its share from 68% in 2009 to an estimated 73% in 2013 at the expense of the higher education sector (whose share fell from 26.6% in 2009 to an estimated 23% in 2013). The estimated share performed by the government sector in 2013 was 4% which is well below the EU-28 average of 12%.

Data from DG Regio¹⁷ indicates that provision of core RTD funding to Ireland during 2007-2012 amounted to €155.2m (this is lower than the €229.8m provided during 2000-2006).

Data on Ireland's performance in Framework Programmes (FP)¹⁸ indicate a substantial increase in the number of projects, participants and EU financial contribution in FP7 over FP6. The number of projects with Irish participants funded in FP6 amounted to 724; this increased to 1,494 projects in FP7. The number of Irish participants in FP6 stood at 913; this number more than doubled to 1,991 in FP7. The EU financial contribution to Irish partners in FP6 amounted to €219.9m; the equivalent amount in FP7 was €634.4m.

The available Eurostat data on Venture Capital as % of GDP points to a positive Irish story: the figure for 2009 stood at 0.028% but that had doubled to 0.054% in 2012.

Data published by the Irish Patents Office¹⁹ indicate that there has been a significant decline in national IP filings (these fell from 961 in 2009 to 390 in 2013). The Irish Patents Office notes that while filing figures for PCT and EPO by Irish resident applicants are positive and show modest increases, these figures do not show the complete picture. This is because many Irish-based foreign owned firms which develop IP in Ireland often have a

¹⁷ Data provided by the JRC Institute for Prospective Technologies Studies (IPTs).

¹⁸ Data provided in confidential email message from Enterprise Ireland, October 2014.

¹⁹ Patents Office (2014), *Eighty Sixth Annual Report of the Controller of Patents, Designs and Trade Marks 2013*, Published by the Stationery Office, Dublin, Ireland. Available at: http://www.patentoffice.ie/en/publications_report.aspx (accessed 25 February 2015).

policy of filing applications to protect those IP rights through their parent company which is headquartered abroad. In such cases, even though the R&D which has given rise to the IP has been carried out in Ireland, the applications might not necessarily be recorded as filings by Irish resident firms.

While statistics on applications to national patent office are not always comparable across EU Member States, they can provide some indication of technological development activities that are not captured by EPO/PCT data. In Ireland, approximately 2,600 patent applications were made at the EPO in the period 2000-2010 while approximately 3,500 patent applicants took the PCT route. The Irish Patents Office received over 7,500 applications in this period (these three figures are based on fractional counting).²⁰

Table 1. Basic indicators for R&D investments

	2009	2010	2011	2012	2013	EU28 (2013)
GDP growth rate	-6.4%	-0.3%	2.8%	-0.3%	0.2%	0.10%
GERD (% of GDP)	1.63%	1.62%	1.53%	1.58%	1.65%*	2.02%
GERD (euro per capita)	605	587	574	594	628*	539.2
GBAORD - Total R&D appropriations (€ million)	898	833	795	760	732	90,505.61
R&D funded by Business Enterprise Sector (% of GDP)	0.85%	0.85%	0.76%	0.79%	n.a.	1.1% (2012)
R&D funded by Private non-profit (% of GDP)	0.01%	0.01%	0.01%	0.01%	n.a.	0.03% (2012)
R&D funded from abroad (% of GDP)	0.27%	0.27%	0.32%	0.34%	n.a.	0.2% (2012)
R&D related FDI (*) (€ million)	n.a.	n.a.	n.a.	n.a.	n.a.	n/a
R&D performed by HEIs (% of GERD)	26.6%	26.5%	24%	23%	23%*	23.19%
R&D performed by Government Sector (% of GERD)	5%	4.8%	4.9%	4.8%	4%*	12.21%
R&D performed by Business Enterprise Sector (% of GERD)	68%	70%	69.6%	72%	73%*	63.76%
Share of project vs. institutional public funding for R&D	35%: 65%	34%: 66%	36%: 64%	37%: 63%	n.a.	n/a
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	4.9%	5.0%	5.1%	5.0%	5.2%	5.6%
Employment in knowledge-intensive service sectors as share of total employment	42.7%	44.3%	44.8%	45.3%	44.7%	39.2%
Turnover from innovation as % of total turnover	n.a.	9.3	n.a.	n.a.	n.a.	13.4% (2010)

Data sources: EUROSTAT, October 2014; the Ministry of Science and Higher Education; GUS; (*) Note: * Estimated 2013 data for GERD and BERD provided by the Department of Jobs, Enterprise and Innovation.

²⁰ Unpublished data from the "INCENTIM KU Leuven, Università Commerciale Luigi Bocconi, KITEs and Technopolis Consulting Group (2014), *Measurement and analysis of knowledge and R&D exploitation flows, assessed by patent and licensing data.*" Study performed for DG Research and Innovation, 2009-2015.

2.5.2 Project vs. institutional allocation of public funding

There has been no legislative reform with respect to the legal framework for the allocation of funding for research and development via competitive or institutional funding channels.

In relation to the allocation of GBAORD by funding mode, the amount of funding for research provided by way of competitive funding programmes increased over the period 2009-2012 from 35% of GBAORD in 2009 to 37% in 2012; conversely, the percentage of institutional funding for research decreased from 65% of GBAORD in 2009 to 63% in 2012²¹.

As noted above, the amount of GBAORD funding has decreased from €898m in 2009 to €732m in 2013 which indicates that the allocation of institutional research funding has declined both in relative and in absolute terms.

The main element of institutional funding is the block grant provided to the HEIs by the Higher Education Authority. The block grant covers core teaching and research activities within institutions; it is important to note that the internal allocation of funds as between teaching and research is a matter for each institution. The allocation by the HEA of the block grant to the HEIs is determined on a formula basis. The allocation is based on a standard per capita amount in respect of weighted EU student numbers in four broad subject price groups. Student numbers in the four groups are weighted to reflect the relative cost of the subject groups. A further weighting is given for research students. Five per cent is also top-sliced from the aggregate grant for all higher education institutions.

The research component of the block grant was estimated by Forfás at €162.5m in 2013²².

Funding for PROs is normally determined on the basis of annual negotiations between the research organisations and their parent Government Department (ministry). Teagasc, the agriculture and food development authority, is the largest PRO and in 2013 had research expenditures of €63m — which represented almost two-thirds of GOVERD.

The main Government departments (ministries) responsible for the allocation of research funds include the Department of Jobs, Enterprise and Innovation, the Department of Education and Skills, the Department of Agriculture, Food and Marine, the Department of Communications, Energy and Natural Resources, the Department of Health and the Department of Environment, Community and Local Government.

The main research funding agencies include Science Foundation Ireland (SFI), Enterprise Ireland, IDA Ireland, the Higher Education Authority, the Irish Research Council, Teagasc, the Health Research Board and the Marine Institute.

The main project-based funding programmes were outlined in Section 2.2 above.

The criteria used by research funding agencies are multi-faceted though an important consideration is the extent to which the project application aligns with the 14 priority areas identified in the national Research Prioritisation strategy. It is estimated that 99% of the

²¹ Source: *Total GBAORD by Funding Mode*, Eurostat. Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_fundmod&lang=en (Accessed 18 February 2015).

²² Forfás (2013), *State Investment in Research & Development 2012-2013*, Dublin, Ireland. Available from: http://www.forfas.ie/media/18122013_State_Investment_in_RD_2012-13-Publication.pdf (Accessed 18 February 2015).

research funding allocated by Science Foundation Ireland in 2013 was in the 14 priority areas identified by the national Research Prioritisation strategy.

The use of international peer review is well established in the Irish STI system for assessing project applications; all SFI funding programmes, for example, involve the use of international experts. International experts are also used in the evaluation of large-scale funding programmes.

There is a difficulty in assessing the efficiency of the current balance between project and institutional funding for research. A contributing factor is the lack of detailed information on the amount of research that is undertaken by the HEIs with block grant funding. A further difficulty is that some research funders are also research performers and data are lacking to determine the split between their institutional and project based funding.

2.5.3 R&I funding

Funding for STI covers the research spectrum from basic/frontier research to close-to-market research. Science Foundation Ireland provides funding for research in the basic/frontier end of the spectrum; its legal remit was amended in 2013 to allow it to fund applied research projects.

Though there is no breakdown of the allocation of R&I funding along the research spectrum, the Forfás publication, "State Investment in Research & Development 2012-2013"²³, provides a breakdown of the types of research being performed by Government departments and agencies. The report estimated that of all allocated funds for research to be undertaken by Government departments and agencies in 2013, 69.2% was in applied research, with expenditure amounting to €68m. Basic research accounted for 19.9% of total funding and stands at €19.5m while Experimental development accounted for 10.9% of all expenditure at €10.7m.

The Forfás document notes that applied research in agricultural sciences continues to be the field of science in which most expenditure takes place. In 2013, €50.1m was allocated to applied science in this area with €17.1m on basic research and €6.8m on experimental development.

The constraints on public finances has resulted in research funding agencies, such as Science Foundation Ireland, requiring research funding recipients to demonstrate how they will use the funds to leverage finance from other, non-Exchequer funding sources, such as Horizon 2020.

In addition to seeking SFI Research Centres to leverage non-Exchequer funding, the Government has also obtained funding from the private sector for their development. In October 2014, the Government announced the provision of 5 new SFI Research Centres involving a total investment of €245m of which industrial partners would contribute with €90m.

The 2014 Researchers Report quotes an OECD study which reports that Ireland has a relatively low level of direct support of business R&D activities. The OECD stated that indirect supports were almost 3 times higher than direct support. One of the main forms of indirect supports is the R&D Tax Credit, the annual cost of which is estimated to have risen from €71m in 2004 to approximately €282m in 2012 according to data published by the

²³ Op Cit.

Revenue Commissioners, the agency responsible for customs, excise, taxation and related matters. By way of contrast, the Forfás "State Investment in Research & Development 2012-2013" document notes that the allocation of GBAORD in terms of direct research funding supports to the industrial production and technology sectors was estimated at €170m in 2013.

The review of the R&D Tax Credit²⁴ which was published in 2013 points out that the State supported the R&D expenditure of private companies in 2011 by around €379m. A total of €261m of this support was indirect, delivered via the tax system through the R&D Tax Credit, with the remaining €118m was direct support delivered through grants.

The R&D Tax Credit is perceived as an important element in the policy mix to attract high added-value FDI research and innovation-related projects to Ireland. The tax credit has been amended on a continuous basis since its introduction to enhance its attraction to companies. The Government announced its intention in the 2015 Budget to abolish the base year for the calculation of the 25% R&D tax credit (the base year had previously been set at 2003). This change will mean that all research and development expenditure will qualify for the tax credit which will make R&D much more attractive for companies.

2.6 Smart Specialisation (RIS3)

The Government has positioned the National Research Prioritisation Strategy as the basis for its Smart Specialisation Strategy for research and innovation/RIS3. As noted in Section 2.2 above, the NRPS involves the prioritisation of public funding for research in 14 Priority Areas and in six underpinning technology platform areas that are adjudged to generate the highest potential economic and societal impact.

Responsibility for the development of Ireland's RIS3 strategic approach lies with the Department of Jobs, Enterprise and Innovation and responsibility for its implementation and monitoring lies with the Research Prioritisation Action Group, which is headed by the Minister for Skills, Research and Innovation.

Ireland, through the Department of Jobs, Enterprise and Innovation, joined the Smart Specialisation Platform (S3) in 2013, and along with Bulgaria, Poland, Romania and Slovakia, underwent a peer review process in July 2014. The peer review was held in Dublin and was jointly organised by the S3 Platform and the Department of Jobs, Enterprise and Innovation. As part of the peer review process, Ireland undertook a self-assessment exercise of its RIS3 strategy. It noted that while Ireland had progressed significantly in most RIS3 areas, Irish policymakers in charge of RIS3 had identified a number of areas of importance. These included raising awareness of the innovation opportunities for less technologically intensive SMEs, encouraging greater engagement among stakeholders for implementing and further developing the strategy and improving connections with clusters/firms internationally.

The development of Ireland's RIS3 strategy is one of the ex-ante conditionalities for accessing European Structural and Investment Funds — particularly for research and innovation investment — over the period 2014-2020. The draft Partnership Agreement

²⁴ Department of Finance (2013), *Review of Ireland's Research and Development (R&D) Tax Credit 2013*, Dublin, Ireland. Available at: <http://budget.gov.ie/Budgets/2014/Documents/Department%20of%20Finance%20Review%20of%20R&D%20Tax%20Credit%202013.pdf> (accessed 25 February 2015).

submitted by Ireland to the European Commission in 2014 includes the statement that Ireland's National Research Prioritisation Strategy is in compliance with this conditionality.

2.7 Evaluations, consultations, foresight exercises

The introduction of EU Community Support Frameworks has been credited with instilling the practice of evaluating policies and programmes in Ireland. Evaluations of STI policies and programmes are now standard practice and often include international experts.

In response to one of the systemic recommendations in the Report of the Research Prioritisation Steering Group, Forfás developed a framework of metrics and targets for STI investment²⁵ in conjunction with RPAG members. The Framework is intended to monitor the impact of public STI investment in broad terms, and secondly, to monitor the impact of the implementation of research prioritisation in the 14 Priority Areas.

The Framework comprises three levels of targets: Overarching National Targets; Departmental/Agency-level Targets; and Priority Area Targets. The targets are underpinned by a wide range of 79 monitoring metrics covering the enterprise support environment, including inputs, outputs and outcomes. The Government adopted the Framework in June 2013. RPAG published its first progress report²⁶ in 2014 which contains details on progress against set targets.

The new Strategic Policy Division within the Department of Jobs, Enterprise and Innovation (DJEI) (which comprises policy advisors formerly employed in Forfás) has responsibility for the evaluation of the programmes of the enterprise agencies to assess value for money of DJEI programme expenditure, in the areas of start-ups, R&D and business development supports. The Higher Education Authority is responsible for evaluating programmes in the higher education sector.

During 2013, Forfás conducted a strategic review of the current performance of the STI system compared to the vision and objectives as set out in the Strategy for Science, Technology and Innovation (SSTI) 2006-2013²⁷. The review indicated that significant steps have been made in establishing a strong public research environment based on building scientific excellence in a number of strategic areas, in many cases meeting the SSTI targets for increases in the numbers of researchers (Forfás, 2014)²⁸.

A new unit, the Irish Government Economic and Evaluation Service (IGEES), has been established as an integrated cross-Government service that aims to support better policy formulation and analysis within the civil service, enhance the role of economics in policymaking and provide Government with evidence-based policy advice. IGEES is comprised of specialist units that have been established and which are operating in Government Departments (ministries).

Ireland makes extensive use of international experts in relation to policy and programme evaluations. International experts are likely to be involved in the forthcoming review of the

²⁵ Op. Cit.

²⁶ Op. Cit.

²⁷ Op. Cit.

²⁸ Forfás (2014), *Forfás Annual Report 2013*, Dublin, Ireland. Available at: <http://www.forfas.ie/media/Annual18072014-Annual-Report-2013-Publication.pdf> (accessed 25 February 2015).

national research prioritisation strategy and also in terms of providing inputs to new STI policy.

3. National progress towards realisation of ERA

3.1 ERA priority 2: Optimal transnational co-operation and competition

The National Reform Programme (2014 update) notes that the national research prioritisation strategy is aligned with grand challenges identified at European level to be addressed through optimal transnational co-operation and competition. Through the Research Prioritisation action plans, the strategy seeks to ensure that Ireland optimises research and innovation investment internationally and leverages international infrastructure as appropriate.

The results of research carried out for the 2014 European Research Area progress update report²⁹ indicates that funding allocated by Irish research organisations to international research projects is small compared to the EU average.

Ireland is an active participant in Joint Programming Initiatives (JPIs) and the ESFRI processes. Ireland is participating in nine of the ten JPIs and in 47 of the ERANETs of which 11 are still running. In relation to the latter, exchequer resource limitations have constrained investment in research infrastructures though Science Foundation Ireland is providing funding in this area through its SFI-HRB-Wellcome Trust Biomedical Research Partnership³⁰ and Research Infrastructures 2012³¹ programmes, and is thus indirectly contributing to the ESFRI process.

Science Foundation Ireland (SFI) has initiated a number of new funding programmes which involve international collaboration. The new SFI legislation permits SFI to provide funding to researchers in Northern Ireland and, with the consent of the Minister of Jobs, Enterprise and Innovation, to international collaborative projects.

The importance of collaboration in research and innovation between Northern Ireland and the Republic of Ireland is recognised by both Governments and the alignment of support structures means that there is now a strong basis on which to grow cooperation to mutual benefit. InterTradeIreland, the cross-border trade and business development body, has prepared a Strategic Action Plan for North-South Cooperation in Horizon 2020.

The Strategic Action Plan sets out the rationale for a North/South Horizon 2020 target of €175m and actions for cooperation which will support the achievement of both administrations' internal priorities in respect of participation in Horizon 2020.

²⁹ European Commission (2014): *European Research Area: Progress Report 2014 — accompanied by Facts and Figures 2014*, DG Research and Innovation, Brussels, Belgium. Available at: http://ec.europa.eu/research/era/pdf/era_progress_report2014/era_facts&figures_2014.pdf (accessed 25 February 2015).

³⁰ Science Foundation Ireland (2015), *SFI-HRB-Wellcome Trust Biomedical Research Partnership*. Available at: <http://www.sfi.ie/funding/funding-calls/open-calls/sfi-hrb-wellcome-trust-biomedical-research-partnership.html> (accessed 25 February 2015).

³¹ Science Foundation Ireland (2015), *SFI Research Infrastructures 2012 initiative*. Available at: <http://www.sfi.ie/funding/funding-calls/closed-calls/sfi-research-infrastructure-call-2012.html>

3.2 ERA priority 3: An open labour market for researchers. Facilitating mobility, supporting training and ensuring attractive careers

3.2.1 Introduction

Ireland is recognised as having a very open and transparent system for recruiting researchers. Irish research funding is very open to access by non-national researchers, subject to the research generally being carried out in Ireland.

Higher Education Institutions in Ireland, particularly the seven universities, generally have a high degree of autonomy in relation to recruitment.

The Euraxess Office in Ireland provides an advisory service to both inward and outwardly mobile researchers and supports the implementation of the Third Country Researchers Directive including through maintaining a database of Hosting Agreements for third country researchers.

Though there was a small reduction in the number of R&D personnel employed in the State-funded sector of approximately 200 personnel between 2006-2013, this was more than offset by the increase in the number of R&D personnel working in the enterprise sector. The Forfás Business Expenditure on Research and Development 2011-2013³² publication notes that there were over 19,000 research personnel in the business sector in 2011, a 21 per cent increase since 2009 and more than 14,000 full time equivalents (FTEs).

3.2.2 Open, transparent and merit-based recruitment of researchers

Institutions in the higher education sector in Ireland operate under a high degree of autonomy and given the importance of attracting foreign researchers, their recruitment processes are internationally recognised as being open and transparent. A More2³³ survey published in 2012 found that over two-thirds of university researchers were satisfied with the extent to which research vacancies were publicly advertised and made known by their institutions.

In 2013, the number of researcher posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 105 in Ireland compared to 72 among the Innovation Union reference group and an EU average of 43.7.

Ireland has a comprehensive equality legislative framework governing recruitment and institutions are legally obliged to ensure that their recruitment processes do not infringe any of the nine grounds for discrimination including gender, age and race.

Ireland has implemented the Hosting Agreement (the Scientific Visa) scheme under which entry visas are fast-tracked and non-EU researchers can work in Ireland without recourse

³² Forfás (2013): *Business Expenditure on Research and Development (BERD) 2011/2012*, Dublin, Ireland. Available at: [http://www.forfas.ie/media/28082013-Business Expenditure on Research and Development 20112012-Publication.pdf](http://www.forfas.ie/media/28082013-Business%20Expenditure%20on%20Research%20and%20Development%2020112012-Publication.pdf) (accessed 25 February 2015).

³³ MORE2 Higher Education Survey (2013), *Support for continued data collection and analysis concerning mobility patterns and career paths of researchers*. Available at: http://ec.europa.eu/euraxess/pdf/research_policies/more2/Final%20report.pdf (accessed 25 February 2015).

to the normal work permit or Green Card. Between the commencement of the scheme in October 2007 and December 2013, the EURAXESS office in Ireland processed nearly 2,200 Hosting Agreements with a total of 42 accredited organisations.

A feature of the scientific labour market in the higher education sector is that there are few opportunities for progression by post-doc researchers. An initiative was undertaken to develop a researcher career framework but this has not been implemented.

3.2.3 Access to and portability of grants

The 2014 Irish Researchers' Report³⁴ states that publicly funded R&D grants and fellowships provided via public funding are always linked to Irish R&D centres. The legal and grant beneficiaries are the Irish institutions and consequently, the grants are not portable to other EU countries. However, the report notes that research can be carried out in foreign countries, subject to the terms of the relevant call.

The Report also points out that national grants or fellowships are open to non-residents, but research must be carried out in Ireland. However, new legislation enables Science Foundation Ireland to fund projects that are undertaken in Northern Ireland and, in certain circumstances where permitted by the Minister for Jobs, Enterprise and Innovation, in other countries.

3.2.4 EURAXESS

The EURAXESS Office in Ireland is administered by the Irish Universities Association for which it receives a grant of €0.1m from the Department of Jobs, Enterprise and Innovation.

The EURAXESS Office is responsible for organising the Hosting Agreement (Scientific Visa) and processed nearly 2,200 Hosting Agreements between 2007 and 2013. The researchers covered by Hosting Agreements came from a diverse range of non-EEA countries of which Indian and Chinese nationals accounted for one-third of the total.

Additionally, the EURAXESS Ireland Office provides practical information to researchers on moving to (or from) Ireland, a job portal and a CV database. The EURAXESS Helpdesk handled approximately 2,000 queries in 2013, of which questions regarding work permits and visas accounted for over three-quarters of the total.

In addition to providing advice to researchers, EURAXESS Ireland has also developed a business portal (<http://www.euraxess.ie/business/default.aspx>) which provides a dedicated entry point for companies focusing on key EURAXESS services of relevance to key industry sectors. The 2014 ERA Progress Report says that the Commission is exploring the possibility of rolling out this facility to other Member States so that business users across Europe will have a tailored interface.

³⁴ European Commission (2014), *Researchers' Report 2014 — Country Profile: Ireland*, Prepared by Deloitte for DG Research and Innovation. Available at: http://ec.europa.eu/euraxess/pdf/research_policies/country_files/Ireland_Country_Profile_RR2014_FINAL.pdf (accessed 25 February 2015).

3.2.5 Doctoral training

The HEA (Higher Education Authority) and QQI (Quality and Qualifications Ireland) worked in partnership with the HEIs throughout 2014 to develop a *National Framework for Doctoral Education*. The purpose of this framework is to:

- Facilitate consistent excellence in the quality of postgraduate education and training;
- Enable and encourage higher education institutions to work more closely in the delivery of an improved learner experience and outcome;
- Maximise the employability of doctoral graduates across a broad range of employment sectors by ensuring that the acquisition of discipline-specific knowledge is complemented by the development of transferable skills;
- Underpin the international standing of the Irish doctoral award.

The *National Framework for Doctoral Education* outlines the core principles of doctoral education consistent with the highest international standards as well as the skills and attributes of graduates of Irish doctoral programmes. It concludes that the core and essential component of doctoral education remains the advancement of knowledge through original research — a fundamental societal value in itself, based on freedom of enquiry, the fostering of innovative thinking and the development of advanced critical skills. Consultation with all research funding agencies and departments has been finalised and the Framework will be launched in 2015 (April/May).

The RPAG progress report also states that the Irish Research Council has launched the Employment-Based Postgraduate Programme³⁵ ('Industrial Masters and PhDs') funding researchers to work in industry on site with their enterprise mentor on research ideas, and the Programme is a partnership across all funders. The Programme, which is a co-educational experience, is demand led by enterprise but applications from the 14 Priority Areas are specifically encouraged.

The majority of universities and Institutes of Technology offer structured PhD training programmes.

3.2.6 HR strategy for researchers incorporating the Charter and Code

According to the Researchers' Report 2014 Country Report: Ireland, all seven Irish universities and a number of the Institutes of Technology (IoTs) have voluntarily signed up to the EU 'Charter & Code' and thus operate a policy of open recruitment.

The research performing organisations that have endorsed the Charter and Code are:

- Dublin City University
- Dublin Institute of Technology
- Dundalk Institute of Technology
- Institute of Technology Tallaght
- The Irish Research Staff Association

³⁵ Irish Research Council (2015), *Employment-Based Postgraduate Programme*. Available at: <http://research.ie/funding/employment-based-postgraduate-programme-2015> [Accessed 18 February 2015].

- National University of Ireland, Galway
- Maynooth University
- Royal College of Surgeons in Ireland
- Teagasc
- Trinity College Dublin
- University College Cork
- University College Dublin
- University of Limerick
- Waterford Institute of Technology

The report also notes that Science Foundation Ireland (SFI) also applies criteria for research grant funding based on the 'Charter & Code'.

The 2014 Irish Country Researchers report states that Irish Research Council (IRC) and the Irish Universities Association are spearheading an initiative to have all Irish HEIs receive the Commission's endorsement of their recruitment policies and working conditions for researchers via permission to use the 'HR Excellence in Research' label. This initiative has so far resulted in the award of the logo to University College Dublin, University of Limerick, National University of Ireland, Galway, University College Cork and Waterford Institute of Technology, and put three of the remaining Irish universities, five Institutes of Technology and three other research performers on the path to receiving the label, in addition to IRC, who are also implementing the process.

Ireland is considered an attractive market for researchers; the main language is English and the major research performing institutions follow open and transparent recruitment procedures. The main challenges are the difficulties associated with the economic crisis and the lack of a researchers' career framework.

3.2.7 Education and training systems

Responsibility for the promotion of careers in Science, Technology, Engineering and Mathematics (STEM) was transferred from Forfás to Science Foundation Ireland (SFI). SFI support this through a range of programmes including: 1) Smart Futures³⁶, a national government-industry collaboration providing access to post primary students and their parents to role models and career pathways in STEM, 2) Discover Primary Science and Maths³⁷, a national programme supporting and recognising the teaching of science at primary school, and 3) through the Discover funding call³⁸ which supports a wide range of education and informal engagement programmes with young people and the general public. The Government has implemented a number of initiatives to encourage greater participation by students in STEM disciplines such as the introduction of Project Maths.

The National Strategy for Higher Education which was published in 2011 sets out proposals for the development of a more flexible higher education system with a greater choice of provision and modes of learning. It also seeks to improve the quality of teaching and learning and the relevance of learning outcomes. A core objective of the strategy is to enhance the capacity and reputation of the Irish higher education system to produce

³⁶ <http://smartfutures.ie> (accessed: 15 April 2015)

³⁷ <http://www.primaryscience.ie> (accessed: 15 April 2015)

³⁸ <http://www.sfi.ie/discover-science-engineering-dse/sfi-discover-funding.html> (accessed: 15 April 2015)

innovative and creative graduates that have the breadth and depth of skills required for the 21st century.

Quality and Qualifications Ireland (QQI) is a new state agency established by the Quality Assurance and Qualifications (Education and Training) Act 2012. It is responsible for maintaining the ten-level National Framework of Qualifications. QQI is responsible for reviewing the effectiveness of quality assurance in further and higher education providers in Ireland including the universities and Institutes of Technology.

In response to recommendations to align supply and demand of trained researchers, the Irish Research Council has rolled out an employment based PhD and Masters programme where awardees will be employees with the majority of time spent in-company. A review of the Employment-Based PhD programme in 2014 found good acceptance of the programme by scholars, HEIs and industry.

The Irish government has published the Technological Universities Bill 2014 in which it proposes to re-cast the Irish higher education sector. This is part of a new framework which was announced in the National Strategy for Higher Education. The Bill envisages that where two or more current Institutes of Technology merge, and where they satisfy certain criteria, they could be classified as technological universities.

3.3 ERA priority 5: Optimal circulation and access to scientific knowledge

3.3.1 e-Infrastructures and researchers electronic identity

There is no specific policy or initiative in relation to e-infrastructures; funding for this investment area came from a number of different funding sources including the Programme for Research in Third Level Institutions and Science Foundation Ireland's Research Infrastructures programme. A number of national policy initiatives have an e-infrastructure component.

The 2014 ERA Progress Report indicated that within the ERA compliant cluster in Ireland, the share of research performing organisations providing digital research services (i.e. cloud services, research collaboration platform, etc.) was higher than within the EU ERA compliant cluster.

The Higher Education Authority has undertaken a national inventory of all significant publicly funded infrastructure and equipment and an online portal is being developed, to this end. In parallel with compiling this national inventory of all Large Items of Research Equipment of Large Infrastructure (LIRE)³⁹, the HEA has developed guidelines for the HEIs on providing access to users from the institutions and enterprise. The key principle embodied in the guidelines is that by default, all public funded equipment should be available to users from other HEIs and from enterprise.

The LIRE initiative complements the MERIL database (Mapping of the European Research Infrastructure Landscape) undertaken at European level. The MERIL portal gives access to an inventory of openly accessible research infrastructures.

³⁹ Higher Education Authority (2014), *Large Items Research Equipment Database*. Available t: <http://www.heai.ie/content/large-items-research-equipment-database> (accessed 30 December 2014).

3.3.2 Open Access to publications and data

A Policy Statement on National Principles for Open Access⁴⁰ was published in October 2012. This was prepared by a Committee of Irish research organisations working in partnership to coordinate activities and to combine expertise at a national level to promote unrestricted, online access to outputs which result from research that is wholly or partially funded by the State.

The Committee and its member organisations responsible for the National Principles Policy Statement advocate for the Green route to open access publication and recognise that the output of publicly funded research in Ireland be made freely and openly available.

A study⁴¹ of Open Access (OA) scientific papers published in peer-reviewed journals during the period 2008-2013 by Science-Metrix on behalf of the European Commission found that of the 5,150 papers sampled in Ireland, Green OA accounted for 15.8%, Gold OA journals accounted for 9.2% and other OA accounted for 36%, giving an overall OA percentage of 58.6% (the equivalent overall OA score for the EU28 was 51.3%).

A number of the major research funders such as the Higher Education Authority, the Health Research Board and Science Foundation Ireland have backed the National Principles on Open Access and have developed their own Open Access policy statements.

Since the publication of the National Principles for Open Access the main focus within the STI system has been on their implementation by research performing organisations.

⁴⁰ National Steering Committee on Open Access (2012): *National Principles for Open Access Policy Statement*, Dublin, Ireland. Available from: <http://www.dri.ie/sites/default/files/files/National%20Principles%20on%20Open%20Access%20Policy%20Statement%20%28FINAL%2023%20Oct%202012%20%29.pdf> (Accessed 24 February 2015).

⁴¹ Archambault, E. et al. (2014): *Proportion of Open Access Papers Published in Peer-Reviewed Journals at the European and World Levels—1996-2013*, Prepared for the European Commission by Science-Metrix. Available at: http://science-metrix.com/files/science-metrix/publications/d_1.8_sm_ec_dg-rtd_proportion_oa_1996-2013_v11p.pdf (Accessed: 23 February 2015).

4. Innovation Union

4.1 Framework conditions

Having regard for budgetary constraints on public funding for research and development, the Government has been and continues to take steps to provide a favourable environment for businesses to invest in RTDI. The attraction of mobile FDI projects with an R&D component is a key national policy objective.

The Government has announced in the Budget 2015 of its intention to establish a Knowledge Development Box as part of an initiative to encourage foreign direct investment by providing incentives to international companies to develop technology in Ireland. The proposed Irish scheme would be similar to UK and Dutch patent boxes and requires the consent of the EU before it can be introduced. The Department of Finance has launched a consultation process in relation to the Knowledge Development Box⁴².

The Government also said in Budget 2015 that it would follow through on a commitment given in Budget 2014 to abolish the base year for the calculation of the 25% R&D tax credit; the base year had previously been set at 2003. The abolition of the base year would take effect from January 2015. A review of the R&D tax credit⁴³ carried out by the Department of Finance in 2013 found it had an impact in attracting FDI projects with an R&D focus. Data provided by the Irish Revenue Commissioners show that the cost to the Exchequer of the R&D tax credit in 2012 was €281m, an increase of €20m on the 2011 figure of €261m.

In October 2014, the Government published its National Policy Statement on Entrepreneurship in Ireland⁴⁴. The Policy statement which had been recommended by a number of a previous policy studies sets out a number of actions to improve the support framework so as to create an entrepreneurial eco-system; these will be focused around six key areas: human capital, business supports, innovation, access to finance, networks and mentoring and access to markets.

Since 2012, the Government has published an annual Action Plan for Jobs⁴⁵. Each annual plan involves a whole of Government approach to mobilising all Government Departments (ministries) to work towards the objective of supporting job creation. The Action Plan for Jobs 2014 builds on the more than 500 measures already implemented through Action Plans for Jobs 2012 and 2013, and contains 385 actions to be implemented by all 16 Government Departments and 46 Agencies with the goal of improving employment.

As with the previous two action plans, the 2014 Action Plan for Jobs includes measures to encourage entrepreneurship and innovation. As an example, the 2014 Plan outlines a commitment to encourage greater purchasing of innovative solutions; it charges Enterprise Ireland with the introduction, on a pilot basis, a Small Business Innovation Research (SBIR)⁴⁶ programme which will provide opportunities for innovative solutions to be

⁴² Department of Finance (2015), *Department of Finance Launches Consultation Process on Knowledge Development Box*. Available at <http://www.finance.gov.ie/news-centre/press-releases/department-finance-launches-consultation-process-knowledge-development> (Accessed 24 February 2015).

⁴³ Op. cit.

⁴⁴ Op. cit.

⁴⁵ Op. cit.

⁴⁶ The first call under the Small Business Innovation Research programme was launched in June 2014; available at: <http://www.enterprise-ireland.com/en/News/PressReleases/2014-Press-Releases/Call-for-Innovative-Communal-Electric-Vehicle-Charging-Solutions.html> (Accessed 20 February 2015).

developed to meet the needs of public bodies. Demand-side innovation initiatives such as those based on public procurement have, however, received little traction in the past.

4.2 Science-based entrepreneurship

There are a number of initiatives to encourage knowledge transfer and the creation of spin-offs from the higher education sector.

The task force which had been set up to advise the Government on its IP policies also recommended in its report, Putting Public Research to Work for Ireland, that closer collaboration between public research organisations and business, including the protection and exploitation of intellectual property arising from publicly funded research undertaken by public research organisations. Knowledge Transfer Ireland (KTI) was established in late 2013 and was formally launched in June 2014 as a partnership between Enterprise Ireland and the Irish Universities Association (IUA) to deliver on this recommendation.

KTI's primary role is to be the identifiable access route to the wealth of technology opportunities and academic talent that exists in Research Performing Organisations and it is intended that it would provide an invaluable service for entrepreneurs and industry, signposting them towards the relevant sources of knowledge and capability within Ireland's Research Performing Organisations. The aim of KTI is to encourage the commercialisation of IP arising from State funded research, with a view to achieving more job creation from our investment in this area.

KTI supersedes a previous initiative, the central Technology Transfer Office (cTTO), which aimed to facilitate the enterprise sector to tap into the technology, IP and expertise within the HEIs and PROs. It is anticipated that KTI will introduce a broader range of knowledge transfer key performance indicators for the HEI sector.

In a recent EU publication, Knowledge Transfer Report 2010-2012 (EU, 2013)⁴⁷, Ireland was ranked first in Europe using a composite indicator of the knowledge transfer activities of public research organisations (start-ups, number of licenses, license income, research agreements, invention disclosures, patent applications and patent grants).

Enterprise Ireland also provides various supports including Incubation Spaces (2013: €0.4m), Research Commercialisation supports, Business Partner Scheme (experienced business person is matched with young entrepreneurs)⁴⁸ and the High Potential Start-Ups (HPSUs)⁴⁹ programme.

Improving access to finance for high growth companies is a key action under the Government's Action Plan for Jobs and Enterprise Ireland (EI) plays a key role in supporting and developing the Venture Capital Sector in Ireland. Enterprise Ireland partners with Venture Capital funds to provide finance. Its 2007-2012 Seed and Venture Capital Scheme was launched to improve access to finance for small and medium sized enterprises and to

⁴⁷ European Commission, Directorate-General for Research and Innovation (2013), Knowledge Transfer Study 2010-2012, Brussels, Belgium. Available at: http://ec.europa.eu/research/innovation-union/pdf/knowledge_transfer_2010-2012_report.pdf (accessed 25 February 2015).

⁴⁸ The full range of supports provided by Enterprise Ireland for SMEs can be viewed here: <http://www.enterprise-ireland.com/en/funding-supports/Company/> (accessed 25 February 2015).

⁴⁹ HPSUs are defined by Enterprise Ireland as start-up businesses with the potential to develop an innovative product or service for sale on international markets and the potential to create 10 jobs and €1m in sales within 3 to 4 years of starting up.

further develop the Seed and Venture Capital Industry in Ireland. Enterprise Ireland points out that over €800m in funding is available through networks of angel investors, seed and venture capital and development capital providers of which €685m is under management in EI-supported seed and venture capital funds.

4.3 Knowledge markets

In June 2012, the Government published the national Intellectual Property Protocol⁵⁰. The IP Protocol sets out the Government's policies to encourage industry — from start-ups and small and medium enterprises to multinational corporations — to benefit from the research and development carried out in Ireland's public research institutions. A previous report by the Innovation Task Force in 2010 had indicated that many SMEs found the high costs of proper legal and IP advice prohibitive, and appeared not to take a proactive strategic position in respect of IP issues. The Innovation Task Force report noted the importance of SMEs obtaining proper legal and IP advice, including IP audits, has been recognised internationally.

The aim of the IP Protocol is to bring clarity, consistency and quality for enterprises working with Ireland's higher education institutes (HEIs) and other State-funded research performing organisations. The IP Protocol also seeks to enable and encourage the use of State-funded research to drive business, innovation and economic competitiveness.

The IP Protocol introduces a framework for industry engagement with RPOs, including standardised IP ownership and contract terms, so that commercial agreements are quick and easy to set up. As noted above, a key component of the National IP Protocol has been the establishment of KTI to provide a responsive interface between the enterprise sectors and knowledge producers in the HEI and PRO sectors.

A number of research funders such as Science Foundation Ireland have subsequently adapted their IP management protocols to ensure that they are aligned with the IP Protocol.

The Government is reviewing the 2013 report of the Copyright Review Committee, *Modernising Copyright*⁵¹, which made a number of recommendations including the establishment of a Copyright Council of Ireland and specialist intellectual property tracks in the District and Circuit Courts, and to the introduction of tightly-drawn exceptions for innovation, fair use, and very small snippets of text in the context of online links.

As part of the Government's 2015 Budget proposals, public officials are investigating the possibility of developing a "knowledge or patent box" scheme in which a preferential corporate profits rate would be levied on assets such as patents which are managed from and located in Ireland. The Government envisages that this new scheme will be helpful in attracting future foreign direct investment in Ireland.

⁵⁰ Department of Jobs, Enterprise and Innovation (2012): *Putting public research to work in Ireland*, Dublin, Ireland. Available at http://www.djei.ie/publications/science/2012/Intellectual_Property_Protocol_Putting_Public_Research_to_Work_for_Ireland.pdf (accessed 25 February 2015).

⁵¹ Department of Jobs, Enterprise and Innovation (2013): *Modernising Copyright: The Report of the Copyright Review Committee*, Dublin, Ireland. Available at <http://www.enterprise.gov.ie/en/Publications/CRC-Report.pdf> (accessed 25 February 2015).

4.4 Knowledge transfer and open innovation

The development R&I linkages between the enterprise sector on one hand and the HEIs and PROs on the other is a key policy goal and is perceived as essential for achieving employment and societal returns on Ireland's public investment in research and innovation. Furthermore, the development of close co-operation between HEIs and MNCs is regarded as important for attracting FDI projects with an R&D component.

Research centres are perceived by policy-makers as a useful mechanism for facilitating industry-academia interaction. In the past, research centres were established in HEIs and had a limited industry involvement. They were also perceived as following an overly academic research agenda.

There has now been a policy shift in the approach to the funding and orientation of research centres involving the enterprise base and the HEI/PRO sector. A new approach is evolving where although the research centres are still HEI-based, their research agendas are increasingly led by industry which now contributes a larger share of their costs.

New research centre funding programmes offered by Science Foundation Ireland and Enterprise Ireland such as the SFI Research Centres and Spokes programmes⁵² and the EI/IDA Technology Centres⁵³ initiative now seek a larger financial contribution from companies. Additionally, the new research centres are now empowered to undertake market-focussed strategic research for the benefit of industry.

In October 2014, the Department of Jobs, Enterprise and Innovation announced the provision of Government and industry funding totalling €245m for the establishment of five new class SFI Research Centres involving €90m co-investment by industry partners (DJEI, 2014)⁵⁴. The new centres will directly employ 700 researcher positions and will address research in critical and emerging areas including applied geosciences, software and medical devices.

A study on the medium term development of the market-focussed element of the Irish research centre landscape is being undertaken by Department of Jobs, Enterprise and Innovation. The study seeks to benchmark international comparators and include proposals on possible models and governance arrangements. The study will also produce an institutional road map for the market-focussed element of the research centre landscape to 2025 and beyond to guide implementation.

Other support measures such as the Industry Fellowship Programme⁵⁵ and the Innovation Voucher scheme⁵⁶ funded respectively by SFI and EI/IDA seek to strengthen and increase the collaborative links between industry and academia: SFI awards directly support over

⁵² <http://www.sfi.ie/funding/funding-calls/closed-calls/sfi-research-centres-programme-2013.html>
<http://www.sfi.ie/funding/funding-calls/open-calls/sfi-spokes-programme-2013.html>

⁵³ <http://www.enterprise-ireland.com/en/Research-Innovation/Companies/Collaborate-with-companies-research-institutes/Technology-Centres.html>

⁵⁴ Department of Jobs, Enterprise and Innovation (2014), *Press release: €245 Million To Be Invested In Five New World-Class SFI Research Centres In Ireland - Minister Bruton, Minister English*, Dublin, Ireland. Available at: <http://www.enterprise.gov.ie/en/News/2014/October/€245-Million-To-Be-Invested-In-Five-New-World-Class-SFI-Research-Centres-In-Ireland-Minister-Bruton-Minister-English.html> (accessed 25 February 2015).

⁵⁵ See: <http://www.sfi.ie/funding/funding-calls/open-calls/sfi-industry-fellowship-programme-2015.html>

⁵⁶ See: <http://www.enterprise-ireland.com/en/Research-Innovation/Companies/Collaborate-with-companies-research-institutes/Innovation-Voucher.shortcut.html>

900 collaborations with industry and Enterprise Ireland support over 800 industry-academic collaborations.

The inauguration of the Higher Education System Performance Framework 2014-2016⁵⁷ now puts a greater onus on the HEIs to contribute to an open and excellent public research system focused on the Government's priority areas and the achievement of other societal objectives and to maximise research collaborations and knowledge exchange between and among public and private sector research actors.

The establishment of KTI represents another mechanism for supporting the optimal circulation of knowledge between the HEI/PRO sectors and industry.

In 2014, KTI published the results of its Annual Knowledge Transfer Survey (KTI, 2014)⁵⁸ on knowledge transfer from the HEI and PRO sectors to the business sector during 2013. The survey document provides data on knowledge transfer activities such as Engagement, Invention disclosures, Patenting activity, Licensing of rights and New companies (see table below).

Table 2 Annual Knowledge Transfer Survey, 2013

Performance indicator	2012	2013
Number of engagement agreements	n.a.	1,598
<i>of which</i>		
- Collaborative research agreements	n.a.	336
- Contract research agreements	n.a.	653
- Consultancy agreements	n.a.	527
Invention disclosures	373	462
Priority patent applications	113	123
Patents granted	41	59
Total number of licences, options and assignments executed	87	139
Number of material transfer agreements at year end	560	334
Spin-outs and start-ups established		
- Spin-outs	15	37
- Start-ups	16	32

(Source: Knowledge Transfer Ireland, 2014)

The Table indicates that for the majority of performance indicators 2013 represented an improvement on the previous year with the exception of Number of material transfer agreements.

KTI have indicated that they will undertake additional studies to build on the results of the 2013 Annual Knowledge Transfer Survey to gain more granularity on the outcomes of knowledge transfer from the publicly-funded research sector (HEIs and PROs) to the enterprise sector.

⁵⁷ Op. Cit.

⁵⁸ Knowledge Transfer Ireland (2014): *Annual Knowledge Transfer Survey 2013 — The Annual Review of Business Interaction and Commercialisation from Publicly-Funded Research in Ireland*, Dublin, Ireland. Available at: http://www.knowledgetransferireland.com/About_KTI/Reports-Publications/KTI-Annual-Knowledge-Transfer-Survey-2013.pdf (accessed 25 February 2015).

The National Competitiveness Council publication, Ireland's Competitiveness Scorecard 2014 (NCC, 2014)⁵⁹ noted that the results of a 2011 OECD study which showed that 8.38 researchers were employed in Ireland for every 1,000 people in employment — in line with the Euro area-14 average of 8.42, but less than the OECD average of 8.74. Overall, the OECD study indicated that 22,131 researchers were employed, a third of whom are female. Higher education institutes employed 49% of researchers, while the business and PRO sectors accounted for 48% and 2.7% respectively.

The MORE2 study⁶⁰ found that 30% of the EU-27 post-PhD researcher population has at some time been active in another sector for a period of more than three months. The share of researchers indicating a period of inter-sectoral mobility of more than three months in private industry was 16% in Ireland compared to 12% on average for the EU-27.

4.5 Innovation framework for SMEs

The National Policy Statement on Entrepreneurship in Ireland 2014 launched by the Government in October 2014 represents an important policy document which identifies the framework needs to develop Ireland's enterprise base and to make Ireland a world-class environment in which to start and grow an enterprise.

The Policy Statement outlines the actions that the Government will take to increase the number of start-ups, increase the survival rate of young enterprises and improve the capacity of start-ups to scale their activities. The document identifies the support measures that will be undertaken to improve business skills, foster innovation, enable access to finance and facilitate the development of networks and clusters. The actions set out in the Policy Statement will be undertaken through the Action Plan for Jobs which have been prepared on an annual basis since 2012.

The Policy Statement provides a profile of innovation related supports for SMEs such as Innovation Vouchers and the Knowledge Transfer Ireland network.

In 2014, a new network of Local Enterprise Offices (LEOs) was established which replaced the former network of City and County Enterprise Boards. The LEOs which are based in local authorities are responsible for the provision of business supports to micro-enterprises i.e. those employing less than 10 people.

Ireland's Horizon 2020 national support network includes European Advisors who can provide assistance and supports to SMEs to access Horizon 2020 funding and the SME instrument⁶¹.

In October 2014, the Government formally launched the Strategic Banking Corporation of Ireland (SBCI)⁶² which will act as a state development bank to help finance the SME sector. Initial funding for SBCI was provided by the German promotional bank Kreditanstalt für Wiederaufbau (KfW), the European Investment Bank (EIB) and the National Pensions Reserve Fund. The new entity will lend to existing retail banks and also to new entrants to the SME lending market. A core objective of the SBCI is to generate competition and choice for SMEs seeking finance in the Irish market.

⁵⁹ National Competitiveness Council/Forfás (2014): *Ireland's Competitiveness Scorecard 2014*, Dublin, Ireland. Available at: <http://www.forfas.ie/publications/2014/title.12472.en.php> (accessed 25 February 2015).

⁶⁰ MORE2, op. cit.

⁶¹ See: <http://www.horizon2020.ie/who-can-help/sme-instrument> (accessed 25 February 2015).

⁶² Strategic Banking Corporation of Ireland — web link: <http://sbci.gov.ie> (accessed 25 February 2015).

A consultation process carried out in relation to the preparation of the Entrepreneurship Policy Statement found that many of the supports for start-ups are difficult to understand and complex to use. The stakeholders surveyed also indicated concerns that legislation to allow people whose initial venture failed a second chance was underdeveloped. This latter issue was also identified by IBEC, the employers' representative group, as a matter for concern. It pointed out that Ireland's bankruptcy laws were punitive and disincentivise rather than encourage entrepreneurship⁶³. It said that they were out of kilter with most developed economies and Ireland's European neighbours. IBEC stated that a balance was needed between encouraging entrepreneurship and discouraging the phoenix syndrome whereby a new company was formed from the ashes and unsatisfied debts of the old.

The Medium Term Economic Strategy notes that an improved bankruptcy and corporate insolvency framework for enterprises with a reasonable prospect of survival will be put in place, thus providing easier access to the courts. It is anticipated that this will enable viable businesses restructure their debts and grow in the future.

Supports for SMEs are regularly evaluated either by Forfás, the former policy advisory board for Enterprise, Trade, Science and Innovation) or by funding agencies such as Enterprise Ireland.

4.6 Venture capital markets

The Action Plan for Jobs 2013 identified the clear ambition of making access to finance a central feature of Government recovery and growth plans. The National Policy Statement on Entrepreneurship includes actions to attract more angel and international venture capital investors and continue to develop the domestic venture capital sector.

The Global Entrepreneurship & Development Index (GEDI) noted that Ireland scored below countries such as Denmark and the US on the availability of risk capital — though it was ranked above the UK.

The National Policy Statement on Entrepreneurship noted that €55m in funding was provided to 186 enterprises through the Seed and Venture Capital Fund in 2013. The Statement also pointed out that based on research carried in other countries there was considerable potential in Ireland to increase the range of alternative lending instruments available to start-ups, including peer-to-peer lending, supply chain finance and crowd funding.

The National Pensions Reserve Fund (NPRF) has been working closely with Enterprise Ireland on the development of Innovation Fund Ireland (IFI)⁶⁴, a Government initiative designed to attract leading international venture capital fund managers to Ireland.

Enterprise Ireland is responsible for managing the Seed and Venture Capital Scheme 2013-2018⁶⁵ with which the Government is seeking to stimulate job creation and support the funding requirements of young innovative Irish companies. The overall objective of the

⁶³ IBEC (2014), *IBEC submission: National Entrepreneurship Policy Statement*, Dublin, Ireland. Available at: [https://www.ibec.ie/IBEC/DFB.nsf/vPages/Enterprise_science_and_technology-Consultations_and_submissions~national-entrepreneurship-policy-statement-31-08-2013/\\$file/ibec_National_Entrepreneurship_Policy_Statement.pdf](https://www.ibec.ie/IBEC/DFB.nsf/vPages/Enterprise_science_and_technology-Consultations_and_submissions~national-entrepreneurship-policy-statement-31-08-2013/$file/ibec_National_Entrepreneurship_Policy_Statement.pdf) (accessed 25 February 2015).

⁶⁴ See: <http://www.nprf.ie/Investments/InnovationFundIreland.htm> (accessed 25 February 2015).

⁶⁵ See: <http://www.enterprise-ireland.com/en/Invest-in-Emerging-Companies/Seed-and-Venture-Capital-Scheme> (accessed 25 February 2015).

Scheme is to increase the availability of risk capital for SMEs to support economic growth through the continued development of the Seed and Venture Capital Sector in Ireland to achieve a more robust, commercially viable and sustainable sector. The Government is committing €175m to the scheme and under the first call of the new Scheme, EI is seeking to invest up to €100m in commercially focused Venture Capital funds in the wider technology and life sciences sectors.

4.7 Innovative public procurement

The Medium Term Economic Strategy notes that the 2014 Action Plan will identify ways to use Government procurement in a strategic way to stimulate collaborative efforts between the public sector, research institutes and firms that will help to deliver innovative solutions.

The Action Plan for Jobs 2014 includes a commitment to encourage greater purchasing of innovative solutions and identifies two action areas:

- Examine practical ways to highlight the merits of purchasing innovative products and services, where appropriate, as a means of achieving cost savings in public procurement.
- Introduce, on a pilot basis, a Small Business Innovation Research (SBIR) programme which will provide opportunities for innovative solutions to be developed to meet the needs of public bodies.

Innovative public procurement has been mentioned in a number of previous STI strategy documents but the actual implementation of policies in this area has been sporadic.

5. Performance of the National Research and Innovation System

5.1 Performance of the National Research and Innovation system

Ireland has traditionally scored highly in relation to STI human resources. The Table 3 in the following page supports this: in 2011, Ireland had more new doctorate graduates per 1,000 population between the ages of 25-34 (1.90) compared with the EU average (1.70). In 2012, Ireland also had a higher percentage of its population having completed tertiary education compared to the EU average: 51.10% versus 35.80%.

Ireland achieved a higher score for the number of international scientific co-publications compared to the EU average. In 2012, its score for the number of international scientific co-publications per million population was 1,137.54 compared to the EU average of 343.15. In the period 2002-2012 it had a higher score (13.15) compared to the EU average (11.17) for scientific publications among the top 10% most cited publications worldwide as a % of total scientific publications of the country (Science Metrix, 2014)⁶⁶.

On average in 2012, Ireland produced 23.30 publications per 10,000 inhabitants, well above the EU-28 average (13.8)⁶⁷.

With regard to finance and support, Ireland's R&D expenditure in the public sector as a percentage of GNP was calculated at 0.53% in 2012, which is lower than the EU average percentage of 0.75%. Ireland's score for 2012 in relation to venture capital and seed capital as a percentage of GDP (0.038) was lower than the EU average (0.076).

R&D expenditure in the business sector as a percentage of GDP was 0.53% in 2012, which was lower than the EU average of 0.75%. Public-private co-publications per million population was estimated at 34.4 in 2011 which is lower than the EU average score of 5.28 (2012).

Ireland's performance in relation to PCT patents per billion GDP was 2.33 in 2010 — which is lower than the EU average score of 3.92. Ireland similarly had a lower score (0.67) than the EU average (0.85) in relation to PCT patent applications in societal challenges per billion GDP in 2010.

The large multinational component of Ireland's economic sector is evident in a range of indicators relating to RTDI outputs. The contribution of medium and high-technology product exports to the trade balance was 1.99 in 2013 compared to the 1.27 EU average. A similar picture emerges in relation to service exports: knowledge-intensive service exports from Ireland as a percentage of total service exports were 71.37 in 2011 which exceeded the EU average of 45.26. Ireland's license and patent revenues from abroad as a percentage of GDP were calculated at 2.27 in 2012, which is nearly four times as much as the EU average percentage of 0.59.

⁶⁶ These publication data are based on Elsevier's Scopus database. ScienceMetrix, Analysis and Regular Update of Bibliometric Indicators, study conducted for DG RTD. They represent an update of the data displayed in the table below. See also http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=other-studies.

⁶⁷ SciVal 2014, Scopus based publication indicators derived from Elsevier's SciVal platform, www.scival.com last accessed December 2014.

Table 3. Assessment of the Performance of the National Research and Innovation System

1. ENABLERS	Year	IE	EU
Human resources			
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2011	1.90	1.70
Percentage population aged 30-34 having completed tertiary education	2012	51.10	35.80
Open, excellent and attractive research systems			
International scientific co-publications per million population	2012	1,137.54	343.15
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	2009	11.54	10.95
Finance and support			
R&D expenditure in the public sector as % of GDP	2012	0.53	0.75
Venture capital (early stage, expansion and replacement) as % of GDP	2012	0.04	0.08
2. FIRM ACTIVITIES			
R&D expenditure in the business sector as % of GDP	2012	1.20	1.31
Linkages and entrepreneurship			
Public-private co-publications per million population	2011	34.42	52.84
Intellectual assets			
PCT patent applications per billion GDP (in PPSE)	2010	2.33	3.92
PCT patent applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health)	2010	0.67	0.85
3. OUTPUTS			
Economic effects			
Contribution of medium and high-tech product exports to trade balance	2012	1.99	1.27
Knowledge-intensive services exports as % total service exports	2011	71.37	45.26
License and patent revenues from abroad as % of GDP	2012	2.27	0.59

Source: European Commission, IUS Database (2014).

5.2 Structural challenges of the national R&I system

There are a number of structural challenges facing the national R&I system. A number of these challenges stem from the dual nature of the Irish enterprises sector which comprises on one hand a small number of foreign direct companies operating mainly in the high tech sector (ICT, life sciences) and, on the other hand, a large number of indigenous enterprises, the vast majority of which are SMEs and which are largely in medium and low tech sectors — though there are significant numbers of SMEs operating in internationally traded service sectors such as software.

Statistics published by the Central Statistics Office show that expenditure on R&D by the enterprise sector is dominated by a very small number of MNCs; 300 companies account for almost 70% of total R&D expenditure in 2012. Despite this, a high proportion of FDI companies in Ireland, 54%, are not R&D active.

The available evidence indicates that increases in RD&I expenditure and employment in indigenous enterprises are being driven by small/medium-sized companies, while increases in RD&I expenditure and employment in the FDI sector are being driven by large firms.

It has long been recognised by Irish policy-makers that indigenous SMEs have a comparatively lower absorptive capacity and that they have low levels of formal collaborations with HEIs. The evidence also points to the fact that most R&D expenditure in

Irish-owned firms, 72%, is being carried out in sectors that are not significant exporters. The sectors which account for approximately two-thirds of export sales from indigenous enterprises (Food, Drink & Tobacco, Other Traditional Manufacturing, and Business Services) only account for 28% of R&D expenditures in indigenous enterprises.

The Medium Term Economic Strategy document notes that indigenous SMEs need to improve their innovation capacity; data published by Forfás reveal that Ireland's share of firms engaged in new product and services development, at 22% of innovating firms, appears to be low when compared to similar data for other countries.

Furthermore, results of research undertaken by Forfás indicate that while progress has been made in building research capacity in the enterprise base, the rate of growth however appears less than envisaged in the Strategy for Science, Technology and Innovation 2006-2013 (SSTI). Overall, despite recent increases in business expenditure on R&D and Innovation, the RD&I performance of the enterprise sector in Ireland is still below selected comparator countries, and the impacts of such expenditures are also lower.

Question marks have been raised about the effectiveness of Ireland's policy mix to support services innovation. A study carried out by Forfás in 2006⁶⁸ pointed out that traditional policy approaches did not provide a sufficient basis for understanding the complexity and distinctiveness of services innovation.

While Ireland has traditionally scored highly in relation to STI human capital development, there are structural issues relating to the development of a comprehensive researcher careers framework. Funding constraints and employment arrangements within HEIs present difficulties for post-docs in pursuing career opportunities within the higher education sector.

5.3 Meeting structural challenges

An analysis of R&D policy mix indicates a multi-faceted approach to addressing structural challenges facing the national R&I system.

Attracting FDI projects with an R&D component to Ireland and incentivising existing foreign companies in Ireland to carry out or increase their research and innovation expenditure are important national priorities. A key element of the policy mix in this regard is the R&D tax credit which was first introduced in 2004 and which has been amended on a number of occasions — most recently in the 2015 budget — to enhance its effectiveness and attractiveness to companies.

Encouraging greater linkages between FDI companies, indigenous companies, HEIs and the PROs is also a headline policy objective. The proposed national STI strategy to be published in 2015 and the wider proposed enterprise strategy are likely to place increased emphasis on clusters and networks in order to facilitate the development of such linkages. The Government has committed additional resources to the development of market-facing research centres in which enterprises will have a greater role in determining their research agendas and will also contribute a higher proportion of its budget. This marks a shift in policy emphasis in relation to the funding of research centres which in the past were deemed to have an over-duly focus on academic research considerations.

⁶⁸ Forfás (2006), *Services Innovation in Ireland — Options for innovation policy*. Dublin, Ireland. Available at: http://www.forfas.ie/media/forfas060928_services_innovation_full_report.pdf (Accessed: 24 February 2015).

The publication of the national IP Protocol and the development of Knowledge Transfer Ireland seek to address issues relating to access to and the transfer of knowledge from the HEI/PRO sectors to the enterprise base, and particularly to indigenous companies.

Forfás was requested by the Prioritisation Action Group in 2013 to carry out a review of public RDI support approaches and practices for innovation in services and businesses' processes. The study⁶⁹ found that there is no single off the shelf good practice that Ireland can follow but that a country specific approach is needed, taking account of existing RDI supports and company needs and building on an integrated portfolio approach including business and applied RDI; research programmes; clusters/networks; and policy and strategy supports. The actions recommended by the Forfás review are being implemented through the PAG.

Pilot projects are being taken in relation to the use of innovative public procurement as a means of stimulating open innovation in the enterprise base. However, while there has been considerable interest in the past among policy-makers in innovative public procurement this has yet to be translated into action in a meaningful way.

The Department of Jobs, Enterprise and Innovation is undertaking research on how to optimise the policy mix to address structural challenges in enterprise R&D performance and the results of this research is anticipated to be published in 2015.

⁶⁹ Forfás Annual Report 2014, Op. Cit.

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Annex 2 - Abbreviations

AKTS	Annual Knowledge Transfer Survey
BERD	Business expenditure on Research and Development
BMW	Border, Midland and Western Region
CSO	Central Statistics Office
cTTO	Central Technology Transfer Office
DES	Department of Education and Skills
DJEI	Department of Jobs, Enterprise and Innovation
DOF	Department of Finance
EI	Enterprise Ireland
EIB	European Investment Bank
EPO	European Patent Office
ERA	European Research Area
ESIF	EU Structural and Investment Funds
FDI	Foreign Direct Investment
FP	Framework Programme
GBAORD	Government budget appropriations or outlays for Research and Development
GDP	Gross Domestic Product
GEDI	Global Entrepreneurship & Development Index
GERD	Gross expenditure on Research and Development
GNP	Gross National Product
HEA	Higher Education Authority
HEI	Higher Education Institutions
HRB	Health Research Board
HPSU	High Potential Start-Ups
IDA	Industrial Development Authority
IGEES	Irish Government Economic and Evaluation Service
IMF	International Monetary Fund
IoT	Institutes of Technology
IOTI	Institutes of Technology Ireland
IP	Intellectual Property
IRC	Irish Research Council
IUA	Irish Universities Association
KfW	Kreditanstalt für Wiederaufbau
KTI	Knowledge Transfer Ireland
LEO	Local Enterprise Office
NCC	National Competitiveness Council
MNC	Multinational Company
NPRF	National Pensions Reserve Fund
NRP	National Reform Programme
NRPE	National research prioritisation exercise
MTES	Medium-Term Economic Strategy
NUTS	Nomenclature of Territorial Units for Statistics/Nomenclature des unités territoriales statistiques
OA	Open Access
PCT	Patent Cooperation Treaty
PPS	Post Programme Surveillance
QQI	Quality and Qualifications Ireland
R&I	Research and Innovation
RIS	Research and Innovation Strategy
RPAG	Research Prioritisation Action Group
RTO	Research Technology Organisation
SBIR	Small Business Innovation Research
S&E	Southern and Eastern Region
SBIR	Small Business Innovation Research
SFI	Science Foundation Ireland

SSTI	Strategy for Science, Technology and Innovation 2006-2013
STEM	Science, technology, engineering and mathematics
STI	Science, Technology and Innovation
VC	Venture Capital

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EUR 27331 EN – Joint Research Centre – Institute for Prospective Technological Studies

Title: RIO Country Report Ireland 2014

Author: Tom Martin

Luxembourg: Publications Office of the European Union

2015 –48 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-49241-9 (PDF)

doi:10.2791/13125

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ISBN 978-92-79-49241-9

