



JRC SCIENCE FOR POLICY REPORT

RIO COUNTRY REPORT 2015: Ireland

Tom Martin
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2016



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JRC101195

EUR 27877 EN

PDF ISBN 978-92-79-57812-0 ISSN 1831-9424 doi:10.2791/133745 LF-NA-27877-EN-N

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How to cite: Tom Martin, Giovanni La Placa; RIO Country Report 2015: Ireland;
EUR 27877 EN; doi:10.2791/133745

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Abstract

The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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Foreword

The report offers an analysis of the R&I system in Ireland for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Irish research and innovation system and assesses the policy response. It 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 quantitative data is, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016. The report contents are partly based on the RIO Country Report, 2014 (Tom Martin, 2015a).

Acknowledgements

The report draft has benefited from comments and suggestions of Siobhán Fitzpatrick, Tim Cullinane and Cian Neville from the Department of Jobs, Enterprise and Innovation of Ireland, and Ruslan Rakhmatullin from JRC-IPTS.

Comments from DG RTD are also gratefully acknowledged.

Peter Fako, Lorenzo Isella and Athina Karvounaraki produced the statistics and the analytical assessments for sections 3.2 and 3.6 of the report.

We would like to thank Sophie Bodart for her assistance in preparing this report for publication.

A special thanks goes to Peter Fako for his support during the editing phase of the report.

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Executive summary

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 quantitative and qualitative data is, whenever possible, comparable across all EU Member State reports.

Context

Ireland has been severely hit by the economic crisis, with dramatic repercussions on its public finances. This led to the agreement with EC, ECB and IMF upon an Economic Adjustment Programme which included a joint financing package of €85b covering the period 2010-2013. After successfully exiting the 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.

The economic outlook looks positive, with figures for 2014 and the forecasts for 2015-2016 showing an increase in GDP, a reduction of the unemployment rate and a decrease in the debt/GDP ratio.

Nevertheless, the crisis left its mark on the public support to R&D: the shares of both the GDP devoted to the R&D appropriations (and to a lesser extent to the GERD funded by the government) have not been preserved. In fact, a declining trend of both indicators from 2009 onwards can be seen, only partially compensated by the indirect funding provided by the tax credit on R&D performed by businesses. Therefore, Ireland did not fully implement a smart fiscal consolidation strategy.

Anyway, thanks to the strategic sustained investment in R&D of the last decade Ireland has been able to join the top 20 countries for scientific output¹ and scores remarkably well in a number of innovation output indicators.

The Irish R&D intensity for 2014 is 1.52%, which is below the Europe2020 target of 2.0%. The business expenditure (BERD), at €2.107m in 2014, accounts for the lion's share, overcoming the threshold of 70% of GERD.

The business R&D landscape is dominated by foreign multinationals, which account for over two-thirds of the total BERD.

Key developments in the R&I system in 2015 included:

- Innovation 2020², the new five-year (2016-2020) Strategy for Research and Development, Science and Technology, was released in December 2015, following a consultation with stakeholders in early 2015;
- The Government's new capital investment plan, Building on Recovery: Infrastructure and Capital Investment 2016-2021 outlines an exchequer spend of €27b over the next six years. A total of €3.78b (14%) will be allocated for Enterprise and Innovation over the time-frame of the plan;
- The introduction in the Budget 2016 of a Knowledge Development Box (KDB) scheme, operational as of January 1, 2016; will implement a competitive corporate tax rate of 6.25% (half of the corporate tax rate applicable to trading income of 12.5%) on profits arising from intellectual property assets, in accordance with OECD guidelines³.

¹ National Reform Programme 2015.

² <https://www.djei.ie/en/Publications/Innovation-2020.html>

³ http://www.idaireland.com/how-we-help/resources/infographics/knowledge-development-box/IDA_KDB.pdf

Ireland performs well in most of ERA Priorities, especially for what concerns the establishment of an open labour market for researchers and gender equality. Ireland has set-up a number of initiatives aimed at building international links between Irish researchers and third country researchers. The system still lacks a national roadmap for research infrastructures. Progress can be made in the uptake of open access publishing.

Recent policies aimed at improving the conditions for knowledge transfer in the country, especially with the establishment of the central TTO Knowledge Transfer Ireland (KTI). On the other hand, the system in support of business R&I is still very fragmented and would benefit from a rationalisation.

The identified challenges for Ireland's R&I system are:

1. Increase the level of R&D activities by indigenous companies;
2. The public sector funding of R&D;
3. Business-academia collaboration and knowledge transfer;
4. Development of demand-side policies and innovation procurement initiatives.

R&I Challenges

Challenge 1: **Increase the level of R&D activities by indigenous companies**

Description

Ireland performs relatively well in terms of innovation outputs, both in the Innovation Output Indicator and on the Innovation Union Scoreboard. This is mainly due to its economic structure, geared towards several high-tech manufacturing sectors and knowledge-intensive services.

However, research and development activity is largely carried out by foreign multinationals and there have been limited spillovers to SMEs⁴.

Statistics published by the Central Statistics Office show that expenditure on R&D by the enterprise sector is dominated by MNCs: 400 companies accounted for 65% of total R&D expenditure in 2013⁵.

Indigenous SMEs show also slightly lower levels of formal collaborations with HEIs compared to foreign-owned businesses (see also Challenge 3)⁶: 19% of Irish-owned R&D performing enterprises collaborate with HEIs or other institutions in Ireland and 7% with HEIs or other institutions outside Ireland, whereas these percentages are 21% and 10% respectively for foreign-owned R&D performing firms.

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 exporters⁷.

The background report⁸ to the 10-year enterprise and jobs strategy, Enterprise 2025,⁹ published in November 2015 notes that despite the fact that there has been an increase in the number of enterprises engaging in RD&I, the reality remains that there is a high proportion of Irish-owned enterprises across the economy that do not undertake any RD&I activities. It says that even in cases of indigenous enterprises that are engaged, the levels of investment in innovation remain low. The background report also states that progress towards targets set out in the Strategy for Science, Technology and Innovation 2006-2013¹⁰ in terms of the numbers of indigenous companies with minimum and significant scale R&D expenditure was slower than envisaged.

The Enterprise 2025 background report points out that a high proportion of Irish owned enterprises are small, and the challenges facing them are similar to those found in other countries – namely the lack of capacity to innovate and to absorb innovations.

Policy response

The predominance of foreign companies in the Irish business R&D landscape has been acknowledged by the Government in its Medium Term Economic Strategy¹¹ document, which notes that indigenous SMEs need to improve their innovation capacity.

⁴ European Semester Country Report 2015.

⁵ <http://www.cso.ie/en/releasesandpublications/er/berd/businessespenditureonresearchdevelopment2013-2014/>

⁶ Forfas "Business Expenditure in research and Development 2011-2012" (2013)

⁷ RIO Country Report 2014.

⁸ Department of Jobs, Enterprise and Innovation (2015), *Enterprise 2025: Ireland's National Enterprise Policy 2015-2025, Background Report*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Publication-files/Enterprise-2025-Background-Report.pdf>

⁹ Department of Jobs, Enterprise and Innovation (2015), *Enterprise 2025: Ireland's National Enterprise Policy 2015-2025, Summary Report*, Dublin, Ireland. Available from: <https://www.djei.ie/en/What-We-Do/Business-Sectoral-Initiatives/Enterprise-2025/>

¹⁰ Department of Jobs, Enterprise and Innovation (2006), *Strategy for Science, Technology and Innovation 2006-2013*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Strategy-for-Science-Technology-and-Innovation-2006-20131.html>

¹¹ <http://mtes2020.finance.gov.ie/>

Enterprise 2025 outlines a range of policy responses to addressing the challenges of increasing the numbers of indigenous enterprises engaged in RD&I activities and increasing RD&I expenditures by this cohort.

The main support measure for research-performing Irish businesses is the R&D tax credit, introduced in 2004, which provides a 25% credit on corporate tax for qualifying R&D expenditure.

A wide range of direct funding schemes are provided by Enterprise Ireland (EI) and Science Foundation Ireland (SFI), especially targeting the collaborative research projects between businesses and between businesses and academia (see Challenge 3).

Demand-side measures to foster the provision to the public sector of innovative products/services by Irish SMEs have been launched with the first SBIR call in 2014 (see Challenge 4).

Assessment

Ireland took several policy measures through the years to increase the R&I capacity of indigenous firms, the most relevant in economic terms being the R&D tax credit, which has a cost in terms of foregone tax revenues estimated at €421m in 2013. However, official figures show the credit is used predominantly by multinational firms and other large employers in the high tech and manufacturing sectors

The Knowledge Development Box will be introduced in 2016 and has a similarly broad application for all types and sizes of firms.

Stakeholders have highlighted the need for State agencies to be constantly vigilant in ensuring that there are no major gaps in RD&I support funds. The Industry Research & Development Group (IRDG), a representative body for research performing organisations, recommended¹² that the funding provided under the Innovation Voucher scheme (currently €5,000) could be extended to €20,000-50,000 so as to increase collaboration between companies and the higher education institutions. IRDG says this proposal would fill a funding gap between the current Innovation Voucher scheme and a research-based Innovation Partnership (both measures are offered by Enterprise Ireland, the enterprise development agency for Irish owned manufacturing and internationally traded service companies).

The large number of support schemes to businesses R&I should be rationalised, as also pointed out by the OECD in its 2013 Economic Survey of Ireland¹³, which called for the consolidation of funding into a drastically smaller number of agencies, with one group dealing with science and basic research, and another with applied research and innovation. The IRDG in its submission to the Consultation Paper for Innovation 2020¹⁴ noted that "*companies can struggle to understand the funding structures in place for Research & Innovation across the various government bodies from Enterprise Ireland, Science Foundation Ireland, IDA Ireland, Irish Research Council, Revenue Commissioners, H2020, etc.*"

¹² Industry Research & Development Group (IRDG) (2015), *Submission by IRDG to DJEI In response to a Consultation Paper For Successor to Strategy for Science, Technology and Innovation*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Consultations/Consultations-files/Industry-Research-and-Development-Group.pdf>

¹³ OECD STI Outlook 2014

¹⁴ Op. Cit.

Challenge 2: **The public sector funding of R&D**

Description

Ireland's R&D expenditure in the public sector as a percentage of GDP was calculated at 0.43% in 2012, which is lower than the EU average percentage of 0.75% and also below the OECD median¹⁵. While Ireland has maintained public spending on research at 2010 nominal levels, this constitutes a decrease in real terms¹⁶.

This concern is reinforced by looking at the declining trend of the public R&D appropriations (GBAORD), which are much lower than the pre-crisis values both in nominal values as a percentage of the total government expenditure: the latter indicator dropped from 1.27% in 2007 to 1.03% in 2013 (the provisional figure for 2014 is 1.00%). This declining trend has partially been compensated by the indirect funding provided by the tax credit on R&D performed by businesses, whose foregone revenues have been estimated at nearly €421m (see Challenge 1). In fact, it has to be noted that Ireland cut its R&I budget at a higher pace than other expenditures, as highlighted by Prof. Reinhilde Veugelers in her recent paper 'Undercutting the future? European research spending in times of fiscal consolidation': "Most countries under high fiscal consolidation pressure cut their public R&I budgets, but some did so more forcefully than others. Ireland cut its public R&I budget by somewhat more than its overall public budget (1 percent in 2012)"¹⁷.

Ireland therefore faces the challenge of returning to a trend of sustained public investment in R&D.

Policy response

In a context of tight public budget, Ireland efforts have been focusing on: 1) maximising the impact of public research funding; 2) getting the highest possible return from the participation of Ireland Horizon 2020.

The National Research Prioritisation Exercise (NRPS) led to the identification of the 14 Priority Areas of the National Research Prioritisation Strategy, which also serves as Ireland's Smart Specialisation Strategy (RIS3). The NRPS aims at directing competitive Government research funding towards the 14 priority areas, which were identified on the basis of existing strengths of the public research system and the enterprise base and opportunities to deliver economic and societal impact and create jobs.

The new strategy Innovation 2020 is "committed to maintaining a focus on the impact and relevance of research for the economy and society. In fact, it states (page 9): "Between 2008 and 2013, business investment in R&D grew by 31%, while public spending fell 22%. Over this difficult period, public funding was redesigned to improve its impact (...)". Five impact indicators are mentioned:

- Increased competitiveness
- Maintaining high-value jobs
- Attracting foreign direct investment
- Developing human capital
- Ensuring a culture of evidence-based policy, processes and practices in both public and private sectors.

¹⁵ OECD STI Outlook 2014.

¹⁶ European Semester Country Report 2015.

¹⁷ <http://www.bruegel.org/download/parent/829-undercutting-the-future-european-research-spending-in-times-of-fiscal-consolidation/file/1731-undercutting-the-future-european-research-spending-in-times-of-fiscal-consolidation>

In accordance with the strategic document Agenda2020, Science Foundation Ireland (SFI), the main Irish public research funder, awards funding to research proposals not only according to excellence criteria, but also to the results of an ex-ante impact evaluation. SFI defines impact as the “demonstrable contribution that excellent research makes to society and the economy”, classifying the impacts of scientific research in 8 categories¹⁸.

The Department of Jobs, Enterprise and Innovation has undertaken a comprehensive programme of evaluations of RD&I interventions provided by the enterprise development agencies to assess their effectiveness & efficiency in terms of exchequer funding and appropriateness to deliver on stated objectives.

The Irish Government has also developed a strategy designed to maximise Ireland’s participation in Horizon 2020. A target of €1.25b for Ireland’s drawdown of funding from Horizon 2020 was adopted. All government Departments and Agencies whose remit includes research and innovation have a role in implementing this strategy and securing the maximum benefits for Ireland. Oversight and direction setting for the implementation of the strategy is carried out on an ongoing basis by the Horizon 2020 High Level Group under the chairmanship of the Department of Jobs, Enterprise and Innovation¹⁹.

Assessment

After exiting its Economic Adjustment Programme in December 2013, Ireland is still under Post-Programme Surveillance: this context does not allow a lot of margin of manoeuvre to increase public expenditure in R&D.

A first progress report on the NRPS has been released in 2014, showing the very good advancement of the strategy in terms of actions’ implementation²⁰. The Department for Jobs, Enterprise and Innovation (DJEI) commissioned also an independent progress report which was published in December 2015.

Impact indicators for the research projects funded by SFI are presented in the yearly reports on the progress towards the achievement of Agenda 2020 KPIs²¹.

An assessment of Ireland's involvement in Horizon 2020 showed that Irish participants recorded a success rate of nearly 15%, ranking 12th in the EU-28. This score is the second lowest (Slovenia being the lowest) among the countries belonging to the group of “innovation followers” in the IUS 2015²².

Challenge 3: **Business-academia collaboration and knowledge transfer**

Description

The weakness of the Irish R&I system in terms of low degree of collaboration between business-academia has been recurrently highlighted in recent years²³. The Enterprise 2025 background report points out that despite some progress being made, there is still evidence of the *considerable challenge* faced in stimulating increased interaction and collaboration between SMEs and the range of research infrastructures available throughout the country.

¹⁸ 1. Economic and commercial; 2. Societal; 3. International engagement; 4. Impact on public policy services and regulations; 5. Health and wellbeing; &. Environmental; 7. Impact on professional services; 8. Impacts on human capacity.

¹⁹ National Reform Programme 2015.

²⁰ <https://www.djei.ie/en/Publications/Publication-files/For%C3%A1s/National-Research-Prioritisation-Exercise-First-Progress-Report.pdf>

²¹

<http://www.sfi.ie/assets/files/downloads/Publications/Organisation%20Publications/Agenda%202020%20Annual%20Review%202014.pdf>

²² https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results_1.pdf

²³ European Semester Country Report 2015, OECD STI Outlook 2014.

Looking at the input side, the level of business enterprise funding of public R&D as a percentage of GDP was 0.007% in 2013 (Eurostat data), one of the lowest in the EU-28 and much lower than the EU average of 0.05% (2012). This value is even more striking if compared with innovation leaders like Germany (0.114%) or Finland (0.065%) or other strong innovators like the Netherlands (0.088%) or Belgium (0.072%).

Another figure provided by OECD shows that the percentage of HERD funded by indigenous industry has dropped from 5.3% in 2000 to a very low 1.6% in 2013. The Survey of R&D in the Higher Education Sector 2012/2013²⁴ notes that in terms of sources of funding of expenditure on R&D by the higher education sector, Irish and foreign business provided €13m and €9m respectively in 2012, cumulatively accounting for 3.4% of total HERD.

Moreover, as already pointed out in Challenge 1, Irish indigenous companies show a lower rate of collaboration with academia compared to foreign MNC.

In terms of business-academia collaboration outputs, the level of public-private scientific co-publications per million population is also relatively low: Ireland ranks 12th in the EU with 34 publications against an EU average of 53²⁵.

Policy response

Science Foundation Ireland (SFI) and Enterprise Ireland (EI) have been providing a range of funding opportunities for public-private collaborative research projects in recent years.

In particular, the SFI Research Centres programmes supports 12 research centres, involving collaboration between HEIs and over 200 companies (split approximately 50/50 between MNCs and SMEs). Government investment of €350m is matched by €190m from industry and will support the employment of approximately 1,300 researchers.

A joint Enterprise Ireland–IDA Ireland Technology Centres programme supports 15 industry-led Technology Centres, generally based in a university with support from partner universities to deliver on the research needs of enterprise.

The SFI Industry Fellowship programme awards can be granted to academic researchers wishing to spend time in industry worldwide and to individuals from industry anywhere in the world (including Ireland) wishing to spend time in an eligible Irish Research Body, while the Irish Research Council's (IRC) post-doc Enterprise Partnership Scheme, awards co-funded postgraduate scholarships and postdoctoral fellowships in partnership with private enterprises and public bodies to the most promising researchers in Ireland.

The Innovation Vouchers granted by EI provide funds (€5,000) to small companies to pay a registered knowledge provider to solve a technical or business challenge.

Finally, one major novelty has been the creation in 2013 of a central TTO called Knowledge Transfer Ireland (KTI)²⁶. KTI's mission is to deliver an efficient and productive research and technology transfer system, to make IP and expertise within public research organisations visible for companies, and to act as a central point of contact. It supports the public research organisations' (HEIs') research and technology transfer infrastructure and provides services complementary to already existing TTO structures.

²⁴ Department of Jobs, Enterprise and Innovation (2015), *Survey of Research & Development in the Higher Education Sector 2012/2013*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Publication-files/Survey-of-Research-and-Development-in-the-Higher-Education-Sector-2012-2013.pdf>

²⁵ Innovation Union progress at Country Level 2014.

²⁶ <http://www.knowledgetransferireland.com/>

Assessment

Irish policy makers have been actively addressing the need to improve the framework for public-private cooperation in R&D. 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, with an increasing leadership by industry in the centres' research agendas.

However, Ireland would benefit from the rationalisation and streamlining of the wide range of small scale grant-based schemes available for business-academia collaboration.

Finally, the regular reporting by KTI using knowledge transfer metrics and indicators (including the subjective assessment provided by businesses) will allow monitoring the progress of business-academia cooperation in Ireland in the years to come.

Challenge 4: Development of demand-side policies and innovation procurement initiatives

Description

Innovative public procurement has been mentioned in a number of Irish STI strategy documents over the years, but this instrument has been largely under-utilised, despite the recommendations made by the Procurement Innovation Group established in 2008 in the report "Using Public Procurement to Stimulate Innovation and SME Access to Public Contracts"²⁷.

Irish policy makers seem to have not yet exploited the potentials of using demand-side instruments such as PCP and PPI as tools to stimulate the innovation capabilities of Irish SMEs and to boost the growth of young companies in the more knowledge-intensive sectors of the economy. According to the WEF "Global Competitiveness Report 2013" Ireland ranked only 88th out of 144 countries in terms of "Government procurement of advanced tech products"²⁸.

In fact, the first "SBIR-type" (Small Business Innovation Research) calls were launched only in 2014, with a strong delay compared to other economies.

Policy response

The Office of Government Procurement (OGP) was officially launched in 2013 as part of a Government drive to reduce costs and achieve better value for money through reform of public procurement. The OGP issued a Circular 10/14 (April 2014)²⁹ which sets out positive measures that public sector buyers should take to promote SME involvement in public sector procurement, includes a specific provision that contracting authorities should consider new and innovative solutions, where possible and appropriate.

The first pilot project has been launched in 2014 by the Sustainable Energy Authority (SEAI) launched in collaboration with Enterprise Ireland (EI), i.e. a SBIR (Small Business Innovation Research) competition, to develop a smart technology solution for charging Electric Vehicles (EVs) in shared access parking areas³⁰.

The Action Plan for Jobs 2015 foresees (Action 63) the development of "5 additional proposals for Small Business Innovation Research (SBIR) or similar test bed actions for innovative procurement related to energy, building on the success of the SEAI/EI/SBIR for multi-user electricity charging in 2014". The action 166 is titled "Examine ways of improving the supply of innovative products and services, where appropriate, in public

²⁷ <http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/Report%20of%20the%20Procurement%20Innovation%20Group.pdf>

²⁸ See for reference: "OECD Economic Surveys: Ireland 2013".

²⁹ Department of Public Expenditure and Reform (2014), *Circular 10/14: Initiatives to assist SMEs in Public Procurement*, Dublin, Ireland. Available from: http://www.procurement.ie/sites/default/files/circular_10-14.pdf

³⁰ <http://www.seai.ie/SBIR#sthash.mNLPB8oY.dpuf>

procurement" and includes an assessment of innovative procurement practices of other countries as potential learnings for Ireland.

A call jointly managed by SEAI and EI to develop a number of smart technology solutions in the field of Building Energy Rating (BER) data management has been launched in September 2015.

Assessment

Ireland has implemented measures on innovation procurement much later than other EU countries, also taking into consideration the strength of its high-tech and ICT sectors.

The SBIR calls launched in 2014 and 2015, together with the plan to engage in a learning process of other countries' procurement practices can be considered as positive developments.

Nevertheless, Ireland could benefit from a comprehensive strategy to boost innovation procurement.

1. Overview of the R&I system

1.1 Introduction

Ireland had a population of 4.6 million in April 2015 and has an area of 70,273 km². Eurostat figures show that Ireland accounted for less than 1% of the total population of the 28 Member States of the European Union in 2014.

Ireland was severely impacted by the economic recession in 2007-2008 and was subject to a bailout programme from the European Union, the European Central Bank and the International Monetary Fund. The country exited the programme in 2014 and economic growth is on an upward path. Ireland's Gross Domestic Product (GDP) increased by 0.2% in 2012 but as the economy recovered, the rate of GDP growth increased to 1.4% in 2013 and accelerated to 5.2% in 2014 (Ireland's GDP growth rate for 2014 was the highest rate in the EU-28). GDP growth in Ireland is expected to reach 6.7% in 2015 though the forecasted growth rate for 2016 is lower at 4.8%. Gross National Product (GNP) which is regarded as a better measure of Irish economic activity grew by 1.6% in 2012 and increased again in 2013 by 4.6% and in 2014 by 6.9%. Ireland's GDP per capita was €37,600 in 2012 and rose to €40,200 in 2014, which was more than €12,900 above the EU-28 average for 2014.

There has been a reduction in Ireland's general government deficit: this fell from -8.1% in 2012 to -4.1% in 2014. Despite this improvement, Ireland still had a higher government deficit profile than the EU-28 average in 2014 (-2.9%).

In tandem with the increase in economic activity, unemployment in Ireland has been falling. Unemployment as a percentage of the labour force declined from 14.7% in 2012 to 11.3% in 2014 which was over 1 percentage point higher than the EU-28 average of 10.2%. The independent think-tank Economic and Social Research Institute (ESRI), in its December 2015 Quarterly Economic Commentary³¹ anticipates that unemployment in 2015 will fall further to 9.3% and it forecasts that the unemployment rate for 2016 reduce again to 7.9 per cent.

Ireland's R&D headline target is to raise combined public and private investment levels to 2.5% of GNP or 2.0% of GDP. There is a concern that with GDP increasing rapidly unless there is a substantial increase in funding for R&D to accompany the new Innovation 2020³² strategy then Ireland faces a risk of not achieving its 2020 headline target.

Gross Expenditure on Research and Development (GERD) in Ireland increased steadily over the period 2012-2014. GERD amounted to €2.871b in 2014, an increase on the €2.756b recorded in 2013 and on the €2.724b recorded in 2012.

Ireland's research intensity rate declined slightly from 1.54% in 2013 to 1.52% in 2014, compared to an average EU-28 intensity of 2.03% in 2014.

Research and Development Expenditure in the Higher Education sector (HERD), on the other hand, declined between 2009 and 2013 (€605) and increased again in 2014 to an estimated level of €631m, still somewhat lower than the 2012 value (€640m)

Ireland has a small PRO sector compared to the EU-28 average; in 2014, R&D performed by the public research organisations amounted to 4.5% of GERD, compared with an average of 12% for EU-28. Teagasc, the agriculture and food development authority, is the largest PRO and had a research budget of €60m in 2014.

Ireland has a dual enterprise sector; on the one side it has a small number of large multinational companies, the majority of whom are in the medium and high tech sectors while on the other side a large number of small and medium sized indigenous companies

³¹ Economic and Social Research Institute (2015), *op. cit.*

³² <https://www.djei.ie/en/Publications/Innovation-2020.html>

are active in the low and medium technology sectors. This duality is reflected in Ireland's high share of employment in high and medium-high technology sectors compared to the EU norm. The multinational sector also accounts for over two-thirds of BERD.

The 2015 edition of the Global Innovation Index³³ has ranked Ireland in 8th position in its listing of the world's most innovative economies. This represents an improvement on its 2014 ranking when it held 11th place in the survey. The annual report, published by Johnson Cornell University, INSEAD and the World Intellectual Property Organization, surveys 141 economies around the world, using 79 indicators to determine innovation capacities and measurable outputs.

The current Government which is a coalition of Fine Gael and the Labour Party has been in power since 2011 (its five year term ends in 2016 when a general election must be held). The Programme for Government agreed by the coalition partners highlights the importance of R&I in generating wealth and employment.

³³ Cornell University, INSEAD, and WIPO (2015): *The Global Innovation Index 2015: Effective Innovation Policies for Development*, Fontainebleau, Ithaca, and Geneva. Available at: <https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf>

Table 1: Main R&I indicators 2012-2014

Indicator	2012	2013	2014	EU average
GDP per capita	€37,600	€38,000	€40,200	€27,300
GDP growth rate	-0.3	0.2	4.8	1.3%
Budget deficit as % of public budget	121.7	123.2	109.7	-2.9%
Government debt as % of GDP	-8.1	-5.8	-4.1	86.8%
Unemployment rate as percentage of the labour force	14.7	13.1	11.3	10.2%
GERD in €m	€2,734	€2,756	€2,842	€283,009 (total for EU-28)
GERD as % of the GDP	1.56%	1.54%	1.52%	2.03%
GERD (EUR per capita)	€596.6	€600.4	€623.5	€558.4
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	5.0	5.2	4.9	5.6% (2013)
Employment in knowledge-intensive service sectors as share of total employment	45.3	44.7	44.8	39.2 (2013)
Turnover from innovation as % of total turnover	N/A	N/A	N/A	11.9 (2012)
Value added of manufacturing as share of total value added	37.0	N/A	N/A	26.2 (2012)
Value added of high tech manufacturing as share of total value added	17.9	N/A	N/A	2.5% (2012)

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

1.2.1 Main features of the R&I system

The Irish R&I system is fairly centralised with the bulk of research and innovation budgets being controlled by Government Departments (ministries). The two key ministries involved in R&I policy development and implementation are the Department of Jobs, Enterprise and Innovation and the Department of Education and Skills. The two ministries accounted for 77% of Government Budget Appropriations and Outlays on R&D (GBAORD) in 2013³⁴.

³⁴ Department of Jobs, Enterprise and Innovation (2015): *State Investment in Research and Development 2013-2014*, Dublin, Ireland. Available from: State Investment in Research & Development 2013-2014.

Ireland comprises two NUTS³⁵ 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 2014³⁶ classifies the S&E Region as an innovation leader even though as a country Ireland is categorised as an innovation follower.

The Government and the European Commission have both approved Ireland's Regional Operational Programmes covering the period 2014-2020, which will be co-funded by the European Regional Development Fund (ERDF) and managed by the Regional Assemblies. Total funding for the two programmes amount to more than €800m of national and EU funding and comprise the following:

- €498m for the Southern & Eastern Region (including ERDF funding of €249 million)³⁷;
- €320m for the Border, Midland & Western Region (including ERDF funding of €160 million)³⁸.

The two Regional Operational Programmes include as part of their investment priorities the provision for promoting R&D investment and the two managing authorities will co-fund a number of national R&I support measures offered by Science Foundation Ireland, Enterprise Ireland and the Marine Institute.

The main research performers are the enterprise sector (of which foreign owned companies account for 65% of BERD) and the higher education sector (of which the seven universities account for over 80% of research contract income).

The Public Research Organisation (PRO) sector is small by EU standards — R&D performed by the government sector within the EU28 in 2014 as a percentage of GERD was 12% while the equivalent Irish figure was 4.5%; the major research performer is Teagasc, the agriculture and food development authority.

1.2.2 Governance

The research and innovation governance structure comprises the Cabinet Committee on Economic Recovery and Jobs at its apex which is supported by a high level governmental co-ordinating body in the form of the Inter-Departmental Committee on Science, Technology and Innovation and by the Research Prioritisation Action Group which oversees the implementation of the National Research Prioritisation Strategy.

Professor Mark Ferguson, the head of Science Foundation Ireland, was appointed Chief Scientific Adviser to the Government in 2012 following the abolition of the Office of the Chief Scientific Adviser as a standalone office. The Higher Education Research Group which is led by the Department of Education and Skills provides strategic direction for the approach of the higher education sector.

Since the abolition of the Advisory Council for Science, Technology and Innovation, there has been no official permanent forum where relevant stakeholders such as industry can provide STI policy advice to the Government. Industry is not represented on the Inter-Departmental Committee on Science, Technology and Innovation or on the Research Prioritisation Action Group (a review of the implementation of the National Research

³⁵ Nomenclature of Territorial Units for Statistics/Nomenclature des unités territoriales statistiques (NUTS).

³⁶ European Commission (2014): *Regional Innovation Scoreboard 2014*, Available at: <http://bookshop.europa.eu/en/regional-innovation-scoreboard-2014-pbNBBC14001/>

³⁷ Southern Regional Assembly (2014): *Southern & Eastern Regional Operational Programme 2014-2020*, Waterford, Ireland. Available from: http://www.southernassembly.ie/en/info/southern_and_eastern_regional_operational_programme_2014_2020

³⁸ Northern & Western Regional Assembly (2014): *Border, Midland and Western Regional Operational Programme 2014-2020*, Ballaghaderreen, Co Roscommon, Ireland. Available from: <http://nwra.ie/bmwop>

Prioritisation Strategy (DJEI, 2015)³⁹ recommended that the membership of the Prioritisation Action Group should be widened to include representatives of other stakeholders in public research: enterprise, the investment community and research performers). Stakeholders were provided with the opportunity not only to make submissions to the formulation of the Innovation 2020 strategy but also to participate in a public forum to debate key issues in relation to the strategy.

Forfás, the policy advisory board for Enterprise, Trade, Science and Innovation, was abolished in 2014 and its policy advisory function and staff were transferred to the Department of Jobs, Enterprise and Innovation.

The Higher Education Authority (HEA) is an agency of the Department of Education and Skills and has a statutory responsibility, at central government level, for the effective governance and regulation of higher education institutions and the higher education system. It is also the funding body for the universities, Institutes of Technology and a number of other institutions designated under the terms of the Higher Education Authority Act, 1972. The HEA, in the delivery of the National Strategy for Higher Education to 2030, is implementing the Higher Education System Performance Framework 2014-2016 through which performance compacts have been agreed between the Authority and the institutions. These compacts are framed within the seven system-level objectives identified by the Department of Education and Skills, one of which explicitly drives research performance and impact.

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

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).

R&I policy and programme evaluation is a core feature of the Irish R&I system as has the use of international experts to undertake evaluations/reviews. An independent panel — including international representatives — was appointed in 2014 to monitor the implementation of the National Research Prioritisation Strategy. The panel was asked to assess, for example, progress in re-orientating competitively-awarded investment for economic objectives, in publicly-performed research, towards the 14 priority areas; it was also tasked with assessing the effectiveness of the Prioritisation Action Group. The panel's report⁴⁰ was published in 2015 and among its many findings was that while achievements to date in terms of the implementation of research prioritisation had been significant, there was scope for improvement and the approach to the implementation of RP should be adapted to reflect experiences to date and the evolved socio-economic context.

The Government re-activated the Inter-Departmental Committee on Science, Technology and Innovation to support the preparation of new Science, Technology and Innovation (STI) strategy, Innovation 2020, which was published in December 2015. The Committee comprises senior officials from research funding/performing government ministries and the Higher Education Authority and the Chief Scientific Adviser and operates under the chairmanship of the Department of Jobs, Enterprise and Innovation.

³⁹ Department of Jobs, Enterprise and Innovation (2015), *Review of Progress in Implementing Research Prioritisation — Report of the Independent Panel*, Dublin, Ireland. Available from: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

⁴⁰ Department of Jobs, Enterprise and Innovation (2015), *Review of Progress in Implementing Research Prioritisation — Report of the Independent Panel*, Dublin, Ireland. Available from: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

A national strategy for participation in Horizon 2020 was approved by the Government in December 2013. A new whole-of-government committee, the Horizon 2020 High Level Group, under the chairmanship of the Department of Jobs, Enterprise and Innovation, is responsible for the implementation of the strategy. A support network of national contact points co-ordinated by Enterprise Ireland has been established to assist Irish organisations to participate in the Programme.

A sub-group of the Horizon 2020 High Level Group, the Strategic Research Proposals Group, was established in 2014 comprising senior executives and officials from all research funding Government Departments and Agencies to focus exclusively on identifying opportunities and mobilising EU funding applications for large-scale projects of strategic value to Ireland. This group is chaired by the Chief Scientific Adviser and SFI Director General, Professor Mark Ferguson, and will complement the EI national contact support structure.

InterTradeIreland, the cross-border trade and business development agency set up under the Good Friday Agreement is a member of the Horizon 2020 High Level Group and is seeking to promote an All-Island approach to Horizon 2020 funding. In December 2014, the organisation published a Strategic Action Plan for Horizon 2020⁴¹ aimed at achieving a target draw-down for North-South collaboration under Horizon 2020 of €175m. The document outlines a strategy of collaboration and cooperation amongst North and South institutions and how aligning the support structures of both administrations will help SMEs interested in growing their business through research and innovation to secure Horizon 2020 funding.

The new STI strategy, Innovation 2020, will result in a new governance structure which will subsume a number of existing groups including the Inter-Departmental Committee on Science, Technology and Innovation, the Prioritisation Action Group and the Horizon 2020 High Level Group into a new group, the Innovation 2020 Implementation Group, which will report to the Cabinet Sub-committee.

Inputs from R&D stakeholder groups such as industry and academia and civil society will be sought through a number of mechanisms including through the convening of fora on a regular basis to obtain feedback on implementation on the strategy, such as ad-hoc committees established by the Government to address specific STI tasks.

1.2.3 Research performers

The higher education sector is the second largest research performing sector after the business sector and in 2014 accounted for 22% of research performed. The main actors in this sector are the seven universities which account for approximately 80% of research funding with the balance being shared by the network of Institutes of Technology and other HEIs.

The Irish Universities Association is the representative body for the seven universities and the Institutes of Technology Ireland is the representative body for the 13 Institutes of Technology, while the Dublin Institute of Technology (DIT) stands alone.

The Higher Education Authority is a statutory organisation for the higher education sector and has responsibility for the strategic development of the Irish higher education and research system.

The Irish public research organisation sector is small by comparison with EU standards; approximately 4.5% of the research performed in 2014 was accounted for by PROs, of which the largest research performing organisation is Teagasc, the agriculture and food development authority.

⁴¹ InterTradeIreland (2014), *Strategic Action Plan for Horizon 2020*, Newry, Co. Down, Northern Ireland. Available at: <http://www.intertradeireland.com/newsevents/news/2014/continued-north-south-research-collaboration-can-deliver-175-million-in-funding.php>.

The business sector accounted for 73.5% of the research performed in Ireland in 2014. Statistics published by the Central Statistics Office (CSO)⁴² show that expenditure on R&D by the enterprise sector is dominated by a very small number of MNCs; the largest 100 enterprises in terms of R&D spend accounted for over €1.4b, or 70%, of BERD in 2013. Of these top 100 enterprises, 80% of the spend can be attributed to foreign owned enterprises. These foreign owned companies are concentrated in a number of high tech sectors such as life sciences and ICT. The research activities of the indigenous business sector is small but growing; there were 1,574 Irish owned enterprises engaged in R&D activities in 2013 which equates to 80% of all R&D active enterprises. CSO data show that in 2013 over 80% of all Irish owned enterprises spent less than €0.5m on research and development compared to 45% of all foreign owned enterprises.

R&D spending in 2013 was highest in the services sector which accounted for 57% of BERD. Spending in this sector was just under €1.2b while the manufacturing sector spent over €864m on R&D.

IBEC is the main representative body for the business sector in Ireland though the American Chamber of Commerce Ireland and the Industry Research & Development Group (IRDG) also have influential voices in relation to R&I issues. The private non-profit sector in Ireland does not fund or undertake research activity of any significance.

⁴² Central Statistics Office (2015), Business Expenditure on Research and Development 2013-2014, CSO Statistical release. Available from the CSO web site:
<http://www.cso.ie/en/releasesandpublications/er/berd/businessexpenditureonresearchdevelopment2013-2014>

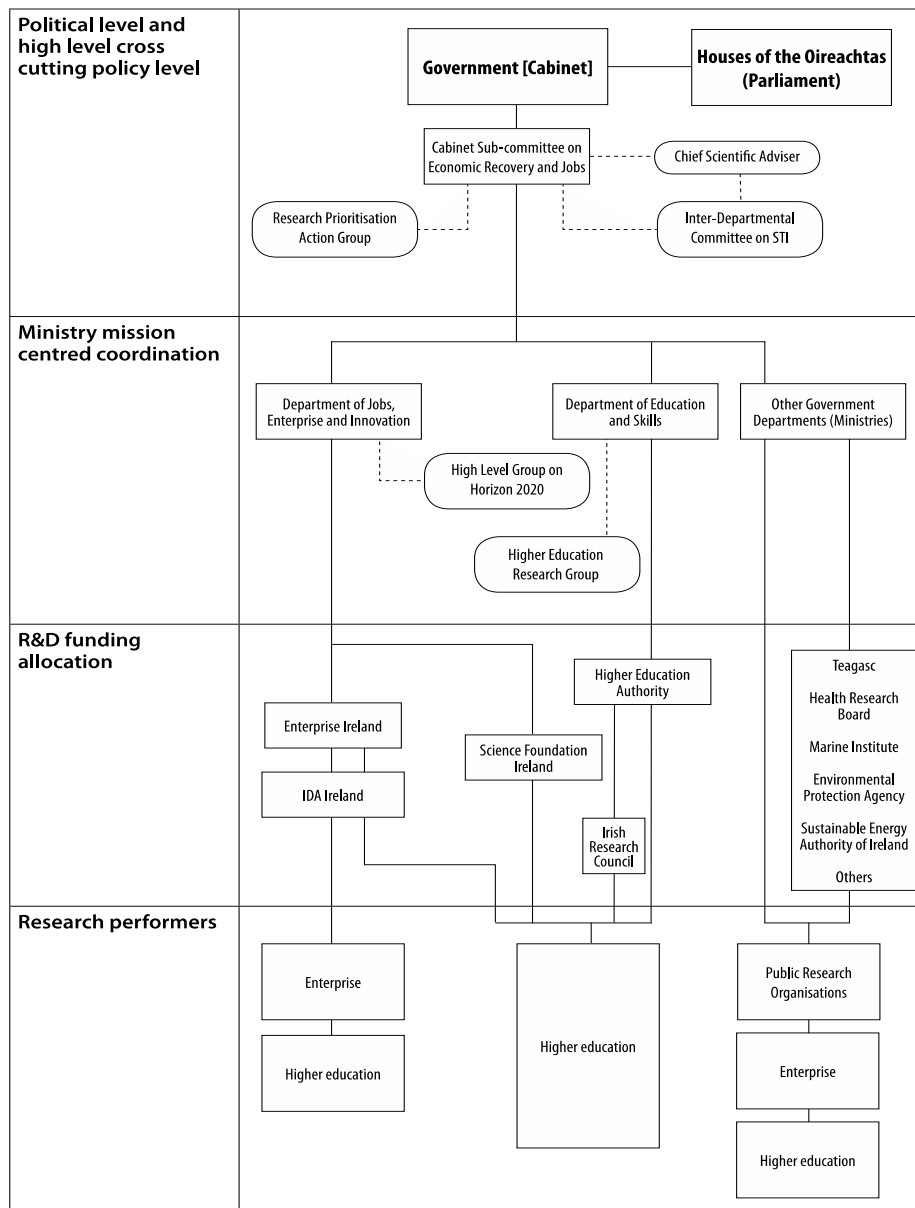


Figure 1: Ireland's RDI governance system

2. Recent Developments in Research and Innovation Policy and systems

2.1 National R&I strategy

A strategy for research and development, science and technology was published in December 2015 and covers the period 2016-2020⁴³. The vision set down in the new strategy, Innovation 2020, is for Ireland to be a global innovation leader driving a sustainable economy and a better society. The aim of Innovation 2020 is to increase public and private investment in R&D to reach 2.5% of GNP by 2020. The strategy also aims to double private investment in publicly performed research.

Innovation 2020 seeks to ensure that the environment fosters innovation in the enterprise sector, so that companies based in Ireland outperform their competitors in international markets, thus leading to increased employment, exports and tax receipts. A key tenet of the strategy is to enhance co-ordination and coherence among policy instruments (grants, R&D tax credits, enterprise-HEI linkage supports) so that public resources are deployed to their maximum effect and that these supports are readily accessible by the enterprise sector and are fully aligned with the needs of the private sector.

The new strategy seeks to build on the National Research Prioritisation Strategy, the objective of which was to focus public investment in research in 14 priority areas, by clustering these areas into six enterprise themes: ICT, Health and medical, Food, Energy, Manufacturing and materials and Services and business processes.

A horizon scanning exercise will be undertaken to identify future areas of strategic commercial activity for Irish-based enterprises.

The new strategy includes actions across a range of policy areas including:

- Supporting innovation in enterprises
- Education
- Innovation for social and economic progress
- Public sector innovation
- International collaboration

The Government has proposed that a new cross-government group, the Innovation 2020 Implementation Group, will be established to oversee the strategy. The Group will report on an annual basis to the Cabinet Committee with responsibility for research and innovation policy on progress in achieving high-level targets and in delivering on actions. The Innovation 2020 Implementation Group will absorb a number of existing R&D-related policy implementation groups such as the Research Prioritisation Action Group.

A number of studies were undertaken by the Department of Jobs, Enterprise and Innovation to feed into the strategy development process. These along with the Innovation 2020 strategy document⁴⁴ were published by DJEI and include:

- An independent assessment of progress in implementing Research Prioritisation;
- A review of Ireland's future research infrastructure needs;
- A review of Ireland's participation in international research organisations;
- A study into Medium Term Development of the Irish Market Focused Element of the Irish Research Centre Landscape Ecosystem;
- Enhancing the IP activities in the firm base in Ireland.

⁴³ See: <https://www.djei.ie/en/Publications/Innovation-2020.html>

⁴⁴ See: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

The development of Innovation 2020 also had regard for sectoral studies such as Food Harvest 2020 and eHealth strategy and other relevant system documents such as the review of funding for the higher education sector.

A consultation process was held in February 2015 in which the Department of Jobs, Enterprise and Innovation, on behalf of the Inter-Departmental Committee on Science, Technology and Innovation, released a consultation document⁴⁵ and invited interested stakeholders to make submissions. A forum was held in July 2015 to which stakeholders were invited to discuss key issues emerging from the consultation process.

Enterprise 2025, Ireland's National Enterprise Policy 2015-2025 published in November 2015⁴⁶ was developed in parallel with Innovation 2020 and both strategies are complementary. Focused on realising a step-change in enterprise performance, Enterprise 2025 places a strong emphasis on embedding innovation in enterprises and on development and attracting talent for the 21st Century.

The Government's new capital investment plan, Building on Recovery: Infrastructure and Capital Investment 2016-2021 (DPER, 2015)⁴⁷, outlines an exchequer spend of €27b over the next six years with a key focus on transport, education, health and enterprise. A total of €3.78b or 14% will be allocated for Enterprise and Innovation over the time-frame of the plan.

2.2 R&I policy initiatives

The main R&I policy focus within the Irish system over the last three years has been on the implementation of the National Research Prioritisation Strategy. Published in 2012, the objective of the prioritisation strategy is to maximise the impact of Government investment in the research and innovation landscape.

The National Research Prioritisation Strategy involves concentrating the majority of competitive public STI funding over the next 5 years in 14 areas of opportunity⁴⁸ 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 was put in place to monitor the implementation of the national research prioritisation strategy and includes the Research Prioritisation Action Group (RPAG).

The RPAG has developed indicators to measure the impact of implementation of research prioritisation in the 14 Priority Areas and more generally the impact of public STI investment. The RPAG progress report⁴⁹ released in 2014 presented an update of the monitoring of these metrics.

⁴⁵ Inter-Departmental Committee on Science, Technology and Innovation (2015): *Consultation Paper For Successor to Strategy for Science, Technology and Innovation*, Dublin, Ireland. Available at:

http://www.heai.ie/sites/default/files/consultation_paper_for_successor_to_ssti_13_feb_2015.pdf

⁴⁶ Department of Enterprise, Jobs and Innovation (2015), *Enterprise 2025, Ireland's National Enterprise Policy 2015-2025, Summary Report* Available from: <https://www.djei.ie/en/Publications/Publication-files/Enterprise-2025-Summary-Report.pdf>

⁴⁷ Department of Public Expenditure and Reform (2015), *Building on Recovery: Infrastructure and Capital Investment 2016-2021*, Dublin, Ireland. Available from: <http://www.per.gov.ie/en/building-on-recovery-infrastructure-and-capital-investment-2016-2021-statement-of-the-minister-for-public-expenditure-and-reform-mr-brendan-howlin-t-d-on-29-september-2015/>

⁴⁸ 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.

⁴⁹ Department of Jobs, Enterprise and Innovation (2014): *National Research Prioritisation Exercise: First Progress Report – June 2014*. Jointly prepared by Forfás and the Department of Jobs, Enterprise and Innovation, Dublin, Ireland. Available

As described in more detail in Section 2.4 below, 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).

In 2014, the Department of Jobs, Enterprise and Innovation commissioned an independent review of the National Research Prioritisation Strategy; the report of the independent panel was published in 2015⁵⁰.

Applications to national funding organisations for competitive research funding are required to demonstrate that the research project aligns with the 14 priority areas identified in the National Research Prioritisation Strategy. It is estimated that virtually all of the research funding allocated by Science Foundation Ireland in 2013 was in the 14 priority areas identified by the prioritisation strategy, in areas of demonstrable potential economic impact for Ireland, in areas of significant partnership with major research entities, or to support the development of young researchers.

The National Research Prioritisation Strategy has resulted in a number of impacts most notably in terms of closer co-operation between the research funding agencies. By its very nature, the strategy has focused on the allocation of competitive public research funding and thus has less relevance for research funding provided to enterprises or to the block grant provided to the higher education institutions.

Another area of R&I policy focus has been on Ireland's Horizon 2020 strategy which was published in 2013. The Government in addition to setting a drawn-down target for Ireland of €1.25b in Horizon 2020 research and technology funding sees the programme as an opportunity for Irish researchers and enterprises to deepen their engagement in collaborative European and international research. An enhanced national support structure has been put in place to assist Irish researchers to participate in Horizon 2020.

Evaluations, consultations, foresight exercises

Forfás, the former policy advisory board for Enterprise, Trade, Science and Innovation, had been undertaking a detailed programme of evaluations since 2012 of supports provided by the enterprise agencies in Ireland. These evaluations are structured under the themes of entrepreneurship and start-up supports; research, development and innovation; and business development and have been undertaken in line with the Forfás evaluation framework, which is based on international best practice.

The evaluations cover programmes offered by Enterprise Ireland (the state agency responsible for the development of indigenous enterprises employing more than 10 employees that export or have the potential to do so), by the network of Local Enterprise Offices (which provide assistance to indigenous enterprises employing less than 10 employees), IDA Ireland (the agency responsible for attracting Foreign Direct Investment), and those programmes funded by Science Foundation Ireland that have a direct 'touch point' with businesses (namely the programmes for Strategic Research Clusters and Centres for Science, Engineering and Technology).

The evaluations were undertaken by Forfás at the request of the Department of Jobs, Enterprise and Innovation and utilised the evaluation framework developed by Forfás in 2011 to ensure a consistency of approach that facilitated comparison (where appropriate) and that was cognisant of the common challenges facing enterprise evaluation.

from: <https://www.djei.ie/en/Publications/Publication-files/Forfás/National-Research-Prioritisation-Exercise-First-Progress-Report.pdf>

⁵⁰ Department of Jobs, Enterprise and Innovation (2015), *Review of Progress in Implementing Research Prioritisation – Report of the Independent Panel*, Dublin, Ireland. Available from: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

The evaluations focused on the appropriateness, efficiency and effectiveness of supports with regard to:

1. Individual programme performance;
2. Programme performance in relation to other interventions in the system;
3. Alignment with national enterprise policy.

In 2015, the Department of Jobs, Enterprise and Innovation published⁵¹ the results of a programme of programme evaluations undertaken by Forfás of supports provided by the State Enterprise Agencies across a range of thematic areas including supports for Research, Development and Innovation (RD&I). A number of these RDI evaluation reports which are enterprise-related included assessments of their impacts on companies.

The economic downturn has had a number of impacts on enterprise and RD&I policies in Ireland. Firstly, the reduction in government budgets has increased the pressure to ensure that enterprise development funds are used to achieve their maximum effect, particularly in terms of exports and employment generation. In 2012, the government published the report of the National Research Prioritisation steering group which recommended that competitive public funding for research should be concentrated in 14 key priority areas. The steering group also made a number of recommendations relating to the RD&I system in order that it become more focused on outcomes and impacts.

The Steering Group said that the Government should re-state its policy goals and objectives for the RD&I system and that these should be underpinned by a set of national indicators that reflect these goals and objectives. The Group also said that the Department of Jobs, Enterprise and Innovation should monitor RD&I performance on an annual basis.

Another recommendation was that there should be an on-going review of all funding programmes to ensure continued relevance and clarity of purpose, that programmes have sufficient scale and that unnecessary duplication is avoided. The review should ensure that the costs of the programme are commensurate with the benefits achieved. New programmes should be avoided if the objectives can be achieved through the adaptation of existing programmes.

In response to these systemic recommendations, Forfás published in 2013 a framework of metrics and targets for monitoring public investment in RD&I. The framework included targets at a national level, at a ministry/agency level and at a priority area level. A number of these targets related to company level impacts such as productivity and the proportion of turnover attributed to new-to-market or new-to-company product innovations.

A number of reviews/evaluations have been carried out in the context of the preparation of the new STI strategy; these included a review of research centres, Ireland's membership of international research organisations and future research infrastructure needs. The Department of Jobs, Enterprise and Innovation published these reviews in tandem with the release of the new national STI strategy, Innovation 2020.⁵²

Consultations were organised in 2015 for the new STI strategy: stakeholders were encouraged to respond to a consultation document⁵³ issued by the Inter-Departmental Committee on Science, Technology and Innovation in February 2015 and a public forum was held in July 2015 to debate key issues emerging from the written consultation. The

⁵¹ Department of Jobs, Enterprise and Innovation (2015), *Evaluations of State Supports for Enterprise, Synthesis Report and Conclusions*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Publication-files/Evaluations-of-State-Supports-for-Enterprise-Synthesis-Report-and-Conclusions.pdf>

⁵² See: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

⁵³ Inter-Departmental Committee on Science, Technology and Innovation (2015): *Consultation Paper For Successor to Strategy for Science, Technology and Innovation*, Dublin, Ireland. Available at: http://www.heai.ie/sites/default/files/consultation_paper_for_successor_to_ssti_13_feb_2015.pdf

Department of Jobs, Enterprise and Innovation published the written submissions received under the Innovation 2020 consultation process⁵⁴.

Consultations were also held in 2015 for the Department of Finance's Knowledge Development Box tax incentive proposals.

In 2015, Teagasc, the agriculture and food development authority, is engaged in a Technology Foresight, with the aim of identifying emerging technologies with the highest potential to contribute to the development of the Irish agri-food sector.

2.3 European Semester 2014 and 2015

Part of the European Semester, Ireland's National Reform Programme 2015⁵⁵ was submitted to the European Commission in 2015 in conjunction with the Stability Programme Update. The National Reform Programme 2015 reiterated that Ireland's R&D Headline Target is to raise combined public and private investment levels to 2.5% of GNP (approximately equivalent to 2.0% of GDP).

In May 2015, the European Commission published its country-specific recommendations for Ireland⁵⁶ on how to strengthen and sustain its recovery. The recommendations build on (i) the country reports presented in February; (ii) a thorough assessment of its plans for sound public finances (Stability Programme) and policy measures to boost jobs and growth (National Reform Programmes); and (iii) the outcome of the dialogue with Member States and other key stakeholders.

The four recommendations in the Irish country report focused on reducing the fiscal deficit, increasing the effectiveness of the healthcare system, increasing the work-intensity of households and finalising solutions to mortgages in arrears. These recommendations were also endorsed by the European Council.

The National Reform Programme 2015 notes that that strong growth in BERD has more than offset the declines in HERD and GOVERD with the net result that GERD has grown from €1,637m in 2003 to an estimated €2,877m in 2013 (an increase of 78%).

The National Reform Programme 2015 also comments on the work being undertaken to develop a new STI strategy to replace the previous strategy statement, the Strategy for Science, Technology and Innovation 2006-2013, which it says will place the National Research Prioritisation Strategy and the focus on research relevance and impact within a broader context. The NRP document says the new Strategy will articulate a vision for science, and in doing so incorporate policy around research to support the broader knowledge base and research to support the development of policy in key sectors of relevance to the economy and society (e.g. health, agriculture, marine, energy, environment, communications) and address key challenges.

The NRP outlines the range of supports to encourage business R&D including the R&D tax credit. It also reviews the new industry-facing programmes offered by Science Foundation Ireland including the twelve SFI Research Centres.

The document is relatively silent on some of the challenges facing the STI sector in Ireland such as the weak linkages between industry and HEIs/PROs, the lack of funding for research infrastructures and the challenges posed by a lack of a career structure for researchers.

⁵⁴ See: <https://www.djei.ie/en/Consultations/Consultation-for-Successor-to-Strategy-for-Science-Technology-Innovation.html>

⁵⁵ Department of the Taoiseach (2015): *National Reform Programme 2015*, Dublin, Ireland. Available from: http://www.taoiseach.gov.ie/eng/Work_Of_The_Department/Economic_and_International/Economic/NRP/

⁵⁶ European Commission (2015): *Recommendation for a Council Recommendation on the 2015 National Reform Programme of Ireland and delivering a Council opinion the 2015 Stability Programme of Ireland*, Brussels, 13.5.2015 COM(2015) 258 final. Available from: http://ec.europa.eu/europe2020/pdf/csr2015/csr2015_ireland_en.pdf

2.4 National and Regional R&I Strategies on Smart Specialisation

The National Research Prioritisation Strategy (NRPS) forms the basis for the development and implementation of Ireland's national smart specialisation strategy for research and innovation (RIS3). As noted above, the NRPS involves the prioritisation of competitive 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. The Research Prioritisation Action Group (RPAG) comprises representatives from Government Departments and research funding agencies and does not have any representatives from the private or higher education sectors.

The National Research Prioritisation/Smart Specialisation Strategy has resulted in the development of Action Plans for each of the Priority Areas, which are designed to identify the actions that are required across research funding organisations to re-align the majority of competitive public research funding around the priority area. Additionally, a detailed "Framework of Metrics and Targets for Monitoring Public Investment in Science, Technology and Innovation" has been drawn up to measure the outputs and impact of the funding provided.

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 Regional Operational Programmes for the Southern and Eastern Region and the Border, Midlands and Western Region reference the Smart Specialisation strategy as a justification for the inclusion of Strengthening Research, Technological Development and Innovation as a thematic objective. The Southern & Eastern Regional Operational Programmes notes that the Smart Specialisation Strategy is a dynamic policy process which will continue to be reviewed over the lifetime of the Operational Programme to ensure that it continues to meet the requirements in terms of performance, monitoring, stakeholder involvement and prioritisation.

The main development during 2014-2015 in relation to Smart Specialisation was that the Government ordered an independent assessment of the NRPS which was undertaken by a panel of national and international experts under the chairmanship of an international expert. The panel's report⁵⁷ which was published in December 2015 recommended that research prioritisation should be positioned in a broader, strategic research framework which recognises the need to fund excellent research in other areas, in order to underpin the wider skills agenda, to meet broader societal goals and to further enhance Ireland's reputation for outstanding science. Another Panel recommendation was that a concerted, system-wide initiative was required to engender greater engagement (meaningful, risk-sharing collaborations) between firms (particularly SMEs) and the public research system. The Panel said that the proposed initiative should, based on feedback from firms, actively simplify and streamline processes and remove obstacles to collaboration. The initiative should also disseminate information to enterprise to improve its understanding of the public research system and the raft of opportunities and supports available.

⁵⁷ Department of Jobs, Enterprise and Innovation (2015), *Review of Progress in Implementing Research Prioritisation — Report of the Independent Panel*, Dublin, Ireland. Available from: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

The Panel also stated that further steps were needed to streamline and strengthen the governance structure for research prioritisation/Smart Specialisation; these were announced in the Innovation 2020 strategy document.

The RPAG issued a report⁵⁸ in 2014 on progress in implementing the National Research Prioritisation Strategy. The Department of Jobs, Enterprise and Innovation, working with members of RPAG, prepared an updates on the various NRPS targets, metrics and deliverables at national and agency level set out in the performance framework. A decision was taken not to prepare a document for formal publication in order to prioritise work on Innovation 2020 (the results of the update fed into the new strategy).

2.5 Main policy changes in the last five years

Main Changes in 2011

The new Government publishes its Programme for Government, Government for National Recovery 2011-2016, which makes commitments in relation to STI supports

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

The Government-appointed Advisory Group for Small Business launches its report, The Voice of Small Business, A Plan for Action

Main changes in 2012

Government adopts 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

Launch of Ireland's Horizon 2020 strategy

Main Changes in 2014

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

Commencement of Higher Education System Performance Framework 2014-2016

Main Changes in 2015

Government launches public consultation process for new science, technology and innovation strategy

Publication of new science, technology and innovation strategy, Innovation 2020

Government announces Knowledge Development Box scheme to be operational by January 2016

Publication of the Government's 2025 Enterprise Policy Strategy

⁵⁸ Op.Cit.

3. Public and private funding of R&I and expenditure

3.1 Introduction

Ireland's Gross Expenditure on Research and Development (GERD) increased from €2,756m in 2013 to an estimated €2,871 in 2014, an increase of €115m or 4%.

GERD as a percentage of GDP declined fractionally from 1.54% in 2013 to 1.52% in 2014 (both figures are estimates). There is a concern that in the context of GDP beginning to accelerate unless R&D expenditures grow at a similar rate then Ireland's research intensity ratio may decline further. Ireland's research intensity ratio of 1.52% lies well below the EU-28 average for 2014 at 2.03%.

The amount of R&D funded by the business sector as a percentage of GDP has been increasing and rose from 0.79% in 2012 to 0.85% in 2013, then declined to 0.83 in 2014.

The business sector performed 73% of GERD in 2014, followed by the higher education sector with 22% and the public research sector with 4.5%.

The SSTI strategy consultation document⁵⁹ notes that there has been a steady decline in State R&D funding over the last five years with expenditure in 2013 of €733m, a 3.6% decrease on 2012 levels. It estimates that expenditure will reduce again in 2014 to €724m, a further decrease of 1.9%. Additionally, it states that GBAORD is low by international comparison — as a percentage of GNP, GBAORD has fallen from 0.64% in 2009 to an estimated 0.49% in 2013. Eurostat statistics show that Ireland's GBAORD as a percentage of GDP declined from 0.42% in 2013 to an estimated 0.39% in 2014.

Ireland's Horizon 2020 strategy has set a draw down target of €1.25b for the programme; data released by the Government indicates that Irish organisations have achieved funding of €251m from the Horizon 2020 programme to November 2015.

Table 2: Basic indicators for R&D investments

Indicator	2011	2012	2013	2014	EU average (2015)
GERD (as % of GDP)	1.53	1.56	1.54	1.52	2.03
GERD (Euro per capita)	573.7	596.6	600.4	623.5	558.4
GBAORD (€m)	794.8	760.4	732.6	723.7	92,828 (total for EU-28)
R&D funded by BES (% of GDP)	0.76	0.79	0.83	0.83	1.12 (2013)
R&D funded by PNP (% of GDP)	0.01	0.01	0.01	0.01	0.03 (2013)
R&D funded by HES (% of GDP)	0.01	0.01	0.01	0.01	0.02 (2013)
R&D funded from abroad	0.32	0.33	0.3	0.3	0.2 (2013)
R&D performed by HEIs (% of GERD)	0.39	0.37	0.35	0.34	0.47 (2014)
R&D performed by government sector (% of GERD)	0.08	0.08	0.07	0.07	0.25 (2014)
R&D performed by business sector (% of GERD)	1.09	1.14	1.16	1.14	1.3 (2014)

(Sources: Eurostat and the Department of Jobs, Enterprise and Innovation).

⁵⁹ Op. Cit.

3.2 Smart fiscal consolidation

3.2.1 Macroeconomic context⁶⁰ and public R&D indicators

Ireland has been strongly hit by the economic crisis, losing around 9% of its real GDP during 2008-09. However, in the latter part of 2013 the Irish economy reached a turning point and grew strongly in 2014 (5.2%) and 2015 (6.9%), driven primarily by net exports and domestic demand. Strong growth of about 3.5-4.5% is expected for 2016–2017 driven by the same factors.

Before the crisis Ireland was perceived to have healthy public finances with government budget surpluses and low levels of public debt (Figure 2). The former turned into a huge deficit (more than 30% of the GDP in 2010), the latter has more than quadrupled during the next two years due to the engagement of the Irish government in rescuing the banking sector. With the exiting of the EU-ECB-IMF macroeconomic adjustment programme in 2013 and the successful implementation of the 2011-2014 National Recovery Plan⁶¹ the government managed to bring down the deficit to around 5.7% of GDP by 2013 and to curb the increase in public debt, which started to decrease from its peak of 123% of GDP registered in 2013. The deficit is projected to further decrease to around 0.8-1.3% of GDP in 2016-2017 should the favourable economic outlook stay unchanged and persisting spending pressures linked to demographics and public service payroll remain under control. Gross general government debt is projected to fall to 91.5% of GDP in 2017, due to the liquidation of the Irish Banking Resolution Corporation and the expected strong economic growth.

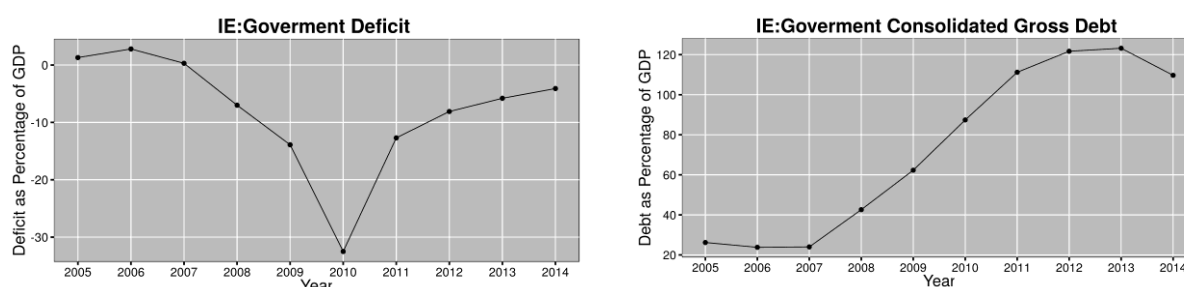


Figure 2: Government deficit and public debt

Data source: Eurostat

Total GERD in Ireland was €2,756m in 2013. There are three main sources of R&D funding: the business sector (€1,478m), the government (€715m), and foreign funding (€531m). Direct funding from the government goes to R&D in the business enterprises (€216m), the government (€121m) and the higher education sector (€473m).

Table 3: Key Irish Public R&D Indicators

	2007	2009	2013
GBAORD, % of gov. exp.	1.26	1.11	1.01
GERD, % of GDP	1.24	1.63	1.58
out of which GERD to public, % of GDP	0.43	0.51	0.42
Funding from GOV to, % of GDP			
Business	0.04	0.04	0.07
Public (GOV+HES)	0.36	0.44	0.34
Total	0.40	0.48	0.41
EU funding, % of GDP	n.a.	n.a.	n.a.

Source: Eurostat

⁶⁰ Sources: DG ECFIN, http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_ireland_en.pdf

⁶¹ <http://www.budget.gov.ie/The%20National%20Recovery%20Plan%202011-2014.pdf>

3.2.2 Direct funding of R&D activities

Figure 3, below shows the historical evolution of GERD financing at current prices in Ireland.

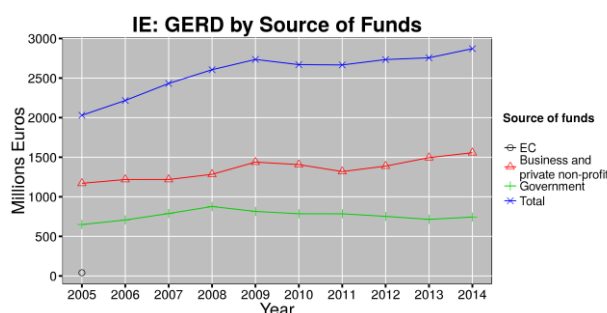


Figure 3: Funding of GERD

Data source: Eurostat

The total GERD increased almost linearly in the period 2005-2009, but, most likely as a long standing consequence of the 2008-2009 crisis, essentially stagnated in the following years. In nominal terms, the levels in 2012 are almost identical to those of 2009. The government funding to GERD increased in the period 2005-2008, but after that experienced negative growth rates every year, stabilising somewhat during 2013-2014. The private sector is the main funder of total Irish GERD. The trend in GERD after 2009 mirrors mainly the trend in private sector funding, which is a growing one, especially during 2012-2014. EC contribution to the total GERD is unfortunately available only for 2005, when it played a completely marginal role.

3.2.2.1 Direct public funding from the government

Direct public funding is usually the main source of the total governmental support to R&D. Figure 4 below shows the time evolution of the total R&D appropriations (GBAORD) and the GERD directly funded by the government.

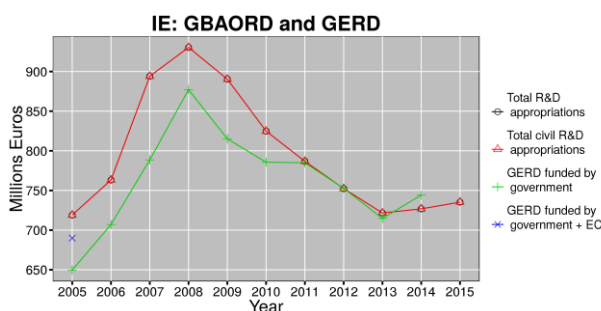


Figure 4: R&D appropriations and government funded GERD in millions of national currency

Data source: Eurostat

After several years of sustained growth, the total appropriations have experienced a declining trend during the crisis and post-crisis period up until 2013, when it seems that the policy trend has changed towards increasing the allocation of public funding to R&D. However, due to the massive decreases, in 2015, current prices they are at almost the same levels as in 2005. Military R&D allocations for Ireland are practically non-existent, as one can infer from the coincidence of the total and total civil appropriations. The trend of the GERD funded by the government is qualitatively identical to that of the appropriations, but we note a significant reduction in the gap between the allocations and the appropriations in 2012 and an overpassing of GBAORD in 2014.

3.2.2.2 Direct public funding from abroad

The data about the external public sources of R&D funding for Ireland is shown (in millions of euros) in Table 4, below:

Table 4: External public sources used for financing total Irish R&D

External source	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total	175.1	286	384.6	406.8	451.703	452.857	545.2	581.6	531.1	553.4
EC	40.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total as % GERD	8.6	12.9	15.8	15.6	16.5	17.0	20.8	21.4	19.3	19.3
EC as % GOVERD	6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA

Due to data sparseness, the only conclusion we can draw is that the funding from abroad has substantially increased its share of the GERD, going from representing less than 9% of the GERD in 2005 to around 19% in 2014.

Distribution of public funding

Figure 5, below shows how the distribution of public funding to sectors of performance evolved over time:

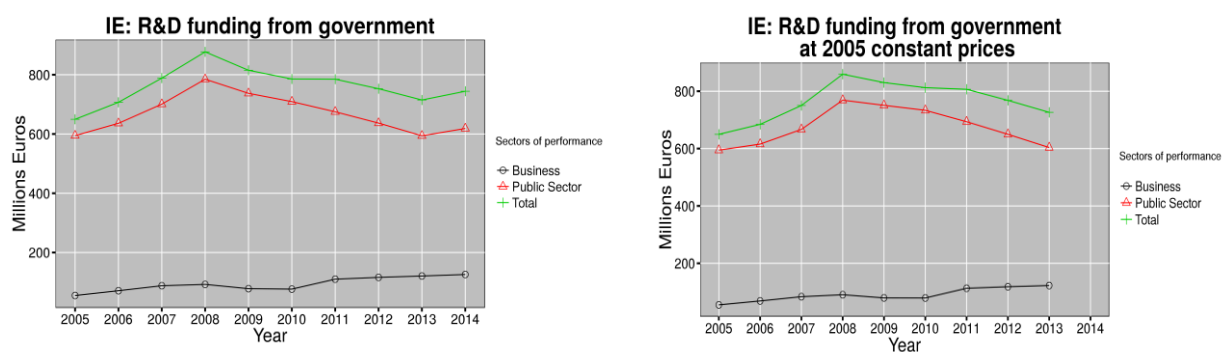


Figure 5: Government intramural expenditure by sectors of performance.

Data source: Eurostat

Not surprisingly, the public sector (GOV + HES) is the main recipient of government funded GERD and it is clearly affected by the cuts after 2008. On the other hand, the funding to the business sector registers a modest growth in 2010-2011. The use of the 2005 constant prices with respect to the nominal values does not substantially alter the observed behaviour of the funding from the government to the business and private sectors, except for the 2014 value of the public sector funding where we see a continuing downward sloping trend in real terms.

3.2.3 Indirect funding – tax incentives and foregone tax revenues

The R&D tax credit scheme in Ireland was introduced in 2004. It is estimated that its annual costs have risen from €71m in 2004 to €421m in 2013, according to the Revenue Commissioners data.

The main features of the regime are:

- Corporation Tax credit of 25% of qualifying R&D expenditure;
- The regime was previously based on incremental spend and provides for expenditure on R&D that was in excess of that company's R&D expenditure in the base year of 2003 to qualify for the credit.
- In line with a Programme for Government commitment, Finance Act 2012 provided that the first €100,000 spend on R&D could qualify for the credit on a full volume

basis and Finance Act 2013 increased this to €200,000. As recommended in the 2013 Review of Ireland's R&D Tax Credit regime, the Budget 2015 removed the base year restriction, effective from 1 January 2015. Since then the credit has applied to all qualifying R&D expenditure.

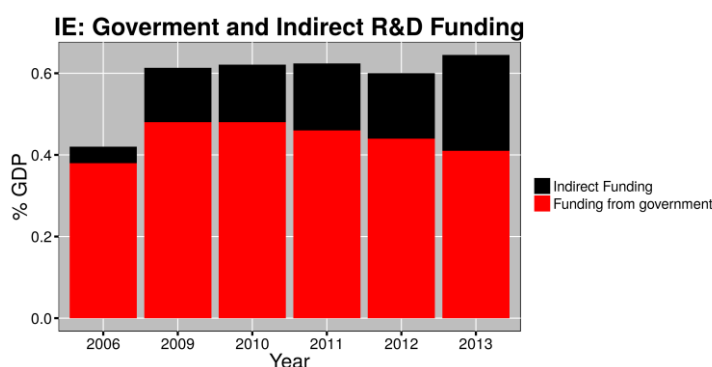


Figure 6: government and indirect funding to R&D.
Data sources: OECD and revenue commissioner's data.

As shown in Figure 6 (OECD data), the indirect funding to R&D has significantly expanded its share of the overall public support to the Irish R&D in the years from 2006 to 2012. The Knowledge Development Box is to be introduced in 2016. Its estimated annual exchequer cost for 2016 is €50m.

The main features of the measure are:

- A corporation tax rate of 6.25% applies where a company's profits are derived from qualifying assets that were the result of qualifying R&D
- In line with the "modified nexus" criteria that was agreed by the OECD, the amount of profits that can avail of the relief is determined by the proportion that the Irish company's R&D costs bear to the total R&D costs incurred to develop the qualifying assets.
- In essence, this means that if a company performs 50% of the R&D that developed an asset in Ireland, then 50% of the income arising to that asset will qualify.

The OECD, in its Economic Review of Ireland 2015⁶², noted that future innovation requires a stronger contribution by Ireland's domestic firms and suggested that government can help strengthen Ireland's sector by rebalancing its innovation policies towards more direct form of supports. For example in 2013, R&D tax credits accounted for 70% of all government supports (R&D investment as a % of GDP).

3.2.4 Fiscal consolidation and R&D

As mentioned in Section 3.2.1, the Irish government started fiscal consolidation during 2011 by the implementation of the National Recovery Plan 2011-2014. Both GBAORD and government financed GERD declined (Figure 3). Figure 7, below shows the scatterplot of the structural balance on the one hand and GBAORD as % GDP (left) as GERD as % GDP (right)⁶³:

⁶² Source: <http://www.oecd.org/ireland/economic-survey-ireland.htm>

⁶³ Structural balance data comes from the AMECO database the other indicators were taken from Eurostat, OECD and the Irish Government websites.

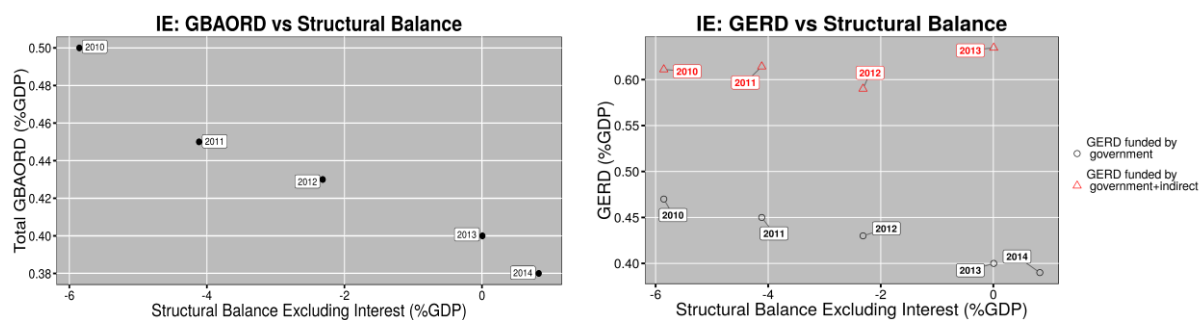


Figure 7: Fiscal consolidation and R&D

Data source: AMECO, Eurostat, OECD, Irish Govt.

Based on Figure 7, during the fiscal consolidation between 2010 and 2014, R&D appropriations declined, with a loss in GBAORD of ca. 0.12% of GDP (i.e. the difference between 2014 and 2010 data). In terms of government financed GERD (Figure 7, right) the losses were somewhat lower between 2010-2012, thanks to the small positive impact of indirect financing through the R&D tax credit, driving down the losses to around 0.08% of GDP. However, the 2013 foregone tax revenues (€421m) have compensated for the decreases in direct finances of the same year and have driven up the total public contribution to 0.62% of GDP, which is the highest since 2010.

Based on the evidence presented in section 3.2.3 and the above discussion, the post-crisis fiscal adjustment process has impacted in reductions in Government research funding for the PRO and Higher Education sectors (although from 2012 onwards there have been small increases in GBOARD). However, the analysis also shows a considerable rise in taxes foregone by the Exchequer due to the increased use by enterprises of the R&D Tax Credit, particularly since 2008. Therefore it is not clear whether the post-crisis fiscal adjustment process has come to at the expense of the total (direct and indirect) public support to Irish R&D.

3.3 Funding flows

3.3.1 Research funders

Public funding for R&I takes a number of forms:

- funding for R&D programmes in the higher education sector administered by the Department of Education and Skills, the Higher Education Authority, Science Foundation Ireland, the Irish Research Council and others;
- funding for business sector R&D, administered via State agencies including IDA Ireland, Enterprise Ireland and others;
- funding for R&D performed in the Government sector e.g. funding administered by Department of Agriculture, Food and the Marine relating to Teagasc, the agriculture and food development authority, and the Marine Institute; and others.

The main government departments (ministries) and public agencies with spending on R&D in 2014⁶⁴ were:

Funding Agencies/Departments (Ministries)	2014 outturn
Higher Education Authority	€204.8m
Science Foundation Ireland	€153.5m
Enterprise Ireland	€100.9m
Teagasc	€60.2m
IDA Ireland	€45.3m
Health Research Board	€41.6m
Irish Research Council	€31.4m
Department of Agriculture, Food and the Marine	€23.0m
Department of Jobs, Enterprise and Innovation	€21.5m
Others	€44.6m
Total	€726.8m

The three major funders (the Higher Education Authority, Science Foundation Ireland and Enterprise Ireland) accounted for 63.2% or €459.2m of total State investment in R&D in 2014.

The Private Not-for-profit sector is a small provider of R&D funding; R&D funding provided by this sector was estimated by Eurostat at €17m in 2014. In the past, philanthropic organisations such as Atlantic Philanthropies played an important role in kick-starting State investment in R&D.

3.3.2 Funding sources and funding flows

Eurostat indicates that there have been significant changes in the provision of research funding within the Irish R&I system. The total amount of funding available for research in 2014 was €2,871m compared to €2,724m in 2012, an increase of €147m.

In 2012, the Business and Abroad categories accounted for 50% and 21% respectively as sources of research funding. However, by 2014 those percentages had changed to 54% and 19% respectively. The Business sector provided €1,372m in research funding in 2012 but this increased to €1,540m in 2014. Funding from Abroad, however, declined slightly over the period: from €575m in 2012 to €553m in 2014.

The Government as a source of research funding declined in real and percentage terms over the period 2012-2014. In 2012, the Government provided €752m in research funding but this declined marginally to €744m in 2014. Its share of overall research funding was estimated at 28% in 2012 but fell to 26% in 2014.

The percentage of funding provided by the Higher Education sector and the Private Non-profit sector was negligible in both 2012 and 2014.

The extent of the importance of international research funding can be gauged by the fact that Irish researchers and enterprises secured funding of €251m from the Horizon 2020 programme to November, 2015⁶⁵. 74% of funding won came from ICT, research grants from the European Research Council (ERC); training grants for researchers (Marie Skłodowska-Curie Actions), Advanced Materials, Advanced Manufacturing and Processing, Biotechnology; Health; Agrifood; and Energy. The Higher Education system accounted for 62.5% (€157m) of funding secured while Irish enterprises achieved over €72m, of which 72% went to SMEs.

⁶⁴ The Science Budget 2014-2015 – Department of Jobs, Enterprise and Innovation.

⁶⁵ Department of Jobs, Enterprise and Innovation press release, 28 July 2015. Available at: <https://www.djei.ie/en/News-And-Events/Department-News/2015/July/28072015a.html>

3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding⁶⁶

Eurostat data⁶⁷ indicate that total GBAORD appropriations in Ireland provisionally amounted to €723.7m in 2014, a decline on the actual 2013 figure of €732.6m. The institutional funding component of GBAORD has declined from €286.7m in 2010 to €243.8m in 2013, a decline of €42.9m. In percentage terms, the institutional funding component has declined marginally from 34% of total GBAORD in 2010 to 33% in 2013.

Total GBAORD project related funding declined from €546.1m in 2010 to €488.8m in 2013, a fall of €57.3m.

The most recent data from the Department of Jobs, Enterprise and Innovation on R&I funding for the higher education sector indicates that there has been a marked reduction in the proportion of indirect (or block) funding for the HEIs and that direct funding has increased significantly in importance. In 2012, indirect funding from the Government accounted for €149m or 23% of R&I funds for HEI research compared to €205m or 42% of all funding sources in 2004. Direct Government funding accounted for €364m or 57% of all sources funding for research in 2012, compared to €293m or 41% of total funding sources in 2004. Total funding for R&D provided to the Higher Education sector amounted to €641m in 2012, an increase of €149m over the 2004 figure of €492m.

EU funds have almost doubled in importance as a source of funding for the Higher Education sector: in 2004, EU funding accounted for 6% of R&D funding sources for HEIs, but by 2012 this had climbed to 11%.

Research funding for HEIs from the Irish and foreign businesses has remained static in both absolute and percentage terms. Ireland at just under 4% of HERD financed by industry is well below the EU28 average of 6.4% and the OECD average of 5.9%.

Table 5: Source of R&D funding for higher education institutions, 2004 and 2012

Source	2004 (€m)	2004 (%)	2012 (€m)	2012 (%)
Direct Government	203	41	364	57
Indirect Government	205	42	149	23
EU Public	30	6	73	11
Irish Business	13	3	13	2
Foreign business	10	2	10	2
Individual	0	0	10	2
Other/own HE funds	31	6	22	3
Total	492	100	641	100

Source: Department of Jobs, Enterprise and Innovation, 2015

⁶⁶ Please use the following definition: "Institutional funding is defined as the total of national budgets in a given country, attributed to an institution, with no direct selection of R&D project or programmes and for which money the organisation has more or less freedom to define the research activities to be performed." Institutional funding can be in the form of non-competitively allocated Block funding. Institutional funding may also be allocated in a variable/competitive manner tied to institutional assessments. "Project funding is defined as the total of national budgets in a given country, attributed to a group or an individual to perform an R&D activity limited in scope, budget and time, normally on the basis of the submission of a project proposal describing the research activities to be done". Steen, J. v. (2012), "Modes of Public Funding of Research and Development: Towards Internationally Comparable Indicators", *OECD Science, Technology and Industry Working Papers*, 2012/04, OECD Publishing. <http://dx.doi.org/10.1787/5k98ssns1qzs-en>. Assessments of the total share of competitive vs non-competitive funding can be a relevant starting point of the analysis, but the aim is to have the competitive funding separated between project funding and competitively allocated institutional funding. Competitive funding of research infrastructures through e.g. a research council can be labelled as project funding. However when infrastructure funding comes in the form of a lump sum budget or earmarked budget then it should be considered as institutional funding.

⁶⁷ Source: *Total GBAORD by Funding Mode*, Eurostat. Available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_fundmod&lang=en

The main sources of direct Government R&D funding for the higher education sector in Ireland are Science Foundation Ireland (which accounted for over a third of direct Government funding), Enterprise Ireland, IDA Ireland and the Irish Research Council.

3.4.2 Institutional funding

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 (there is no separate core funding stream for research); 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 taught masters' students and research students. In addition to weighting research students, 5% of the core allocation is top-sliced and allocated on the basis of the number of PhD degrees awarded (75%) and the share of contract research income by academic staff member (25%) (Forfas, 2013). This element of the model currently applies only in the university sector and not the Institutes of Technology. The research component of the block grant was €189m in 2015.

A new performance-related funding element to the recurrent funding allocation model was introduced by the Higher Education Authority. This performance-related element seeks to benchmark the HEIs against best national and international practice. This element was introduced in 2014 and the HEA proposes that up to 10% of the annual core recurrent grant will be linked to performance by HEIs in delivering on national objectives set for the Higher Education sector. The framework comprises a range of indicators including increased collaboration with the enterprise sector, increase in non-Exchequer research funding and increased citations.

The amount of recurrent funding to the higher education sector that is attributable to research has fallen from €205m in 2004 to €149m in 2012. However, the numbers attending higher education continue to increase and because part of their institutional funding is related to student numbers the HEIs must ensure that they have sufficient staff resources to cover teaching duties which in some cases can act to limit their research activities.

Funding for Public Research Organisations is normally determined on the basis of annual negotiations between the PROs and their parent Government Department (ministry). Teagasc, the agriculture and food development authority, is the largest PRO and in 2014 had research expenditures of €62.8m — which were equivalent to almost two-thirds of GOVERD.

3.4.3 Project funding

The main project 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 (HRB) and the Marine Institute. The important project-based funding programmes provided by these agencies are outlined in Appendix 4.

With the reductions in institutional funding for research, academic researchers have been compelled to seek project funding from both national and international research programmes to finance their research activities.

The criteria used by the national research funding agencies are multi-faceted though important considerations are research excellence and the extent to which the project application aligns with the 14 priority areas identified in the national Research Prioritisation strategy. In respect of the latter, it is estimated that 99% of the research funding allocated by Science Foundation Ireland in 2013 was in the 14 priority areas identified by the national Research Prioritisation strategy, in areas of demonstrable

potential economic impact for Ireland, in areas of significant partnership with major research entities, or to support the development of young researchers.

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

Though SFI continues to assess research funding applications on the basis of scientific excellence, it now also applies equal focus on impact across its funding programmes. It defines impact as the '*demonstrable contribution that excellent research makes to society and the economy*'. SFI now uses international experts in the translation, commercialisation and development of scientific research to evaluate the research impact of funding applications.

A number of state funding agencies use as a criterion for the provision of research funding the extent to which project promoter can leverage additional non-Exchequer funding.

The provision of funding for research centres from agencies such as SFI is now focused on developing with a smaller number of large-scale centres with sufficient critical mass.

A number of the state funding agencies focus on the provision of funding for individuals (the Irish Research Council which provides research funding for researchers at various career stages, from postgraduate study to senior research project-based awards – within and across all disciplines, whilst also funding projects with a societal focus engaging government entities and civic society –) while Enterprise Ireland mostly funds research projects.

IBEC in its submission⁶⁸ to the STI consultation process noted that Government's focus on innovation policy has led to the development of a range of national innovation support programmes targeted specifically at industry. The IBEC submission document states that these included both direct supports (e.g. grants) and indirect supports (e.g. taxation). IBEC points out that there are approximately fourteen State and semi-state agencies offering funding for research activities by companies. It said, however, there has been a lack of clear and consistent information on the wide range of assistance available and a perception that it is difficult to access these supports. IBEC believed the problem is particularly acute for entrepreneurs starting a new business.

It should be noted that the OECD in its 2013 economic review of Ireland⁶⁹ highlighted the large number of R&I support schemes and suggested they should be rationalised.

3.4.4 Other allocation mechanisms

Little centralised data exists on other R&I funding mechanisms that are not classified as project or institutional funding.

⁶⁸ Irish Business and Employers Confederation (IBEC) (2015), *IBEC submission on the consultation paper for a successor to Strategy for Science, Technology and Innovation 2006-2013*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Consultations/Consultations-files/IBEC.pdf>

⁶⁹ Organisation for Economic Co-operation and Development (2013), *OECD Economic Surveys: Ireland 2013*, Paris, France. Available from: http://www.oecd.org/eco/surveys/2013%20Economic%20Survey%20IRELAND_Overview_Eng_FINAL%2030%20Aug.pdf

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

A wide range of direct support measures is available to incentivise/support research and innovation within the private sector. The main public agencies responsible for providing these support measures are Enterprise Ireland (responsible for the development of indigenous manufacturing and internationally traded service enterprises) and IDA Ireland (responsible for attracting foreign direct investment). Both organisations mainly focus their support measures on close to market innovation.

In addition to providing supports to individual enterprises, both Enterprise Ireland and IDA Ireland also support the development of research centres involving networks of companies and higher education institutions. A key feature of these supports is that the research centres pursue an industry-led research agenda.

Both Enterprise Ireland and IDA Ireland also support enterprises to develop their management development skills, such as new product development and research and innovation skills.

Enterprise Ireland also provides funding for academic researchers to explore the commercialisation of their research.

The STI strategy consultation paper issued by the Department of Jobs, Enterprise and Innovation in February 2015 noted that in 2013 Enterprise Ireland provided R&I funding of €100.4m while IDA Ireland provided €58.2m in R&I funding. Other public agencies also provided funding for the private sector but this support is not disaggregated from funding for research undertaken by the agency themselves or from what they provide to other categories of research performers e.g. the higher education institutions.

Before its abolition and the subsuming of its staff and functions into the Department of Jobs, Enterprise and Innovation, the former policy advisory board for Enterprise, Trade, Science and Innovation, Forfás, published evaluations⁷⁰ it had carried out of R&I support schemes which were largely adjudged to have been effective. The Department of Jobs, Enterprise and Innovation published a report⁷¹ in 2015 that synthesised all of the evaluations undertaken by Forfás of all enterprise supports which indicated that supports provided to companies by the agencies were sanctioned on a case-by-case basis with the specific suite of supports tailored to their different stages of scale and development. These evaluations have been informed by the Framework for the Evaluation of Enterprise Supports developed by Forfás in 2011⁷² and assess the support measures in terms of appropriateness, efficiency and effectiveness within a Programme Logic Model. The evaluations generally focus on both quantitative and qualitative outcomes — cost benefit analysis is undertaken where data permits.

Although the support measures provided by the public agencies are generally appropriate for the needs of the private sector though there have been calls for a stronger focus on supports for innovation within service sector enterprises. Industry representative bodies have also advocated for greater flexibility with some support measures; as an example, they recommend that the amount of funding provided under the Innovation Voucher scheme should be increased to address a perceived gap in support measures to encourage research collaboration between industry and higher education institutions/public research organisations.

⁷⁰ Department of Jobs, Enterprise and Innovation (2014): *Evaluation of Enterprise Supports for Research, Development and Innovation*, Dublin, Ireland. Available from: <https://djei.ie/en/Publications/Publication-files/Forfás/Evaluation-of-Enterprise-Supports-for-Research-Development-and-Innovation.pdf>

⁷¹ Department of Jobs, Enterprise and Innovation (2015): *Evaluations of State Supports for Enterprise — Synthesis Report and Conclusions*, Dublin, Ireland. Available from: <https://djei.ie/en/Publications/Publication-files/Evaluations-of-State-Supports-for-Enterprise-Synthesis-Report-and-Conclusions.pdf>

⁷² Forfás (2011), *Framework for the Evaluation of Enterprise Supports*, Dublin, Ireland.

Public procurement as a lever to stimulate innovation within the private sector has largely been under-utilised and while there have been a number of pilot projects in different sectors e.g. energy, few have been mainstreamed. A pilot scheme, the Small Business Innovation Research (SBIR) programme, has been introduced to provide opportunities for innovative solutions to be developed to meet the needs of public bodies (see the section below "Public procurement of innovative solutions"). The Sustainable Energy Authority of Ireland has launched two energy-related calls under the SBIR programme.

3.5.2 Public Procurement of Innovative solutions

The Irish Government procurement spending amounted to €12b in 2013 for the public procurement of goods, services and works⁷³, slightly less than 7% of Irish GDP.

Legal Public Procurement framework

EU public procurement Directive 2004/18/EC has been transposed into Irish legislation by the Public Sector Procurement Regulations, made by the Minister for Finance under SI 329 of 2006⁷⁴. The Regulations made by the Minister for Finance under SI 50 of 2007 implemented the EU public Procurement Directive 2004/17/EC⁷⁵.

The Office of Government Procurement published a set of Guidance on various aspects of public procurement, including guidelines on national and EU public procurement procedures, called "*General Procurement Guidance*". Four provisions are worth mentioning:

1. *Buying Innovation: The 10 Step Guide to SMART Procurement and SME Access to Public Contracts (2009)*⁷⁶. The 10 Step Guide is designed to stimulate innovative business activity in Ireland, while improving the delivery and efficiencies of public sector goods and services. It also identifies a number of actions to be taken to break down barriers and facilitate improved access for SMEs to public contracts.
2. *Circular 10/14: Initiatives to assist SMEs in Public Procurement*⁷⁷. Section 4.7 of the circular specifically addresses innovation and public procurement.
3. *Green Tenders – An Action Plan on Green Public Procurement (2012)*⁷⁸
4. *Progress Report of High Level Group on SME Access to Public Procurement for 2015*⁷⁹.

The integration of Green Public Procurement (GPP) principles aim at boosting the "image of Ireland as an innovative, eco-efficient, open and forward-looking place to do business". Moreover, GPP is also seen as a driver for innovation.

The Office of Government Procurement launched in autumn 2014 a public consultation in view of the transposition of the 2014/24 EU Directive on Public Procurement into the Irish national legislation⁸⁰.

⁷³ <http://www.procurement.ie/sites/default/files/ogp-public-service-spend-tendering-analysis-2013-1.pdf>

⁷⁴ <http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/Public%20Sector%20Procurement%20Regulations%202006.pdf>

⁷⁵ [http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/EC%20\(Public%20Utilities%20Contracts\)%20Regulations%202007.d](http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/EC%20(Public%20Utilities%20Contracts)%20Regulations%202007.d)

⁷⁶ <http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/25.%20Buying%20Innovation%2010%20Step%20Guide.pdf>

⁷⁷ http://www.procurement.ie/sites/default/files/circular_10-14_0.pdf

⁷⁸ <http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/27.%20Green%20Tenders%20-%20An%20Action%20Plan%20on%20Green%20Public%20Procurement.pdf>

⁷⁹ http://www.procurement.ie/sites/default/files/progress_report.pdf

⁸⁰ <http://www.procurement.ie/ga/nuacht/2095>

The PCP/PPI landscape in Ireland

The potential of Pre-Commercial Procurement and Procurement of Innovation (PPI) has been identified in the strategic document of the then Department of Enterprise, Trade and Development (DETE) *"Innovation in Ireland"* (2008)⁸¹, which states (page 15): *"Selling to the public sector is an opportunity for firms, especially SMEs, to demonstrate their capabilities, establish their credibility, and prove the viability of new products or services. In this way, innovation in public procurement can stimulate long-term export success by showcasing emerging and innovative products and services and providing authoritative reference clients for Irish companies. Pre-commercial procurement – where the risks are shared between public procurers and firms – can be used to promote innovation while respecting State Aid rules"*.

The Department of Enterprise, Trade & Employment also established in 2008 the Procurement Innovation Group which comprised representatives of industry, academia, government departments and State agencies. The Group's objectives are to:

1. Raise awareness of the benefits of using public procurement to stimulate research and innovation;
2. Identify obstacles or problems in the current procurement process which impede opportunities for innovation;
3. Examine the potential of the Public Procurement Directives to ensure a level playing field for all innovative companies wishing to participate in public tendering;
4. Create an environment in which the potential of innovation for public procurement can be realised;
5. Make recommendations on how objectives may be achieved.

The Focus Group published in July 2009 its report titled *"Using public procurement to stimulate innovation and SMEs access to public contracts"*⁸², in which 13 key Recommendations were outlined.

The Focus Group also published the above mentioned guide "Buying Innovation – The 10 Step Guide to SMART Procurement and SME Access to Public Contracts".

The first two Recommendations of the Focus Group report (page 12) were aimed at reaching the two objectives "...of an R&D driven innovative, green and competitive economy on the one hand and first class public services for its citizens on the other. To realise this opportunity requires both high-level political commitment and detailed changes of practice within the procurement community and those who work with them". The two Recommendations are:

Recommendation 1: Each public sector organisation, with a substantial procurement budget to:

- 1.1 Adopt a Procurement of Innovation policy;
- 1.2 Embed the "Buying Innovation – 10 Step Guide" into procurement procedures.

Recommendation 2: Clearly identify on tenders that an innovative solution is being sought which will facilitate:

- 2.1 Tracking the percent of the total budget spent on innovation;
- 2.2 SMEs proposing the solution.

The "Action Plan for Jobs 2012"⁸³ mentions (page 59) the need to develop a "Procuring Innovation Initiative", with the objective to "increase the purchasing of innovative

⁸¹ <http://www.djei.ie/publications/science/innovationpolicystatement.pdf>

⁸² <http://etenders.gov.ie/Media/Default/SiteContent/LegislationGuides/Report%20of%20the%20Procurement%20Innovation%20Group.pdf>

⁸³ <http://www.djei.ie/publications/2012APJ.pdf>

solutions from SMEs by encouraging a more flexible approach to tendering that focuses on procuring solutions to specific needs, rather than specific products or services".

The Guidance (April 2014) from the Office of Government Procurement (OGP) sets out positive measures that buyers should take to promote SME involvement in public sector procurement, including a specific provision that contracting authorities should consider new and innovative solutions, where possible and appropriate.

The Science Foundation of Ireland strategy "Agenda 2020"⁸⁴ (July 2012) mentions (Action D1.2.7 at page 26) the need to: "Foster integration of R&D and innovative products into public procurement, services and policy".

The strategic document "*Innovation 2020*"⁸⁵ set-out the country's five year strategy on research and development, science and technology. The commitment titled "*We will promote innovation in the public sector...*" (page 45) mentions public procurement as a way "to stimulate the take-up of new technologies". The strategy indicates also that in the coming years the potential of extending the SBIR initiative to the healthcare sector will be explored. The SBIR initiative is also mentioned as one of the Innovation 2020's Key actions for Innovation in the Public Sector.

The SBIR initiative

The first concrete initiative in public procurement of innovation in Ireland was launched by Enterprise Ireland in collaboration with Sustainable Energy Authority of Ireland (SEAI) and ESB eCars in July 2014, with the first SBIR competition to develop a smart technology solution for charging electric vehicles in shared access parking areas⁸⁶. This competition is being run in two phases, Phase 1 concluded in October 2015, Phase 2 which will run in early 2016.

A second SBIR project was released in October 2015 by the SEAI in the area of SMART Technology Solution for Home Owner Utilisation and will progress into 2016 via Phase 1 of the process.

A particular focus of the competition was to help consumers to access and interpret Building Energy Ratings (BER), an indication of the energy performance of a building. The objective underpinning the competition was to make the BER a more significant factor in property purchase/rental decisions and also to better inform home upgrade opportunities.

3.5.3 Indirect financial support for private R&I

Indirect R&I supports to the private sector have become significantly more important in the past decade. The main form of indirect support is the R&D tax credit which is available at 25% of qualifying R&D expenditures. Prior to 2015, the tax credit was available on incremental qualifying expenditures over the amount spent on R&D activities in the base year (2003).

A review⁸⁷ of the R&D tax credit by the Department of Finance in 2013 stated that it played a vital role in supporting thousands of jobs and almost €2b of research activity. As recommended in the review, Budget 2015 removed the base year restriction, effective from 1 January 2015.

Stakeholders such as IRDG have called on the Government to make the R&D Tax Credit limits on outsourcing to higher education institutions less restrictive. They state that making this change would complement other Government support measures to foster

⁸⁴ <http://www.sfi.ie/assets/files/downloads/News%20and%20Events/AGENDA%202020.pdf>

⁸⁵ <https://www.djei.ie/en/Publications/Publication-files/Innovation-2020.pdf>

⁸⁶ http://www.procurement.ie/sites/default/files/progress_report.pdf

⁸⁷ 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>

industry-higher education research collaboration. The Department of Jobs, Enterprise and Innovation states, however, that the outsourcing limit was increased in 2015.

More than 1,500 companies availed of the R&D tax credit in 2013, significantly up from just 75 in 2004. Over that same period, the cost to the Exchequer — in credits and foregone taxes — has risen from just over €70m in 2004 to €421m in 2013. It can be used for a range of expenses linked to technology or science.

In 2015, the Government launched its new Knowledge Development Box (KDB) tax incentive. The new KDB scheme — which was first announced in Budget 2015 — is designed to stimulate investment in RD&I by foreign owned and indigenous enterprises. The measure open to all Irish corporate taxpayers and is designed to encourage companies to develop intellectual property in Ireland⁸⁸. The Government announced that the new scheme will be operational in 2016

The KDB complies with the OECD's 'modified nexus' standard and will involve the application of a tax rate of 6.25% to trading profits arising to certain Intellectual Property Assets which are the result of qualifying R&D activity carried out in Ireland. In accordance with the OECD guidelines, the amount of profits that a company can avail of the relief will be determined by the proportion that its Irish R&D costs account of the total R&D costs incurred to develop the qualifying assets e.g. if Irish company performs 50% of the R&D that developed the asset in Ireland, then 50% of the income arising to that asset will qualify.

The scheme seeks to encourage companies to develop IP in Ireland that have a high 'value add' for the Irish economy⁸⁹.

3.6 Business R&D

3.6.1 The development in business R&D intensity

The Irish BERD intensity (see Figure 8) has been quite stable in the period 2009-2014 and it was 1.14% of the GDP in 2014. Services and manufacturing account for more than 95% of the BERD expenditure. The intensity of the expenditure in the services, the leading macro-sector of the Irish BERD, has been almost constant since 2009, whereas the BERD intensity in manufacturing, after a minor dip in 2011, registered a new increase in 2013. The business sector is the main funder of the Irish BERD (Figure 9), but the gap between the total BERD intensity and the business sector (BES) contribution has been increasing over time. This is a consequence of both the stagnation of the business contribution (whose intensity in 2014 is practically identical to 2009-2010) and the rising contributions from the government and from abroad, whose trend seems to have partially compensated the decline of the BES contribution

As stated in previous sections, one peculiarity of the Irish business R&D landscape relies in the predominance of foreign owned enterprises, which "accounted for 65% of all R&D expenditure, with just over €1.2b being spent on current expenditure which represented 93% of all expenditure of foreign owned enterprises. The remaining 7% or €90m was spent on capital expenditure. Irish owned enterprises in comparison spent just over €700m on R&D with current expenditure at €645m accounting for nearly 92% of this expenditure. The remaining 8% or €58m was spent on capital expenditure"⁹⁰. There is a polarisation between Irish and foreign owned enterprises also in terms of number of R&D active companies, size, and level of expenditure: "there were 1,574 Irish owned enterprises engaged in R&D activities in 2013 which equates to 80% of all R&D active enterprises compared to 405 foreign owned enterprises which accounts for the 20% of all R&D active enterprises. Over 80% of all Irish owned enterprises spent less than

⁸⁸ Michael Noonan, Minister, Department of Finance, 25/11/2015: <https://www.kildarestreet.com/debate/?id=2015-11-25a.160>

⁸⁹ Richard Bruton, Minister, Department of Jobs, Enterprise and Innovation: <https://www.kildarestreet.com/wrns/?id=2015-11-26a.267>

⁹⁰ Central Statistics Office of Ireland: "Business Expenditure On Research And Development 2013-2014": <http://www.cso.ie/en/releasesandpublications/er/berd/businessexpenditureonresearchdevelopment2013-2014/>

€500,000 on research and development compared to 45% of all foreign owned enterprises". The largest 100 enterprises in terms of R&D spend accounted for over €1.4bn, or 70%, of the total R&D expenditure in 2013. Of these top 100 enterprises, 80% of the spend can be attributed to foreign owned enterprises"⁹¹.

Even more striking in this regard is the analysis of the data included in the EU Industrial R&D Scoreboard⁹²: 21 Irish-registered companies appear in the 2013 ranking of top-1000 EU R&D investors. The Irish BERD was €2,021.9m in 2013, whereas the sum of the total R&D spent by top R&D performers registered in Ireland was €3,742m, a figure 85% higher. This shows that a lot of R&D intense companies headquartered in Ireland do not actually perform their R&D activities in the country.

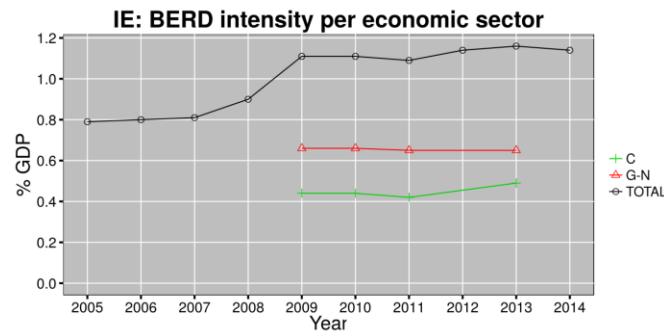


Figure 8: BERD intensity broken down by most important macro sectors (C= manufacture, G_N=services).

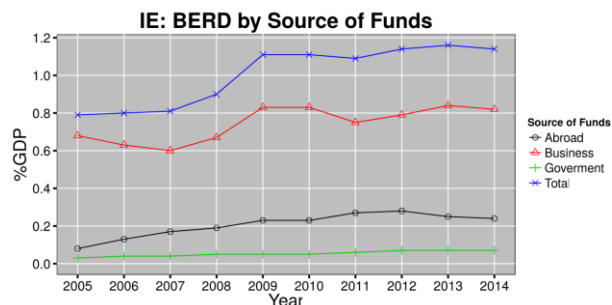


Figure 9: BERD by source of funds

3.6.2 The development in business R&D intensity by sector

The computer, electronic and optical products and pharmaceutical manufacturing industries are the top R&D performing sectors in Ireland (see Figure 10). Unfortunately, data are available only for the years 2009-2011 and 2013. The R&D expenditure of the pharmaceutical sector decreased substantially between 2009 and 2011, then grew again in 2013, although being well below the 2009 levels. The computer, electronic and optical products, on the other hand, was quite stable for the three-year period 2009-2011 around the €150m value, then dropped to nearly €100m in 2013.

⁹¹ Ibid.

⁹² <http://iri.jrc.ec.europa.eu/scoreboard14.html>

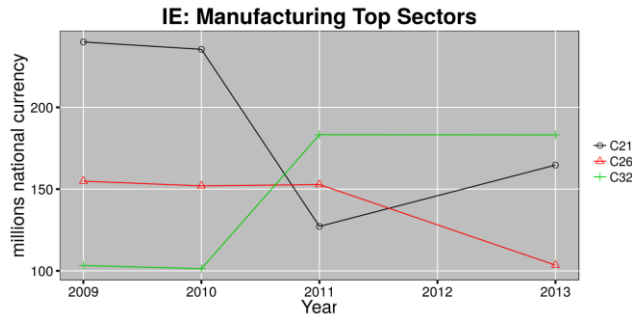


Figure 10: top sectors in manufacturing

(C26=manufacture of computer, electronic and optical products; C21=Manufacture of basic pharmaceutical products and pharmaceutical preparations; C32=other manufacturing).

The ICT, wholesale and retail trade and technical and scientific activities are the top service sectors (see Figure 11). The R&D expenditure in the professional, technical and scientific activities is essentially flat in the period 2009-2013, whereas in the same time window we observe a significant increase of the expenditure in the ICT sector. The business expenditure for research related to the wholesale and retail trade decreased significantly in the years 2011-2013.

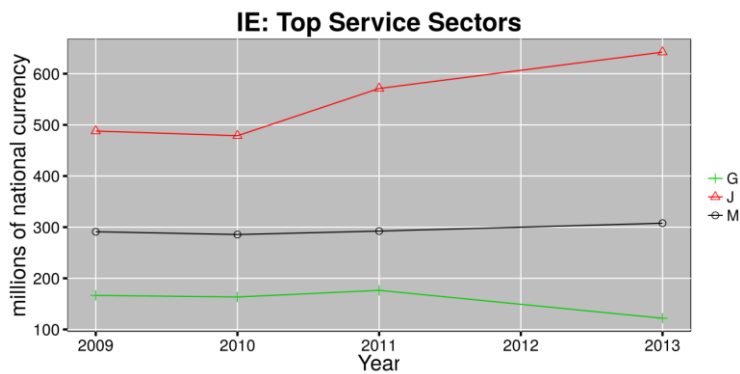


Figure 11: top service sectors

(J=information and communication, G=wholesale and retail trade; repair of motor vehicles and motorcycles, M=professional, scientific and technical activities).

3.6.3 The development in business R&D intensity and value added

In terms of gross value added (GVA), manufacturing appears as the leading sector with a fairly relevant contribution to the Irish GVA, thanks mainly to the manufacture of pharmaceuticals as well as food and beverage products (Figure 13 and 14), which in recent years has been comparable in value to the one of wholesale and retail trade (leading sector in services).

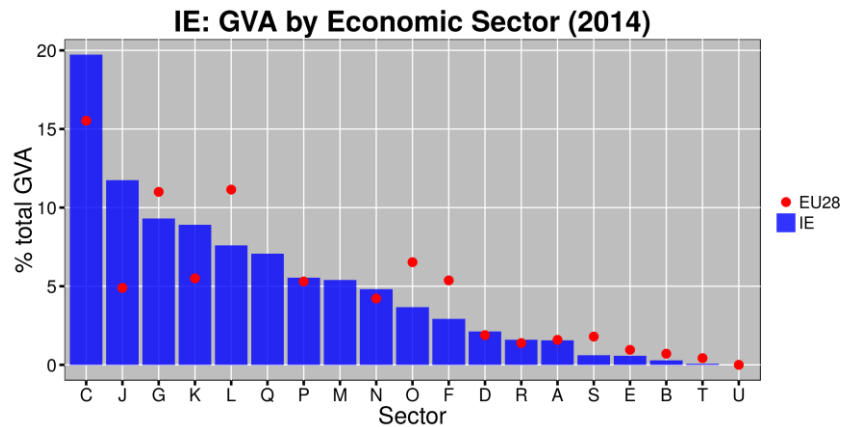


Figure 12: economic sectors as percentage of the total GVA.

Top 6 sectors in decreasing order: 1) Manufacturing; 2) Information and communication; 3) Wholesale and retail trade; repair of motor vehicles and motorcycles; 4) Financial and insurance activities; 5) Real estate activities; 6) Human health and social work activities

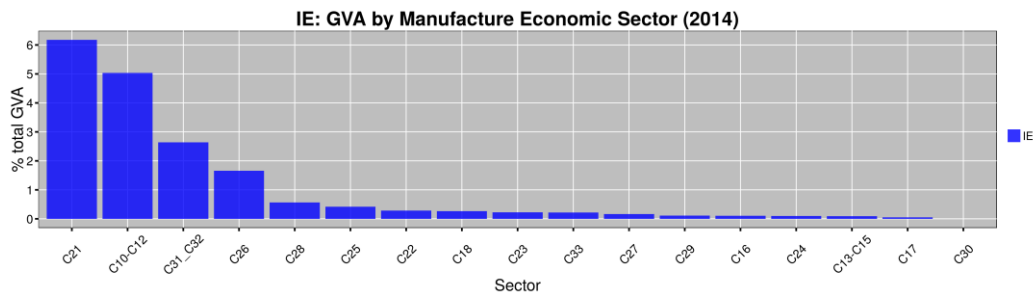


Figure 13: GVA in manufacturing.

Top 6 manufacturing sectors: 1) Manufacture of basic pharmaceutical products and pharmaceutical preparations; 2) Manufacture of food products; beverages and tobacco products; 3) Manufacture of furniture; other manufacturing; 4) Manufacture of computer, electronic and optical products; 5) Manufacture of machinery and equipment n.e.c.; 6) Manufacture of fabricated metal products, except machinery and equipment

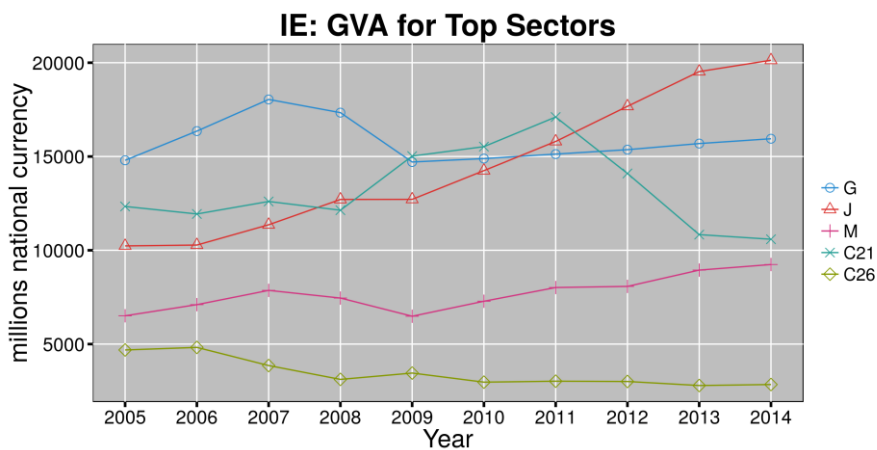


Figure 14: Gross Value Added (GVA) for top sectors

(C26=manufacture of computer, electronic and optical products; C21=Manufacture of basic pharmaceutical products and pharmaceutical preparations; J=information and communication, G=wholesale and retail trade; repair of motor vehicles and motorcycles, M=professional, scientific and technical activities).

The available data show quite different trends from 2007 for the manufacture of pharmaceutical products and the services in the wholesale and retail trade sector. The pharmaceutical sector increased until 2011 and suffered significant drops afterwards, while the services in the automotive sector declined during the crisis and is on a slow but stable increasing path. The manufacture of computers and electronic/optical products is still important in terms of GVA, but to a lesser extent than either of the aforementioned sectors.

3.7 Assessment

During the period 2012-2014, GERD increased from €2,734m to €2,871m. The business sector accounted for 54% of GERD funding in 2014, up from 52% in 2012. The Government as a source of research funding declined in real and percentage terms during 2012-2014.

The economic crisis and the constraints on Exchequer finances have severely impacted on the publicly-funded research system. Institutional funding available to the public research organisations and the higher education institutions has declined.

GBAORD is showing slow signs of recovery following the economic crisis in 2008-2009. According to the Science Budget 2014-2015, GBAORD was €722m in 2013 (having peaked at €930m in 2008) and is estimated to increase to €735m in 2015. However, GBAORD as a percentage of GNP decreased from 0.47% in 2013 to an estimated 0.43% in 2015.

The reduced institutional allocation for research has compelled HEI-based researchers to apply for project-based funding from the state agencies and from international programmes such as Horizon2020.

The allocation of public project-based R&I funding for academic researchers is based on a number of criteria including research excellence and the extent to which the research is aligned with the 14 priority areas identified in the National Research Prioritisation Strategy. The capacity of the project promoters to lever additional non-Exchequer funding is also an important criterion.

A document submitted by Trinity College Dublin (TCD)⁹³ to the Department of Jobs, Enterprise and Innovation in 2015 as part of the consultation process for the new STI strategy indicates that the decline in HEI funding is beginning to have a detrimental impact on academic outputs. The TCD data shows that for the first time in a decade, in 2011-2012 the increase in the number of documents published by Irish researchers stalled. A subsequent increase in 2012-2013 was proportionately lower than in previous years and has been followed by a sharp decrease in 2013-2014. The TCD submission document also notes that PhD enrolments have been falling since they peaked in 2012.

The business sector is the main performer of RDI in Ireland and accounted for 73% of GERD performed in 2014. Multinational firms are the main performers of RDI — they account for 65% of all R&D expenditures. However, there has been significant increase in the number of indigenous enterprises undertaking research and innovation.

The significant take-up by the enterprise sector of the R&D tax credit means that indirect public supports for R&I activities are now in financial terms larger than the direct measures to support in-company R&D provided by the State enterprise development agencies; the OECD calculated that in 2013, R&D tax credits accounted for 70% of all government supports (R&D investment as a % of GDP). The dominance of indirect R&I supports will increase when the Government's new Knowledge Development Box scheme becomes operational in 2016.

⁹³ <https://www.djei.ie/en/Consultations/Consultations-files/Trinity-College-Dublin.pdf>

A review undertaken by the Department of Finance of the R&D tax credit indicated that it had contributed to supporting almost 70% of €1.86bn of research activity in the enterprise sector.

The OECD in its most recent policy brief for Ireland noted that despite the economic recovery that productivity growth overall is quite modest with Irish multinationals thriving through the crisis and that it is the domestic SME sector that is lagging behind with much lower levels of competitiveness, productivity and R&D spend; the challenge being to make Irish-owned firms more dynamic and innovative. Another OECD report focusing on STI policy suggested there is a trend for countries to move towards more targeted policy mixes — targeted at specific types of firms, especially SMEs or new technology-based firms. Given the prominence of the R&D tax credit in Government supports to the business sector, there is scope for strengthening the indigenous sector by rebalancing innovation policies towards more direct forms of support which would also include support for collaboration or partnering with public research performers.

Recent policy pronouncements have emphasised the importance of public procurement as a driver of innovation and these has been matched by the funding of a pilot scheme, the Small Business Innovation Research programme. It remains to be seen if the SBIR and similar initiatives will be mainstreamed.

4. Quality of science base and priorities of the European Research Area

4.1 Quality of the science base

Table 6: Output indicators

Indicator	Year	EU average
Number of publications per thousand of population	1.26 (2013)	0.52 (2013)
Share of international co-publications	53.2% (2013)	36.4% (2013)
Number of international publications per thousand of population	2.37 (2013)	1.43 (2013)
Percentage of publications in the top 10% most cited publications	15.05 (2010)	12.25 (2010)
Share of public-private co-publications	34.4 (2014)	52.8 (2014)

Source: European Commission

International data on research outputs indicate that Ireland scores higher than the EU average in a number of indicators. Ireland was given a score of 1.26 in terms of the number of publications per thousands of population in 2013 compared to the EU average of 0.52.

Ireland's share of international co-publications was estimated at 53.2% in 2013, again considerably above the EU average of 36.4%. In terms of the number of international publications per thousand of population, the Irish score for 2013 was 2.37 as against the EU average of 1.43.

Ireland obtained a score of 15.05 in 2010 in relation to the percentage of publications in the 10% most cited publications, which exceeded the EU average of 12.25.

However, Ireland's share of public-private co-publications was estimated at 34.4% in 2014 which is well below the EU average of 52.8%.

Professor Mark Ferguson, head of Science Foundation Ireland and the Chief Scientific Adviser to the Government, states that Ireland has climbed four places to 16th on the international Scientific Excellence Index which measures citations in scientific journals.⁹⁴

The STI strategy consultation paper notes that as a result of the increase in R&I expenditure over the past two decades, Ireland has since 2009 been listed among the top 20 countries in global rankings for the quality of its scientific research. It quotes Thomson Reuters Essential Science Indicators which ranks Ireland:

- 1st in immunology;
- 1st in animal and dairy;
- 3rd in nanotechnology;
- 4th in computer science.

⁹⁴ <http://www.irishtimes.com/sponsored/climbing-the-international-innovation-rankings-1.2366650>

The representative body for the seven universities, the Irish University Association, in its submission⁹⁵ to the Innovation 2020 consultation phase quoted the Thomson Reuters InCites 2 bibliometric database as indicating that the Irish higher education institutions were (cumulatively) in the top 1% in the world in 19 of the 22 Essential Science Indicator fields.

As noted earlier in Section 3.7, Trinity College Dublin (TCD) in its submission to the Department of Jobs, Enterprise and Innovation in 2015 on the successor strategy to the Strategy for Science, Technology and Innovation drew attention to a decline in the number of documents published by Irish researchers. The TCD submission document notes that the number of documents published by Irish researchers as measured by Thomson Reuter's ISI Web of Knowledge showed, after a number of years of continuous growth, a steep decline in 2013-2014. It also points out that based on an analysis of data provided by Thomson Reuters, for the first time in over a decade, Ireland's percentage of world papers fell sharply between 2011 and 2012 and is still declining, and in the same period, Ireland's overall impact relative to the world declined.

The TCD submission document also highlights that Irish university PhD enrolments fell from 8,040 in 2012 to 7,147 in 2014, a decline of 893 or 11 per cent.

The QS World University Rankings 2015-2016⁹⁶ publication has given lower positions to the two top ranking Irish higher education institutions, Trinity College Dublin (drops from 71st to 78th place) and University College Dublin (drops from 139th to 154th place). There were small gains in rankings for other HEIs such as NUI Galway and Dublin City University. The 2015-2016 edition of the Times Higher Education World University Rankings publication⁹⁷ also shows that Trinity College fell from 138th place in the world to 160th. There was better news for the second ranked Irish HEI, University College Dublin, whose ranking increased in 2015-2016 to 176th place, up 50 places. In the 2009-2010 rankings both Trinity College Dublin and University College Dublin had been in the top 100 places.

The National Reform Programme 2015 states that in relation to R&I systems integration the implementation of National Research Prioritisation Strategy has resulted in enhanced co-ordination and co-operation between the state agencies and government departments funding research. Additionally, the development and implementation of the Prioritisation Action Plans has driven practical co-operation at the operational level as the majority of the actions in the Plans require several funders to co-operate in their implementation.

4.2 Optimal transnational co-operation and competition

4.2.1 Joint programming, research agendas and calls

The National Reform Programme 2015 pointed out 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.

Ireland's Horizon 2020 strategy views the Programme as an opportunity for Ireland to deepen its engagement in collaborative European and international research. The Government has stated that Ireland will target up to €1.25b in research and technology funding under the new programme.

⁹⁵ Irish Universities Association (2015), *Strategy for Research and Innovation (SSTI II): IUA Response to Consultation*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Consultations/Consultations-files/Irish-Universities-Association.pdf>

⁹⁶ QS Quacquarelli Symonds Limited 1994 – 2015 (2015): *QS World University Rankings 2015-2016*. Available at: <http://www.topuniversities.com>

⁹⁷ <https://www.timeshighereducation.com>

Science Foundation Ireland is seeking to enable Ireland's researchers to compete effectively for EU funding through Horizon 2020. SFI programmes also seek to incentivise Irish researchers to apply for European Research Council (ERC) Funding while HEIs and other research funders actively support researcher participation.

Ireland is an active participant in Joint Programming Initiatives (JPIs) and the ESFRI processes. Ireland is participating in seven of the ten JPIs. According to the ERA-LEARN 2020 database⁹⁸, Ireland participated in 56 of the ERANETs, of which 8 are still active, 7 of the ERA-NET Plus, of which 4 are still active and 10 ERA-NET Cofunds under Horizon 2020, all of which are still active.

European Innovation Partnerships (EIPs) are a new approach to EU research and innovation. Irish research organisations are members of EIPs: as an example, the Environmental Protection Agency is a member of EIP Water and EIP Raw Materials.

In 2015, SFI entered into an agreement with Biotechnology and Biological Sciences Research Council (BBSRC), one of the seven UK Research Councils, to support research applications that cut across national boundaries involving collaborative teams led by researchers from Ireland and the UK. The new partnership is intended to support collaborative research and technology development in all areas of the BBSRC remit such as bioscience for health, agriculture, food security, industrial biotechnology and bioenergy. BBSRC's budget for 2014-2015 is approximately £509m (€695m) and supports around 1,600 scientists and 2,000 research students in universities and institutes across the UK.

The Department of Jobs, Enterprise and Innovation commissioned a review of Ireland's membership, or possible membership, of 14 International Research Organisations (IROs) and the report⁹⁹ was published in December 2015 with the launch of Innovation 2020.

The report considered the overall benefits to Ireland of existing and potential IRO memberships and derived a ranking following application of a weighted cost-benefit factor. A suite of options were presented and the report recommended that Ireland retain membership of ESA, COST, EUREKA, EMBC; initiate membership of ELIXIR and LOFAR; engage in negotiation with CERN to establish if steady-state Associate Membership is an option for Ireland; consider continued membership of EMBL in the light of the outcome of the negotiations with CERN. It also recommended that Ireland should join the European Southern Observatory (ESO) but warned the membership costs were substantial. The report also recommended a more structured approach to putting in place necessary support services, to ensure that those IROs that are chosen for membership can deliver on their full potential, in terms of benefits to the relevant research, education and industrial communities.

Innovation 2020 subsequently committed to initiating negotiations with CERN and ESO for Ireland's membership options and initiating membership of ELIXIR. It also committed to a formal review of membership of IROs at least every 5 years, commencing in 2020.

4.2.2 RI roadmaps and ESFRI

The National Reform Programme 2015 says Ireland is actively participating in the ESFRI processes.

In 2015, the Department of Jobs, Enterprise and Innovation published a report¹⁰⁰ on Ireland's future Research Infrastructure (RI) needs. The study aimed to (1) take stock of RI investments made to date in the light of national STI priorities and (2) identify any

⁹⁸ <https://www.era-learn.eu/network-information/countries/ie>

⁹⁹ CIRCA Group Europe, Ireland, and Fraunhofer ISI Karlsruhe, Germany (2015), *Review of Irish Membership of International Research Organisations*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Review-Irish-Membership-IRO.html>

¹⁰⁰ Department of Jobs, Enterprise and Innovation (2015), *Ireland's future Research Infrastructure needs*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Publication-files/Irelands-Future-Research-Infrastructure-Needs-Study.pdf>

future investment needs in the period to 2020 (and beyond) that might be strategically required for the achievement of national STI priorities. The findings of the study were intended as building blocks for improving Ireland's RI strategy.

In relation to the first objective, the study found that the main RI investment vehicle was the Programme for Research in Third Level Institutions (PRTLTI)¹⁰¹ which between 2000-2015 had provided the HEIs with €1.2b in exchequer and private matching funding for buildings, research centres, research equipment, research programmes and training (particularly structured PhD programmes). The PRTLTI funding has been supplemented by HEA and SFI support measures aimed at funding Research Infrastructures along with RI funding from other Government ministries; the report estimates that the Government has invested between €60-80m per year in Research Infrastructures.

The second part of the study focused on establishing future RI investment needs in the period to 2020. A survey of stakeholders identified a range of suggestions for future Research Infrastructure investments.

The report recommended that the scope of RI support programmes should include core facilities and resources as well as buildings, technical operators, access and support services and RI management.

Another recommendation was that a long-term financial commitment should underpin the Research Infrastructure strategy. The report highlighted the requirement for Ireland to develop a Research Infrastructure roadmap so as to establish the prioritisation of national and pan-European Research Infrastructures.

Finally, the report suggested that Ireland could benefit from the establishment of a permanent governance structure to oversee the development and implementation of the Irish RI roadmap.

The Innovation 2020 strategy states that an Irish RI roadmap will be developed. The strategy document sets out guiding principles that could be used to inform future RI investment decisions including supporting excellent research, recognising the needs of the wider research community in order to tackle global challenges and the importance of linkages to ESFRI.

The Department of Jobs, Enterprise and Innovation and the Department of Education and Skills along with other ministries and research agencies have been tasked with the preparation in 2016 of a RI investment strategy with a particular focus on developing a successor to the Programme for Research in Third Level Institutions.

One of the challenges to be addressed in the implementation of new STI strategy is determining what level of funding should be provided for Research Infrastructures. Constraints on Exchequer funding since the start of the economic crisis in 2008 have resulted in a decline in RI funding provision. HEIs have indicated the need not only to develop new research facilities but also to identify sources of funding to upgrade/maintain existing equipment.

4.3 International cooperation with third countries

Resource constraints within the PRO and higher education sectors have resulted in a small number of initiatives at a national and State agency level aimed at building international links between Irish researchers and third country researchers.

Ireland has instituted Joint Economic Commissions (JECs) with a relatively small number of high growth and emerging countries which benefit from the bilateral platform that the JEC process presents. Ireland has JECs with Russia, the Republic of Korea, Saudi Arabia and China, which provide a basis for ongoing, detailed and focused interactions with those countries. The focus of JEC discussions with the partner countries is mainly on

¹⁰¹ For more information on the Programme for Research in Third Level Institutions, see: <http://www.heai.ie/en/funding/research-funding/programme-for-research-in-third-level-institutions>

trade and investment opportunities but other areas such as international science and technology cooperation, tourism and educational exchange are also covered.

Ireland has also signed Scientific and Technological Cooperation agreements with China, India and Israel.

At a State agency level, Science Foundation Ireland has put in place funding to help Irish researchers to develop third country international linkages.

SFI-funded researchers formed over 2,498 academic collaborations in 2014, 74% of which were with international partners. The international collaborations cover most of the world – the largest numbers are with European academic institutions (58%), with North America and Asia comprising 22% and 11% respectively. The primary objective for these collaborations is to facilitate joint publications and/or research.

Science Foundation Ireland's International Strategic Cooperation Award (ISCA) programme supports new and existing research-based collaborations between Ireland's Higher Education Institutions and partner organisations in four designated countries: Brazil, the People's Republic of China, India, and Japan – collectively known as the 'Partner Countries'. The award programme provides the funding to coordinate and carry out a range of activities designed to initiate and/or strengthen academic and associated linkages between one or more of SFI's eligible research bodies and one or more organisations in one of the four Partner Countries.

In the case of Brazil, for example, the ISCA-funded initiative seeks to develop research and educational links between the two countries across five thematic areas:

- ICT
- Environmental Science and Technologies
- Advanced Materials and Nanotechnology
- Biopharmaceuticals, Biotechnology and Health
- Sustainable Energy and Agroproduction.

The initiative involves a number of Irish universities and Institutes of Technology along with Brazilian counterpart organisations under the Research Brazil Ireland (RBI) banner. The RBI project has opened a new office in Brazil to assist in identifying potential industrial and research collaborations, facilitate communication and generally help overcome the barriers which have traditionally impeded a more comprehensive engagement between the two countries.

Ireland is a participant in the Small Advanced Economies Initiative (SAEI)¹⁰² along with Denmark, Finland, Israel, New Zealand, Singapore and Switzerland. All SAEI member countries are classified as advanced economies by the International Monetary Fund and are of similar size in terms of populations (5-10 million). The Initiative's current work programme includes a focus on science and innovation, and it has published two reports in this area: *Prioritisation of Public Sector Research across the SAEI* and *Broadening the Scope of Impact: Defining, assessing and measuring the impact of major public research programmes*¹⁰³.

4.4 An open labour market for researchers

4.4.1 Introduction

Ireland has a very open and transparent system for recruiting researchers. Irish research funding is accessible by non-national researchers, though the research must generally be carried out in Ireland.

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

¹⁰² See the SAEI web site for more details: <http://www.smalladvancedeconomies.org>

¹⁰³ http://www.smalladvancedeconomies.org/wp-content/uploads/SAEI_Impact-Framework_Feb_2015_Issue2.pdf

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. The number of researchers in Ireland originating from third countries has been steadily increasing; the numbers entering under the Hosting Agreement scheme (which implements Council Directive 2005/71/EC) has more than doubled between 2008-2015.

Although 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 2011-2013 publication reports that there were over 19,000 research personnel in the business sector in 2011, a 21% increase since 2009 and more than 14,000 full time equivalents (FTEs). The number of researchers in the higher education sector also increased; the total number of researchers (FTE) amounted to 5,792 in 2010 but this figure had increased to 6,002 in 2012.

The Organisation for Economic Co-operation and Development (OECD) ranked Ireland in 17th place (out of 37 countries) for the number of researchers (FTE) per 1,000 labour force in 2012 (a drop of two places since 2008)¹⁰⁴.

The number of people with a tertiary education and employed in science and technology in Ireland has been rising steadily; in 2010, Eurostat calculated that 0.409m people with a third level qualification were employed in science and technology but this number had risen to 0.479m in 2014.

Eurostat figures also show that the number of scientists and engineers employed in Ireland increased from 164,000 in 2010 to 183,000 in 2014.

Concern has been expressed at the falling numbers of PhD and Masters students in Irish universities; the number of PhD students fell by 12% between 2011 and 2014 while the decrease in Masters students during the same time period was smaller by 3%.

In 2015, the European Commission awarded six Irish higher education institutions the "HR Excellence in Research Award" for their implementation of the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.

4.4.2 Open, transparent and merit-based recruitment of researchers

Under Irish law, all of the seven universities are autonomous institutions and have the authority to recruit their own staff. However, as they are largely funded by the Exchequer, the universities and the network of Institutes of Technology are subject to the Government's Employment Control Framework which seeks to reduce the employee headcount within the publicly-funded higher education institutions.

Ireland has an extensive employment equality legal framework which prevents discrimination across nine grounds: Gender, Civil status, Family status, Sexual orientation, Religion, Age, Disability, Race and Membership of the Traveller community.

Irish HEI recruitment processes are internationally recognised as being open and transparent. A MORE2¹⁰⁵ 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.

¹⁰⁴ <https://www.djei.ie/en/Publications/Publication-files/Survey-of-Research-and-Development-in-the-Higher-Education-Sector-2012-2013.pdf>

¹⁰⁵ 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

A new academic recruitment portal, universitiesvacancies.com¹⁰⁶, has been established to promote awareness of academic, research and professional/ managerial/ administrative/ support services job vacancies in the University and Higher Education Sector in Ireland. The participating higher education institutions include all seven universities (and their representative organisation, the Irish Universities Association), the Royal College of Surgeons of Ireland and Dublin Institute of Technology.

Ireland was one of the early implementers of Council Directive 2005/71/EC (the Admission of Third Country researchers directive). The Euraxess Office in Ireland which is hosted by the Irish Universities Association processes Hosting Agreements on behalf of the Department of Jobs, Enterprise and Innovation which enables non-EEA researchers to work in Ireland without recourse to work permits or Green Cards.

There are 54 accredited Hosting Agreement institutions including all seven universities and 12 Institutes of Technology along with 11 research institutions and 24 companies.

Recent statistics from the Irish Euraxess Office indicate that there has been an increase in the number of third country researchers entering Ireland under the Hosting Agreement scheme. In 2008, there were 276 researchers registered under the Hosting Agreement scheme but by December 2015 this had increased to 656.

The data from the Irish Euraxess Office shows that the number of new non-EEA researchers joining Irish institutions on Hosting Agreements between January-December 2014 was 340 while the number of non-EEA researchers joining during the period January-September 2015 was 310.

Policy attention is returning to the issue of a career framework for researchers. There have been a number of attempts in the past by the Higher Education Research Group and Advisory Council for Science, Technology and Innovation to develop a single national research career framework. There is recognition that there are difficulties with the current system including a lack of progression opportunities within HEIs and learning and development opportunities. Constraints on the ability for early and mid-career researchers to apply for research funding are also being reviewed.

4.4.3 Access to and portability of grants

Irish research funding is very open to access by non-national researchers, subject to the research generally being carried out in Ireland — in many instances the research funding is provided to the host institution such as a higher education institution rather than to the researcher.

The 2014 Irish Researchers' Report¹⁰⁷ 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 enactment of new legislation in 2013 permits Science Foundation Ireland to provide funding to researchers in Northern Ireland and, with the consent of the Minister, to participate in international collaborative projects.

4.4.4 Doctoral training

The National Strategy for Higher Education to 2030 and the National Prioritisation Research Exercise report both recommended the development of a National Framework for Doctoral Education¹⁰⁸ which was published in 2015.

¹⁰⁶ <http://www.universityvacancies.com>

¹⁰⁷ 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

¹⁰⁸ Higher Education Authority and Quality and Qualifications Ireland (2015), *National Framework for Doctoral Education*,

The Higher Education Authority and Quality and Qualifications Ireland (QQI) were responsible for developing the Framework in association with key stakeholders including Irish University Association (IUA), Institutes of Technology Ireland (IOTI) and Dublin Institute of Technology (DIT). The purpose of this Framework for the development of Irish doctoral education is, *inter alia*, to facilitate consistent and enhanced excellence in the quality of doctoral education and training including Masters Research in order to ensure that Ireland has high quality, international standard PhD programmes.

The Framework mainframes best practices in structured PhD programmes developed by Irish higher-education institutions. Its principles commit the key stakeholders in Irish graduate education and research to the highest standards in the provision of doctoral education and research. Research funders are also committed to supporting the principles articulated in the Framework.

One of the challenges facing policy makers is to reverse the declining number of students applying for PhD programmes.

4.4.5 Gender equality and gender mainstreaming in research

The Department of Jobs, Enterprise and Innovation's survey of R&D in the Higher Education sector between 2012-2013¹⁰⁹ outlines Ireland's performance internationally with respect to female researchers as a percentage of total researchers within the higher education sector. It notes that Ireland performs rather well, ranking 13th out of 34 countries on this indicator. The survey found that some 43 per cent of all HEI-based researchers in Ireland were female.

Science Foundation Ireland's Advance Award Programme is aimed at encouraging women to return to or stay in a career in Science, Technology, Engineering and Mathematics (STEM). In 2014, SFI awarded funding of €1.7m to ten recipients under the Advance Award Programme which seeks to enhance diversity and gender-balance within the Irish private and public research system by enabling more women with science degrees who have taken a career break to return to the sector.

The Irish Research Council is currently implementing its Gender Strategy and Action Plan 2013-2020¹¹⁰ the objective of which is to encourage and implement initiatives which promote equality between women and men at all stages of the researcher career.

The Athena SWAN Charter was launched in Ireland in 2015 to address gender inequality in HEIs. All seven universities, 14 institutes of technology and the Royal College of Surgeons have signed up to the charter, thereby committing them to advance women's careers in science, technology, engineering, mathematics and medicine employment in academia. The initial implementation of the Programme which was first developed in the UK will be on a pilot basis until April 2017. The introduction of the Athena SWAN charter into Ireland was supported by the Higher Education Authority.

In 2015, the Higher Education Authority asked former European Commissioner and Government Minister, Maire Geoghegan-Quinn, to chair a five member independent panel to undertake a national review of gender equality amongst staff in higher education. The panel will undertake a comprehensive, system-wide review of gender-profiles and gender-equality policies, inclusive of all higher education institutions in receipt of funding from the HEA and will report within 12 months.

Dublin, Ireland. Available at: <http://www.heai.ie/news/national-framework-doctoral-education-0>

¹⁰⁹ Department of Jobs, Enterprise and Innovation (2015): *Survey of Research & Development in the Higher Education Sector 2012-2013*, Dublin, Ireland. Available from: <https://djei.ie/en/Publications/Publication-files/Survey-of-Research-and-Development-in-the-Higher-Education-Sector-2012-2013.pdf>

¹¹⁰ Irish Research Council (2013), *Gender Strategy and Action Plan 2013-2020*, Dublin, Ireland. Available from: http://www.research.ie/sites/default/files/irish_research_council_gender_action_plan_2013_-2020_0.pdf

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 e-Infrastructures and researchers electronic identity

There is no specific national policy or initiative in relation to e-infrastructures; funding for this investment area derived 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. 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.

4.5.2 Open Access to publications and data

The National Steering Committee on Open Access Policy in Ireland comprises organisations which came together in 2012 to advocate for open access publication in Ireland. The Committee issued recommendations for a position statement later that year, which was subsequently adopted by the Irish Government in October 2012. The National Steering Committee and its member organisations 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. Member organisations commit to advocating for the implementation of the OA statement locally within their institutions.

Since the launch of the Open Access policy statement, the main focus of the National Steering Committee has been on implementation of the policy and on training provision, networking and building collaboration between data holders.

A number of the leading research funding organisations that are represented on the National Steering Committee have published policy statements on Open Access and include the Health Research Board (HRB), the Irish Research Council, the Health Service Executive (HSE) and Science Foundation Ireland. Two higher education institutions, Dublin Institute of Technology and Trinity College Dublin, have also published Open Access policy documents. In general, these Open Access policy documents are based on recognised best practice and are aligned with the National Common Principles for Open Access Policy Statement¹¹¹ and complement the pre-existing open access policies and practices from Irish research funding organisations, Irish research performing organisations and Irish library and repository groups.

The Health Service Executive which is responsible for the delivery of healthcare services in Ireland inaugurated the HSE Open Access Research Awards in 2014 to recognise the efforts of healthcare professionals and those working in the healthcare system that are engaged in research. To be eligible for the HSE Open Access Research Awards applicants must be: (a) be working for the HSE, on behalf of the HSE or in the Irish health system; (b) have published and made openly (freely) accessible a piece of published research within the last 2 years; and (c) have published research which identifies a health service improvement.

¹¹¹ 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>

Insight Centre for Data Analytics, one of the largest SFI-funded research centres, published a White Paper in 2015, *Towards a Magna Carta for Data*¹¹², which sought to inform EU policy and regulations on data privacy, ownership, research and innovation.

¹¹² Insight Centre for Data Analytics (2015): *White Paper: Towards a Magna Carta for Data*, Ireland. Available at: https://www.insight-centre.org/sites/default/files/basic_pages_file/magna_carta_for_data_pdf.pdf

5. Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

The 2015 edition of the World Bank's annual publication, *Doing Business* (World Bank, 2015)¹¹³, indicates that Ireland stands out as a country which has performed well in terms of implementing reforms to make doing business easier. Ireland was ranked 13th place in the global ranking for ease of doing business (and was the 5th highest ranked country among the EU-28 after Denmark, UK, Finland and Sweden).

Ireland scored highly on a number of indicators such as trading across borders and protecting minority investors. Lower rankings were observed in relation to obtaining credit, getting electricity and with dealing with construction permits.

The National Competitiveness Council in its annual publication, *Ireland's Competitiveness Scorecard 2015* (NCC, 2015)¹¹⁴, notes from a national competitiveness perspective, facilitating entrepreneurship by ensuring that the State does not place undue administrative burdens and costs on entrepreneurs and business owners is critical. It says that while a range of recent structural reforms (e.g. the Companies Act and the Integrated Licensing Applications Service) will help to support entrepreneurship, other elements of Ireland's environment for entrepreneurship are relatively poor in an international competitiveness context; in particular, reducing the time and complexity of procedures associated with enterprise start-up must continue to be a policy priority. The World Bank's *Doing Business 2015* report ranked Ireland in 19th place on the world index for starting a business.

Since the financial crisis of 2007-2008, Ireland has made changes to its insolvency regime. The 2015 *Doing Business* report puts Ireland in 21st place in the global rankings for resolving insolvency. The Organisation for Economic Co-operation and Development noted in an economic commentary on Ireland (OECD, 2013) that insolvency costs were still too high.

The World Economic Forum ranked Ireland in 24th place in its 2016 *Global Competitiveness Report* (WEF, 2015)¹¹⁵, an improvement of 1 place from the 2015 survey, and is ranked the 11th most competitive within the EU-28. Ireland scored well in terms of market efficiency, institutions, health and primary education and labour market efficiency but exhibited weaknesses in relation to infrastructures, market size, financial markets and the macroeconomy.

5.2 Young innovative companies and start-ups

In November 2015, the Government published *Enterprise 2025: Innovative, Agile, Connected* (DJEI, 2015)¹¹⁶, its 10-year enterprise and jobs strategy covering the period 2015-2025, a key aim of which is to create 26,000 extra jobs by 2020. The strategy includes policies to support both indigenous start-up enterprises and foreign investment. *Enterprise 2025* pledges that the Government will work with companies to realise a transformative step change in their performance and to embed a culture of innovation and continuous change.

¹¹³ International Bank for Reconstruction and Development/The World Bank (2015), *Doing Business 2015 — Going Beyond Efficiency*, 12th Edition, Washington DC, USA. Available from:

<http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Full-Report.pdf>

¹¹⁴ National Competitiveness Council (2015), *Ireland's Competitiveness Scorecard 2015*, Dublin, Ireland. Available from: <http://www.competitiveness.ie/Publications/2015/Ireland%20s%20Competitiveness%20Scorecard%202015.html>

¹¹⁵ World Economic Forum (2016), *The Global Competitiveness Report 2015-2016: Insight Report*, Geneva, Switzerland. Available from: http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

¹¹⁶ Department of Jobs, Enterprise and Innovation (2015), *Enterprise 2025: Ireland's National Enterprise Policy 2015-2025, Summary Report*, Dublin, Ireland. Available from: <https://www.djei.ie/en/What-We-Do/Business-Sectoral-Initiatives/Enterprise-2025/>

The strategy document sets out a target for increasing the number of start-ups by 25% to almost 16,000 per annum in 2020 and for increasing the 5-year survival rate by 25%. Enterprise 2020 also details targets for growing the number of existing indigenous owned enterprises; it commits by 2020 to increasing by 33% the number of enterprises with greater than €3m sales and greater than €20m sales currently and a significant step change in the numbers of enterprises with annual sales of €100m from 54 to 90. The document also commits to delivering a coordinated approach to attracting internationally mobile entrepreneurs and emerging companies to Ireland.

Enterprise 2025 also sets out targets for RD&I performance; it commits to increasing the number of Irish and foreign-owned enterprises with innovation activities of scale by 30% by 2020.

Enterprise 2025 makes reference to a number of policy statements which preceded it including the National Policy Statement on Entrepreneurship in Ireland 2014 (DJEI, 2014)¹¹⁷ which sets out the framework needed to make Ireland one of the most entrepreneurial nations in the world, acknowledged as a world-class environment in which to start and grow a business.

The entrepreneurship policy statement identified six areas of the entrepreneurship ecosystem (Culture, human capital and education, Business environment and support, Innovation, Access to finance, Networks and mentoring and Access to markets) that Government could influence to make a positive impact on entrepreneurs and start-ups. The overarching objectives as set out in the policy statement are to:

1. Increase the number of start-ups by 25% (3,000 more start-ups per annum);
2. Increase the survival rate in the first five years by 25% (1,800 more survivors per annum);
3. Improve the capacity of start-ups to grow to scale by 25%.

A range of direct supports for new start-ups are provided by state enterprise development agencies, primarily Enterprise Ireland and the network of Local Enterprise Offices.

Enterprise Ireland's High Potential Start-Up (HPSU) initiative targets 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.

Enterprise Ireland also funds a development programme for new entrepreneurs, the New Frontiers programme, which is aimed at early stage start-ups and seeks to accelerate the development of sustainable new businesses that have strong employment and growth potential. Between 2012 and 2014, the Programme provided training, funding and other support services to 445 participants.

The agency is also responsible for the Innovation Voucher scheme which funds collaborative links between Ireland's public knowledge providers (i.e. higher education institutes, public research bodies) and small businesses. In 2014, Enterprise Ireland provided €2.625m (€2.635m, in 2013) in Innovation Voucher funding.

Supports for micro-enterprises employing less than 10 employees are provided by the network of Local Enterprise Offices (LEOs). The LEOs also provided a "sign-posting" service by directing enterprises to State-funded agencies providing supports more relevant to their sector i.e. agri-food or crafts.

There are a range of entrepreneurship competitions including a number which focus on young entrepreneurs and those aimed at entrepreneurs in the education system.

¹¹⁷ Department of Jobs, Enterprise and Innovation (2014), *National Policy Statement on Entrepreneurship in Ireland 2014*, Dublin, Ireland. Available at: <https://www.djei.ie/en/Publications/National-Policy-Statement-on-Entrepreneurship-in-Ireland-2014.html>

5.3 Entrepreneurship skills and STEM policy

The National Policy Statement on Entrepreneurship (DJEI, 2014) recognises the importance of the need to include entrepreneurship in education, in society and in corporate behaviour. The report of the Research Prioritisation Steering Group (Forfás, 2011) included as one of its systemic recommendations that innovation activity should be recognised by the system for career progression for academic staff within HEIs and public research organisations. On a more general level, the latter document recommended that initiatives to align the supply of trained researchers from academia with the demand from the enterprise base for such skills be kept under continuous review.

While previously entrepreneurship skills and STEM policies were pursued separately, there is increasing recognition from a policy perspective that they are not separate. This new thinking is reflected in new approaches to doctoral training and in the funding of enterprise-based Masters/PhD programmes.

Two key policy documents, the National Strategy for Higher Education to 2030 (DES, 2011) and the National Prioritisation Research Exercise report (DEJI/Forfás, 2012) recommended the development of a National Framework for Doctoral Education. A new National Framework for Doctoral Education¹¹⁸ was published in 2015 by the Higher Education Authority and Quality and Qualifications Ireland which is consistent with European and international standards, principles and guidelines, including the Salzburg principles, the Salzburg II recommendations and the EU Commission's Principles for Innovative Doctoral training.

The Framework endorses the following skills and attributes as key educational objectives for all graduates of Irish doctoral programmes: research skills and awareness; ethics and social understanding; communication skills; personal effectiveness/development; team-working and leadership; career management; and entrepreneurship and innovation.

The national doctoral framework has been endorsed by all seven universities, Dublin Institute of Technology and the network of Institutes of Technology.

The National Research Prioritisation Strategy report in addition to advocating a structured PhD approach also called for the provision of industrial Masters and PhD programmes. The Irish Research Council (IRC) currently funds a number of such programmes (the Enterprise Partnership Scheme, the Employment based Postgraduate Programme and the Elevate Postdoctoral scheme) under which the student is employed by their employer mentor for the duration of their MSc/PhD programme. These IRC-funded schemes provide a 'co-educational' experience and thus provide an opportunity for a researcher in their formative years to be exposed to a research and innovation environment, and to a workplace outside academia.

A number of universities such as University College Dublin and Maynooth University are offering modular course provision where students can take electives outside of their core degree area. These offerings are very much aligned with the recommendations from the Expert Group on Future Skills Needs which advocates the provision of higher education programmes incorporating the development of hard and soft skills among graduates.

Entrepreneurship education is increasingly provided throughout the higher education sector and is supported by networks such as the Campus Entrepreneurship Enterprise Network (CEEN), the Irish national network for promoting and developing entrepreneurship and enterprise within HEIs. CEEN aims to create a sustainable national platform for raising the profile, extending engagement and further developing entrepreneurship across the Irish higher education sector.

¹¹⁸ Op. Cit.

5.4 Access to finance

Following the global financial crisis of 2008-2009, it has been Government policy to support SMEs in accessing an appropriate supply of financing from both bank and non-bank sources. A number of measures have been introduced to provide credit to the enterprise sector including the establishment of the Strategic Banking Corporation of Ireland (SBCI) providing up to €800m of funds and the transitioning of the National Pension Reserve Fund (NPRF) into the Ireland Strategic Investment Fund (ISIF).

In 2014, the Government launched the online portal, Supporting SMEs Online Tool¹¹⁹, which simplifies the process for SMEs seeking information on available Government supports for their business. Another initiative introduced in 2015 is the SURE scheme, a tax refund scheme for start-up companies; eligible entrepreneurs may be entitled to an income tax refund of up to 41% of the capital invested in their new enterprise.

The Credit Review Office mediates disputes between lenders and prospective SME borrowers who have been refused credit. Up to the first quarter of 2014, 55% of appeals have been found in favour of borrowers.

The National Policy Statement on Entrepreneurship recommended a number of actions to attract more angel and international venture capital investors and continue to develop the domestic venture capital sector.

Enterprise Ireland, which has been investing in the domestic venture capital sector since the mid-1990s, is responsible for the management of the Seed and Venture Capital Scheme 2013-2018¹²⁰ 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 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, Enterprise Ireland is seeking to invest up to €100m in commercially focused Venture Capital funds in the wider technology and life sciences sectors.

Two new committees have been established by the Government that focus on access to finance. The first is the SME State Bodies Group which has been tasked with responsibility for developing and implementing an integrated set of actions on Access to Finance as set out in the various Action Plans for Jobs and contributing to the work of the Cabinet Committee on Mortgage Arrears & Credit Availability. The second committee is the SME Funding Consultation Committee which addresses issues relating to access to credit by small and medium sized enterprises.

The EVCA Benchmark 2012 study¹²¹ indicates that fiscal incentives are available in Ireland at a company level in relation to business R&D expenditure, R&D capital expenditure, contracting researchers, technology transfer, co-operative external research and young and innovative companies but not for innovative spin-outs.

The National Competitiveness Council states that the financial crisis in Ireland resulted in significant public funds being used to recapitalise the banking sector. In addition, the State has had to intervene to boost the supply of credit to SMEs through a range of initiatives such as the Microenterprise Loan Fund and the Credit Guarantee Scheme, both modified in 2015 to improve uptake¹²² and the Strategic Banking Corporation of Ireland.

¹¹⁹ <http://www.supportingsmes.ie/BusinessDetails.aspx>

¹²⁰ <https://www.enterprise-ireland.com/en/Invest-in-Emerging-Companies/Seed-and-Venture-Capital-Scheme/>

¹²¹ European Private Equity and Venture Capital Association/EVCA (2013), *Tax Benchmark Study 2013*, Brussels, Belgium. Available from: http://www.investeurope.eu/uploadedFiles/Benchmark2012.pdf?dm_i=1GL5.1K23D.827W8K.5C4G8.1

¹²² <https://www.djei.ie/en/News-And-Events/Department-News/2015/September/25092015.html>, <http://www.rte.ie/news/business/2015/0223/682210-credit-guarantee-scheme/>

In addition to the total stock of credit available continuing to fall, Irish enterprises also had to pay higher rates of interest compared to their EU peers for loans of varying sizes¹²³.

Although the proportion of enterprises who consider access to finance as a major concern is declining, a number of major weaknesses remain in the Irish financial system as a result of the financial crisis and the high proportion of non-performing loans.

5.5 R&D related FDI

Foreign direct investment inflows represent a very significant element of Irish economic activity: in 2012, FDI investment inflows accounted for 18.2% of Irish GDP compared to an OECD average of 1.3%. The FDI sector in Ireland is supported by IDA Ireland, the national FDI promotion agency, with 1,254 client companies employing more than 187,000 people directly and a further 130,000 indirectly. In 2013, FDI companies spent €21b in the Irish economy and exported goods and services to the value of €121b. FDI companies also account for a major element of BERD.

The attraction of R&D related foreign direct investment projects to Ireland is a major policy objective for Irish R&I policy makers as is the encouragement of existing multinational companies in Ireland to undertake R&D.

In 2014, the Department of Jobs, Enterprise and Innovation published its Policy Statement on Foreign Direct Investment in Ireland (DJEI, 2014)¹²⁴ in which it said that Ireland would 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 under the National Research Prioritisation Strategy.

The Ireland National Reform Programme 2015 states that in 2014, of 189 foreign direct investments in Ireland, 24 were in research, development and innovation, activities that are central to productivity and new business development in Ireland's multinational sector.

However, statistics published by the Central Statistics Office show that R&D expenditure by the enterprise sector is concentrated in a very small number of MNCs; CSO data on BERD show that the largest 100 enterprises in terms of R&D spend accounted for over 70% of the total R&D expenditure in 2013. Of these top 100 enterprises, 80% of the spend could be attributed to foreign owned enterprises.

In addition to the direct support measures available from IDA Ireland, FDI companies in Ireland can also avail of the R&D tax credit and Knowledge Development Box, alongside indigenous companies.

Under the R&D tax credit, eligible enterprises can receive up to 25 per cent of their expenditure on R&D in the form of cash or a credit against their corporation profits tax. The Department of Finance (DOF, 2013) published a review of the R&D tax credit in 2013 which found it had an impact in attracting FDI projects with an R&D focus, as well as supporting smaller domestic companies.

In addition to the R&D Tax Credit, the Government in its Budget 2016 announced the introduction of a Knowledge Development Box (KDB). With effect from January 1, 2016, it will implement a corporation profits tax rate of 6.25% on qualifying income (half of the regular corporate tax rate of 12.5%).

¹²³ National Competitiveness Council (2015), *Ireland's Competitiveness Scorecard 2015*, Dublin, Ireland. Available from: <http://www.competitiveness.ie/Publications/2015/Ireland%20s%20Competitiveness%20Scorecard%202015.html>

¹²⁴ Department of Jobs, Enterprise and Innovation (2014), *Policy Statement on Foreign Direct Investment in Ireland*, Dublin, Ireland. Available at: <https://www.djei.ie/en/Publications/Publication-files/Forfás/Policy-Statement-on-Foreign-Direct-Investment-in-Ireland1.pdf>

The Minister for Finance said in his Budget 2016 speech that Ireland was first country to respond directly to the final reports of the OECD Base Erosion and Profit Shifting (BEPS) review process (OECD, 2015)¹²⁵ published in October 2015. The Minister said that Ireland was an active participant and contributed fully to the BEPS Review process.

5.6 Knowledge markets

A report¹²⁶ commissioned by the Department of Jobs, Enterprise and Innovation on IP activity in the enterprise sector found that activity in formal and registered IP is low in Ireland relative to the selected comparator countries. The Technopolis Group report found that patenting in particular in Ireland was noticeably low compared to innovation leaders such as the UK and the Netherlands and more recently compared to Singapore, which had now overtaken Ireland in filing volume. Patent filing in Ireland has been declining since a peak in 2006 though the proportion of patents attributed to HEIs was greater than in other countries and was continuing to increase steadily.

A small number of firms are responsible for the majority of patent applications. Approximately 0.2% of firms in Ireland account for 77% of applications between 1999-2013.

Patent activity was concentrated in a number of sectors (pharmaceuticals, medical devices and ICT hardware) and the so-called 'patent cliff' may have been a factor in the decline in industry patent filing in Ireland. It should be noted that these are sectors most commonly associated with the MNC sector while key sectors for indigenous companies are food and drink, business services and computer consultancy, sectors that are not considered traditionally patenting sectors.

The report also found that informal and unregistered IP Rights were of significant importance across key sectors of the Irish economy. Copyright, for example, is associated with a number of sectors with high employment such as business and financial services, software and food and drink.

Barriers to use of IP varied according to firm size and age, and the report noted that there was a perception among enterprises that the cost of protecting IP was a barrier to the use of more formal IPR. These perceptions around the cost of formal IP were more likely to be found in small and micro enterprises.

The report found that there was most scope to support indigenous enterprises to improve their IPR management capabilities. While there were indirect supports available to Irish enterprises, there were no direct IP-specific support measures.

The report made a number of recommendations including the establishment and implementation of a national IP statement that would take a holistic view of IP. In light of the recommendations, the new STI strategy 'Innovation 2020' commits to raising IP awareness and building IP capability and resilience at enterprise level.

Knowledge Transfer Ireland (KTI) plays an important role in disseminating information on IP within the higher education and public research sectors. Its overall purpose is to deliver an efficient and productive research and technology transfer system, to make IP and expertise within public research organisations visible for companies, and to act as a central point of contact. It supports the public research organisations' (HEIs') research and technology transfer infrastructure and provides services complementary to already existing TTO structures. KTI has an Industry Advisory Board and a Stakeholder Forum that offer advice and share intelligence¹²⁷.

¹²⁵ Organisation for Economic Cooperation and Development (2015), *OECD/G20 Base Erosion and Profit Shifting Project – Final Reports*, Paris, France. Available from: <http://www.oecd.org/ctp/beps-2015-final-reports.htm>

¹²⁶ Technopolis Group (2015), *Enhancing the intellectual property activities in the firm base in Ireland*, a report for the Department of Jobs, Enterprise and Innovation, Dublin, Ireland. June 2015. Available from: <https://www.djei.ie/en/Publications/Enhancing-the-Intellectual-Property-Activities-in-the-Firm-Base-in-Ireland.html>

¹²⁷ Danish Council for Research Policy: "International Perspectives on Framework Conditions for Research and Technology

At the end of 2015, work was underway to launch a revised national IP Protocol early in 2016. The new Protocol will be consistent with existing policy and will introduce some practical additions to speed up negotiation between industry and research performing organisations.

The Intellectual Property (Miscellaneous Provisions) Act 2014¹²⁸ was enacted in 2015 to update a number of elements of patents and trademarks legislation. The legislation exempts from the realm of patent infringement acts that are carried out for purposes of clinical tests and trials to secure regulatory approval for new or generic versions of medical or veterinary products. Legitimate research and trials will now enjoy greater immunity from patent infringement proceedings, while any follow-on commercial manufacture will continue to enjoy legitimate patent protection. The legislation is expected to benefit the pharmaceutical industry in the development of new medicinal products in Ireland.

5.7 Public-private cooperation and knowledge transfer

5.7.1 Knowledge Transfer Indicators

Funding: BES-funded/publicly-performed R&D

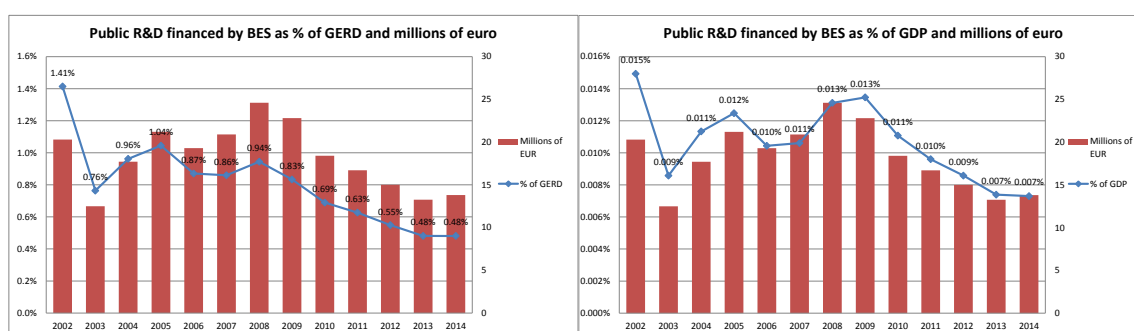


Figure 15: BES-funded public R&D in IRELAND as % of GERD (in €MLN) and % of GDP

The Irish research system is characterised by very low levels of business enterprise (BES) funded-publicly performed R&D. If we look at the last ten years, the level of expenditure as a percentage of GERD reached its peak in 2008 (0.94%) to decline constantly to reach the low level of 0.48% in both 2013 and 2014. The indicator expressed as a percentage of GDP shows a similar trend, reaching the highest value of 0.013% of GDP in 2008 and 2009. The latest available figures show a very low value of 0.007% of GDP in 2013 and 2014. The same indicator expressed in million Euro shows a quite similar trend: the highest level of BES-funded public research was recorded in 2008 – €24.6m – followed by a constant decline until 2013 (€13.2m) and by a small increase in 2014 at €13.8m.

Transfer" Pages 31-32. http://ufm.dk/en/publications/2014/danish_council_research_policy_pdfa-1.pdf

¹²⁸ Government of Ireland (2014), *Intellectual Property (Miscellaneous Provisions) Act 2014*. Available from: <http://www.oireachtas.ie/documents/bills28/acts/2014/a3614new.pdf>

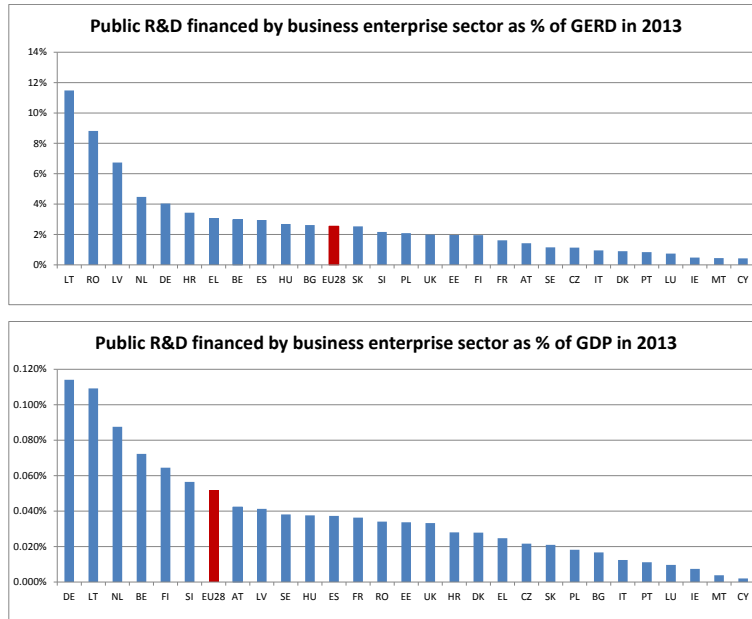


Figure 16: BES-funded public R&D as % of GERD and as % of GDP in 2013 in Member States¹²⁹

The two charts in Figure 16 show the values of BES-funded public R&D in all EU-28 as percentages of GERD and GDP respectively. Ireland, ranked 26th, is one of the worst performers, leaving only Malta and Cyprus behind. This value is even more striking if compared with innovation leaders like Germany or Finland or other strong innovators like the Netherlands or Belgium.

The business R&D framework is characterised by a predominance of multinational companies (MNC), which account for more than 65% of the total R&D expenditure, with limited spillovers to indigenous Irish SMEs. Indigenous SMEs show slightly lower levels of formal collaborations with HEIs compared to foreign-owned businesses: 19% of Irish-owned R&D performing enterprises collaborate with HEIs or other institutions in Ireland and 7% with HEIs or other institutions outside Ireland, whereas these percentages are 21% and 10% respectively for foreign-owned R&D performing firms.

Funding: Structural funds devoted to knowledge transfer

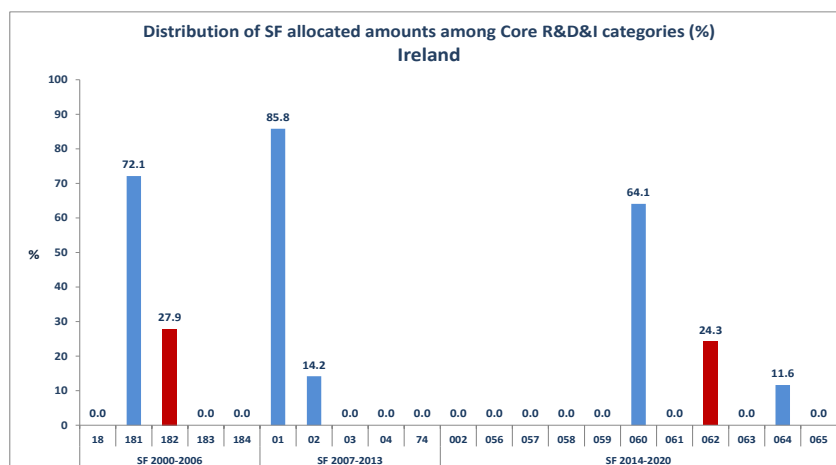


Figure 17: Structural Funds for core R&D activities 2000-2006, 2007-2013 and 2014-2020¹³⁰. We use the categories: 182 (2000-2006), 03 and 04 (2007-2013) and 062 (2014-2020) as proxies for KT activities.

¹²⁹ 2013 was chosen as the latest data series providing a full comparison within EU-28.

Ireland has allocated 24.3% of its Structural Funds for core R&D activities to "Technology transfer and university-enterprise cooperation primarily benefiting SMEs" in the 2014-2020 programming period, a much higher amount than the EU average of 15.7%. This figure shows a shift in the country's priorities, given the fact that no fund was given to knowledge transfer-related R&D activities in the previous 2007-2013 programming period.

Cooperation: Share of innovative companies cooperating with academia

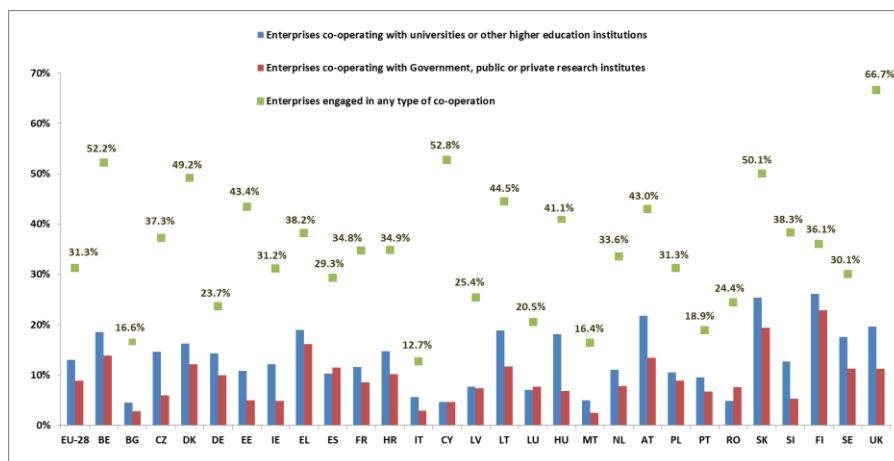


Figure 18: CIS survey 2012 – share of innovative enterprises cooperating with academia

Figure 18 depicts the level of cooperation activities of innovative companies in the EU-28, according to the CIS 2012. The percentage of "enterprises engaged in any type of co-operation" (green dot) in Ireland is 31.2%, practically the same level as the EU-28 average (31.3%). The percentage of enterprises involved in cooperation with universities or other HEIs (blue bar) is 12.1%, also not far from the EU-28 average of 13.0%, while only 4.9% of Irish innovative enterprises is cooperating with Government, public or private research institutes (red bar), a level four percentage points below the EU-average of 8.9%. Ireland is scoring better than countries like France or the Netherlands in terms of cooperation with universities, but it's still far behind the UK levels for both indicators (19.6% and 11.3% respectively).

¹³⁰ Figure 17 provides the Structural Funds allocated to Ireland for each of the above R&D categories. The red bars show the categories used as proxies for KT. Please note that the figures refer to EU funds and they do not include the part co-funded by the Member State. The categories for 2000-2006 include: 18. Research, technological development and innovation (RTDI); 181. Research projects based in universities and research institutes; 182. Innovation and technology transfers, establishment of networks and partnerships between business and/or research institutes; 183. RTDI infrastructures; 184. Training for researchers. The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation. The categories for 2014-2020 include: 002. Research and Innovation processes in large enterprises; 056. Investment in infrastructure, capacities and equipment in SMEs directly linked to Research and Innovation activities; 057. Investment in infrastructure, capacities and equipment in large companies directly linked to Research and Innovation activities; 058. Research and Innovation infrastructure (public); 059. Research and Innovation infrastructure (private, including science parks); 060. Research and Innovation activities in public research centres and centres of competence including networking; 061. Research and Innovation activities in private research centres including networking; 062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs; 063. Cluster support and business networks primarily benefiting SMEs; 064. Research and Innovation processes in SMEs (including voucher schemes, process, design, service and social innovation); 065. Research and Innovation infrastructure, processes, technology transfer and cooperation of enterprises focusing on the low carbon economy and on resilience to climate change.

Cooperation: Technology transfer offices (TTOs offices), incubators and technological parks

In Ireland each of the Universities and Institutes of Technology (HEIs) has its own Technology Transfer Office (TTO) that supports the means in which industry accesses the skills, knowledge, technologies, intellectual property and other research within the HEI system. The Enterprise Ireland Technology Transfer Strengthening Initiative (TTSI) programme¹³¹, which ran from 2007 to 2012, contributed €30m in funding to the creation of 10 TTOs, funding 32 posts and associated operational costs. The second edition of the initiative, TTSI2, is currently ongoing (until 2016) and will provide €22m funding and an extra 5.5 FTE posts, financing also 8 Technology Transfer consortia of universities and Institutes of Technology across Ireland. Following a recommendation from a Government-led task force that reviewed the state of business-public research collaborations in 2012, Enterprise Ireland and the Irish Universities Association created in 2013 the cTTO, the Central Technology Transfer Office, formally launched in 2014 as Knowledge Transfer Ireland (KTI)¹³². KTI currently employs 5 people, and it is accountable to the Department of Jobs Enterprise and Innovation (DJEI)¹³³.

Proposals for the continued support and evolution of the Technology Transfer system were being developed and examined during 2015 and at year-end preparations were underway for TTSI3, a successor to the TTSI initiative, which will build on the current programme.

Moreover, thirty business incubators in Ireland are currently hosted by universities, Institutes of Technology and bio-incubation facilities across Ireland, which connect the research and business worlds.

Cooperation: Share of public-private co-publications

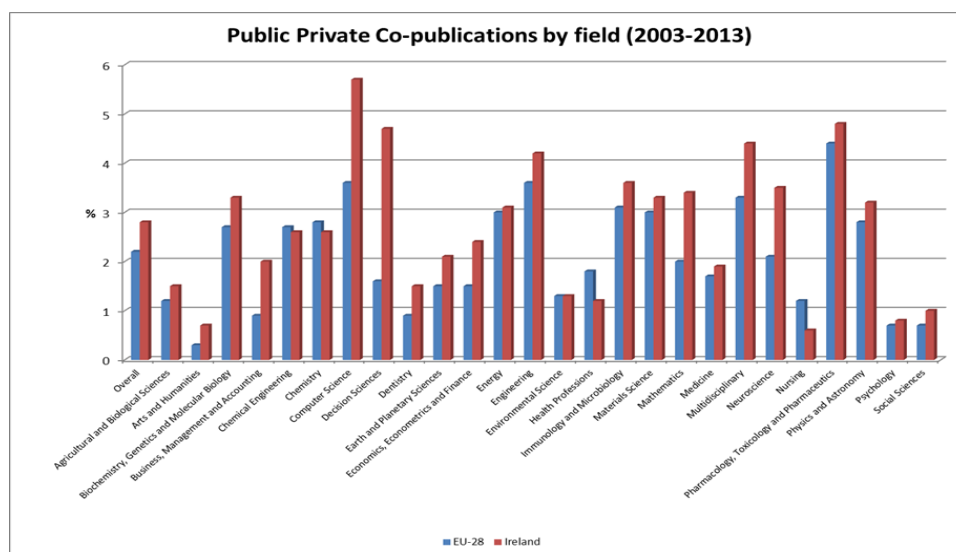


Figure 19: Co-publications by field 2003-2013 in Ireland. Scopus database

¹³¹ See for reference: <http://www.astp-proton.eu/downloads/Events/Conferences/AC2014/Presentations/Alison%20Campbell%20-%20TTO%20Partnerships.pdf>

¹³² Website: <http://www.knowledgetransferireland.com>

¹³³ Enterprise Ireland provides a list of HEIs based business incubators: <http://www.enterprise-ireland.com/en/Researchers/Spin-Outs/Incubation-Centers-Maps-and-Contacts.html>

Figure 19 shows the 2003-2013 average percentage of academia-industry co-publications by field in Ireland compared to the European average. The total share of co-publications, displayed by the red "overall" bar on the left of the chart, is 2.8%, which is above the EU-28 average of 2.2%. Ireland excels in some fields, where it performs better than the EU-28 average, like for instance Computer science (5.7%), Pharmacology and toxicology (4.8%), Engineering (4.2%) and Biochemistry (3.3%). In terms of co-publications per million population Ireland, with 82.3, is far above the EU-28 average of 29.0, ranking 5th after Denmark (182.1), Finland (155.0), the Netherlands (114.8) and Sweden (113.3)¹³⁴.

Cooperation: Patenting activity of public research organisations and universities together with licensing income

The latest publication by Knowledge Transfer Ireland¹³⁵ reported on the "sharp growth" in the indicators about the commercialisation activities of Irish HEIs and PROs, which increased by 21% between 2013 and 2014. The total number of licences, options and assignments rose from 139 to 168, despite a little decrease in the total number of licences, from 103 to 97.

In terms of priority patent applications by Irish PROs, they slightly decreased from 123 in 2013 to 117 in 2014. The Knowledge Transfer Study allows for benchmarking Ireland with the other surveyed countries as well as with the EU average. With 3.4 patents granted per 1,000 researchers Ireland performance is lower than the EU average of 4.5. On the other hand, Ireland ranks 4th for the number of licence agreements per 1,000 researchers at 14.8, well above the EU average of 6.5. Licensing income per 1,000 researchers is 352,000 Euro per 1,000 researchers, compared to 399 000 Euro of the EU average (Ireland ranks 9th). Finally, in Ireland there were 68.0 research agreements per 1,000 researchers, while the EU average is 82.8.

Cooperation: companies

In 2015, Knowledge Transfer Ireland published its Annual Knowledge Transfer Survey 2014¹³⁶ covering knowledge transfer interactions between HEIs/PROs and the enterprise sector.

There was a decrease in both the number of spin-outs and start-ups stemming from Irish PROs between 2013 and 2014. Spin-outs fell from 37 to 27; of these, 19 (70%) were from the University sector, six (22%) from the Institutes of Technology sector and two were created out of the National College of Art and Design (7%).

The number of start-ups decreased more sharply from 32 to 14.

The Publicly funded research sector entered into research agreements in 2014 with 1,371 different companies, executed 2,337 new collaborative research, contract research and consultancy agreements, and signed 168 Licences, Options and Assignments (see table below for a comparison of KTI outcomes for 2012-2014).

¹³⁴ The number of public private co-publications per million population and the EU-28 ranking differs from the indicators provided in the IUS. Apart from the use of a different bibliometric database, an explanation for this discrepancy is that in the case of the IUS, domestic enterprises are taken as the unit of analysis whereas SciVal considers both universities and companies. As a result the indicator provided here also takes into account co-publications between domestic universities and foreign companies – which may be substantial in Ireland.

¹³⁵ http://www.knowledgetransferireland.com/About_KTI/Reports-Publications/KTI-Annual-Report-and-Annual-Knowledge-Transfer-Survey-2014.pdf

¹³⁶ Knowledge Transfer Ireland (2015), *Annual Report and Annual Knowledge Transfer Survey 2014*, Dublin, Ireland.

Available from: http://www.knowledgetransferireland.com/About_KTI/Reports-Publications/KTI-Annual-Report-and-Annual-Knowledge-Transfer-Survey-2014.pdf

Table 7: Annual Knowledge Transfer Survey 2014

Performance indicator	2012	2013	2014
Number of engagement agreements <i>of which</i>	n.a.	1,598	2,337
- Collaborative research agreements	n.a.	336	647
- Contract research agreements	n.a.	653	1,163
- Consultancy agreements	n.a.	527	367
Invention disclosures	373	462	423
Priority patent applications	113	123	117
Patents granted	41	59	50
Total number of licences, options and assignments executed	87	139	168
Number of material transfer agreements at year end	560	334	174
Spin-outs and start-ups established			
- Spin-outs	15	37	27
- Start-ups	16	32	14

(Source: Knowledge Transfer Ireland).

According to the Knowledge Transfer Study, there are 3.8 start-ups per 1,000 researchers in Ireland, well above the EU average of 1.7. Indeed, Ireland ranks 3rd in this indicator.

5.7.2 Policy debate

A key principle of STI policy is to seek closer co-operation between industry and the higher education sectors, driven by the desire to commercialise the results of the State's investment in R&I so as to generate economic impact including export sales and employment. One part of this policy approach is the establishment of research and technology centres mostly based in HEIs with research agendas that are industry-led or industry-informed. The funding of the centres includes a substantial cash and in-kind contribution to match Government funding (the review¹³⁷ of the National Research Prioritisation Strategy notes that in the case of the new SFI Research Centres, industry contributes 30% of which 10% is in cash). In almost all cases, the centres have performance metrics on the amount of private sector funding they have generated.

Policy debate in recent years has focused on the need to develop close-to-market research/technology centres. The Department of Jobs, Enterprise and Innovation commissioned a study on the potential for developing such centres so as to ensure that Ireland had an appropriate translational capacity to bridge research and technology commercialisation now and into the future and that enterprise in Ireland have access to the necessary research infrastructure, capability and services to support research based innovation. The study¹³⁸ found that at the beginning of 2015, Ireland's market-focused research centre landscape consisted of twelve SFI Research Centres, fifteen EI/IDA

¹³⁷ Department of Jobs, Enterprise and Innovation (2015), *Review of Progress in Implementing Research Prioritisation – Report of the Independent Panel*, Dublin, Ireland. Available from: <https://www.djei.ie/en/News-And-Events/Department-News/2015/December/08122015.html>

¹³⁸ Fikkers, Derek Jan, and Ploeg, Matthias (2015), *Strengthening Ireland's Market-Focused Research Centre Landscape: Roadmap for the further development of market-focused research centres in Ireland*. Project led by Technopolis Group (Amsterdam) funded by the Department of Jobs, Enterprise and Innovation. Available from: <https://www.djei.ie/en/Publications/Publication-files/Strengthening-Irelands-Market-Focused-Research-Centre-Landscape.pdf>

Technology Centres and a group of sector-specific centres, more specifically Teagasc (agriculture and food research), Tyndall National Institute (information and communications technology research) and NIBRT (bioprocessing research and training).

The report found that state-funded market-focused research centres in Ireland have a relatively large share of public core funding and have a relatively small industry cash contribution compared with market-focused research centres in several countries of similar size.

Another finding from the report was that Irish market-focused research centres differed from similar centres in other EU Member States in several important respects. Most Irish research centres are smaller in size than their overseas counterparts. The Irish research centres are also most likely to be based in HEIs; overseas market-focused centres, on the other hand, have connections to universities — which are crucial to them — but operate more independently from them. The overseas research centres have longer public funding horizons than the Irish centres. Additionally, overseas market-focused research centres spend relatively more resources on short-term applied contract research, as well as on contract research services, than the EI/IDA Technology Centres and SFI Research Centres and the sector oriented centres in Ireland.

The study found that there was a demand for more short-term applied contract research that was unmet as the SFI Research Centres and the EI/IDA Technology Centres were established to primarily perform collaborative research.

The report made a number of recommendations in relation the development of market-focused research centres in Ireland. Chief among these was that scope exists to build on and evolve the current network of centres to focus on more applied research areas and in upper-middle and high Technology Readiness Levels (TRLs) and in short-term applied and contract research. It also recommended the development of a broader RTO-type research centre model that would deliver research across TRL 2-8 with emphasis on mid to high TRLs and RTO functions, including technology validation and testing services, pilot lines in the case of manufacturing research, contract research services and consultancy.

5.7.3 Policy Measures

Ireland has also taken a number of steps in recent years to improve the environment for the development, exploitation, and development of intellectual property (IP), including measures to make it easier to commercialise and ultimately create jobs from ideas developed through publicly-funded research. Knowledge Transfer Ireland which was established in 2012 as a central technology transfer office acts as a one-stop shop for enterprises seeking to use IP deriving from public-funded research.

In the frame of the national IP Protocol exercise a Framework for Industry Engagement with Public Research and the governance and reporting arrangements within the national technology transfer system was set out. The aim was to provide more clarity for industry when engaging with higher education institutions (HEI).

The 2012 national IP Protocol foresaw the creation of a new central TTO, firstly identified as “cTTO”, then launched as Knowledge Transfer Ireland (KTI). KTI’s overall purpose is to deliver an efficient and productive research and technology transfer system, to make IP and expertise within public research organisations visible for companies, and to act as a central point of contact. It supports the public research organisations’ (HEIs’) research and technology transfer infrastructure and provides services complementary to already existing TTO structures. KTI has an Industry Advisory Board and a Stakeholder Forum that offer advice and share intelligence¹³⁹.

¹³⁹ Danish Council for Research Policy: "International Perspectives on Framework Conditions for Research and Technology Transfer" Pages 31-32: http://ufm.dk/en/publications/2014/danish_council_research_policy_pdfa-1.pdf

At the end of 2015, work was underway to launch a revised national IP Protocol early in 2016. The new Protocol will be consistent with existing policy and will introduce some practical additions to speed up negotiation between industry and research performing organisations.

Ireland put in place several financial measures to support the collaboration between the Irish research base and businesses.

Enterprise Ireland, the government organisation responsible for the development and growth of Irish enterprises has been active since the early 2000s with funding calls tailored for business-research collaborations.

The Innovation Partnership Programme¹⁴⁰, launched in 2001, drives collaboration between industry and academia. The programme encourages Irish-based companies to work with Irish research institutes resulting in mutually beneficial co-operation and interaction. Companies can access expertise and resources to develop new and improved products, processes, services, and generate new knowledge and know-how. The participating company benefits in terms of its growth, the evolution of its strategic research and development and the creation of new knowledge that it can use to generate commercial advantage. The research institute benefits in terms of developing skill sets, intellectual property and publications. The Programme provides grants of up to 80% towards eligible costs of the research project. Funding from Enterprise Ireland will normally not exceed €200 000. The expenditure for Innovation Partnership Programme amounted to €8.5m in 2014 (€7.3m in 2013).

The Commercialisation Fund Programme¹⁴¹ aims to convert the outputs of state funded research into innovative new products, services and companies. The Programme supports researchers in Higher Education Institutions and Research Performing Organisations to undertake research that has the potential to result in the commercialisation of new innovations by way of licenses to improve the competitiveness of Irish Industry or through the spin out of new start-up ventures. A budget of €24m was allocated for 2014.

With Innovation Vouchers¹⁴², available since 2007, SMEs can receive €5 000 vouchers to be spent in higher education institutes in exchange for innovative solutions to small business challenges.

The Technology Gateway¹⁴³ programme, started in 2013 and running until 2018, serves as an open access mechanism for industry to harness technological expertise within the Irish institutes of technology. The current network of 12 Gateways delivers technology solutions for Irish industry close to market needs and acts also as a local access point to the wider resources in the Irish research infrastructure. The programme will fund up to €1.2m in 5 years for each Gateway. The Technology Gateway programme builds on the Applied Research Enhancement (ARE) programme which had served to develop the industry focused technology capability within the Institutes of Technology.

Two other programmes were launched in 2014 targeting R&D projects developed by businesses: the R&D Fund Small Projects and the R&D Fund Standard Projects. The first¹⁴⁴ supports product, process or service R&D projects where the anticipated grant is less than €150 000. This may suit companies undertaking R&D for the first time or companies progressing R&D activity in the business. Among the eligible expenses:

¹⁴⁰ http://www.enterprise-ireland.com/EI_Corporate/en/Research-Innovation/Companies/IPP-Brochure.pdf

¹⁴¹ <http://www.enterprise-ireland.com/en/funding-supports/Researcher/Funding-to-Commercialise-Research/>

¹⁴² <http://www.enterprise-ireland.com/en/Research-Innovation/Companies/Collaborate-with-companies-research-institutes/Innovation-Voucher.shortcut.html>

¹⁴³ http://www.enterprise-ireland.com/EI_Corporate/en/Research-Innovation/Companies/Collaborate-with-companies-research-institutes/Technology-Gateway-Programme.html

¹⁴⁴ <http://www.enterprise-ireland.com/en/Research-Innovation/Companies/R-D-Funding/R-D-Fund-Small-Projects-.shortcut.html>

- Sub-contracted research and design (outsourcing), licensing in and purchase of patents, which are sourced at a fair market price, are eligible costs;
- The loan of qualified personnel (for SMEs only): a person may be seconded from a research organisation or a large enterprise to a SME company. The seconded person must be employed in a newly created function, must work on research, development and innovation activities and must have been employed for at least two years in the research organisation or large enterprise.

The R&D Fund Standard Projects¹⁴⁵ supports projects which have the potential to develop novel products and services with a clear competitive advantage in their target market. This will enable companies to increase employment through sustainable and substantially increased sales. The maximum R&D grant that a company can receive is €650 000. The maximum grant rates for all companies applying to the R&D Fund is up to 50% of the total cost of the project. Grant rates are determined by the size of the company according to the following rule: 45% for small, 35% for medium-sized and 25% for large companies. A collaboration bonus of up to 15% is available for innovative projects where there is collaboration between two companies, but the total maximum funding cannot exceed 50% of the total project cost.

Science Foundation Ireland (SFI) is the Irish national foundation for investment in scientific and engineering research. SFI also "advances co-operative efforts among education, government, and industry that support its fields of emphasis and promotes Ireland's ensuing achievements around the world".

In this frame, the SFI Industry Fellowship Programme¹⁴⁶ aims to facilitate exchanges between academia and industry to stimulate excellence through knowledge transfer and training, thereby building critical mass in areas of strategic importance for Ireland and enabling economic and societal challenges to be tackled. Fellowships enable access for researchers to new technology pathways and standards and facilitate training in the use of specialist research infrastructure. Fellowships can be awarded to academic researchers wishing to spend time in industry worldwide and to individuals from industry anywhere in the world (including Ireland) wishing to spend time in an eligible Irish Research Body. Fellowships can be for between 1 and 12 months in duration if full time or for up to 24 months if part time. The maximum Industry Fellowship award amount is €120,000 direct costs.

The SFI Research Centres Programme,¹⁴⁷ links scientists and engineers in partnerships across academia and industry to address crucial research questions; foster the development of new and existing Irish-based technology companies; attract industry that could make an important contribution to Ireland and its economy; and expand educational and career opportunities in Ireland in science and engineering.

There are currently twelve SFI Research Centres that have been established through an investment of €355m from the Irish Government through SFI and a further €190m from industry collaborators. Over 200 companies are involved in collaborations with the centres.

SFI contributes up to 70% of the overall Research Centre budget, awarding €1-5m per annum in direct costs over a 6 year period. A minimum of 30% of the Centre budget, 10% of which must be cash, must be secured from industry.

The SFI Research Centres are focused on strategic areas of importance to Ireland with a focus on delivering scientific excellence with economic and societal impact - Pharma, Big Data, Medical Devices, Nanotechnology/Materials, Marine Renewable Energy, Food for

¹⁴⁵ Ibid.

¹⁴⁶ <http://www.sfi.ie/funding/funding-calls/open-calls/sfi-industry-fellowship-programme-2015.html>

¹⁴⁷ <http://www.sfi.ie/assets/media/files/downloads/Funding/Funding%20Calls/centres/Research%20Centres%20Programme%20Call%202013.pdf>

Health/Functional Foods, Perinatal Research, Applied Geosciences, Software, Digital Content, Telecommunications and Medical Devices.

The SFI Investigators¹⁴⁸ programme, started in 2011, supports research that has the potential for economic and societal impact. It addresses crucial research questions that expand educational projects and career opportunities in Ireland, in science and engineering and prepare the research community to lead and win in Horizon 2020 and other non-exchequer funding programmes. A budget of €59.5m is allocated for 2014.

The SFI Partnership¹⁴⁹ programme provides a flexible mechanism that supports ambitious research projects of scale between industry and academia. SFI matches the investment provided by industry. The exact contribution that SFI may grant to a specific collaborative initiative and the approach to cost-sharing will be dependent upon the strategic nature of the collaboration and the likely benefits derived for the partners involved and the Irish economy.

The Government in its Budget 2016 followed through on a commitment given in the previous budget to introduce a Knowledge Development Box (KDB) scheme, which will enter into force as of January 1, 2016. The measure provides corporation tax rate of 6.25% (half of the regular corporate tax rate of 12.5%) for certain profits arising to Intellectual Property Assets which are the result of qualifying Research & Development activity carried out in Ireland¹⁵⁰.

Finally, SFI is measuring the impact of its research funding to PROs using also metrics related to the collaborations with industry, thus incentivising such collaborations with public research.

Various Irish Government Departments have been addressing the need to improve the performances of the Irish R&D&I systems with a series of reports and analyses. Since the mid-2000s Ireland has put in place a lot of efforts to improve the framework for cooperation between research and business.

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 costs¹⁵¹.

Ireland shows a very low level of privately-funded public R&D and below-average cooperation patterns of innovative companies with universities and PROs. However, in other areas, like public-private co-publications, Ireland excels compared to the EU-average.

One of the main identified barriers to the collaboration between HEIs/PROs and businesses, especially SMEs, namely the IP framework, has been addressed by the IP Protocol exercise, which set a series of recommendations and led to the set-up of the central TTO, i.e. Knowledge Transfer Ireland.

There is anyway a range of similar schemes supporting collaborative research between business and academia, with the risk of creating duplications.

¹⁴⁸ <http://www.sfi.ie/funding/funding-calls/closed-calls/sfi-investigators-programme-2014.html>

¹⁴⁹ <http://www.sfi.ie/funding/funding-calls/open-calls/sfi-partnerships.html>

¹⁵⁰ Department of Finance (2015), *Financial Statement of the Minister for Finance, Mr. Michael Noonan, T.D.*. Dublin, Ireland. Available from: <http://www.budget.gov.ie/Budgets/2016/FinancialStatement.aspx>

¹⁵¹ RIO Country Report Ireland 2014.

The Irish Academy of Engineering said in its submission to the STI strategy consultation process that anecdotal evidence suggested PhD graduates and post-docs were not moving from academia/research centres into industry in sufficient numbers. The Academy said it was important to actively encourage mobility into the indigenous sector to build absorptive capacity.

5.8 Regulation and innovation

A review of the literature suggests that monitoring the impact of regulations on innovations is not high on the official agenda.

The National Policy Statement on Entrepreneurship in Ireland noted that business regulation could be a barrier to entrepreneurs. It pointed to the fact that the High Level Group on Business Regulation, a standing dialogue of officials, business and union representatives, chaired by the Department of Jobs, Enterprise and Innovation, is responsible for identifying ways of reducing the burden of red tape on business, in all facets and not necessarily innovation. The High Level Group provides a web portal¹⁵² for all key business regulatory compliance issues with a view to help reduce the regulatory burden on the enterprise sector.

5.9 Assessment of the framework conditions for business R&I

The framework conditions that are conducive to encouraging enterprises to invest in research and innovation are largely in place in Ireland. Business expenditure on R&D accounted for 70% of GERD in 2012.

There are a range of direct and indirect support measures available to the business sector in relation to R&I. As pointed out in this Section, Ireland has a 25% R&D tax credit scheme which has been enhanced on a regular basis since its introduction in 2004 and the uptake of the tax credit has grown significantly. The Government has announced that it will introduce a Knowledge Development Box scheme in 2016 in which eligible companies that undertake R&D in Ireland will be able to reduce their corporate profits tax rate by 50%.

The enterprise development agencies, Enterprise Ireland and IDA Ireland, provide a range of direct supports to enterprises in relation to R&I activities. These measures provide financial assistance and other supports for in-house research and also for developing linkages with knowledge providers in the higher education institutions and the public research organisations. In 2014, Enterprise Ireland provided €110.6m in direct R&I supports while IDA Ireland, the state agency in charge of inward investment, provided approximately €60m in the form of R&I grants.

The OECD in its 2013 economic review¹⁵³ pointed to the large number of R&I support schemes and suggested they should be rationalised. The business representative organisations have also suggested that there are the plethora of research centres established with SFI and EI funding seeking to carry out research activities with companies.

The National Directory of Research Centres 2015, published by the Department of Jobs, Enterprise and Innovation (DJEI) includes substantial detail on all research and technology centres of scale. The Directory of Innovation Supports, Research Centres and Technology Centres 2016, published last December by DJEI, expands on the 2015 Directory to include the key financial R&D supports available to companies and detail on how companies can access these supports.

One of the main difficulties facing the enterprise sector is in relation to access to finance. Though there have been a number of Government-initiated support measures to address the issue, recent studies indicate that SMEs encounter problems in accessing credit.

¹⁵² businessregulation.ie

¹⁵³ Op. Cit.

6. Conclusions

6.1 Structural challenges of the national R&I system

The Innovation Union Scorecard 2015 shows Ireland as an “innovation follower”, whose innovation performance is above the EU average and has improved since 2014.

Of the structural challenges and weaknesses faced by the Irish R&I sector, some have been evident for some time while others are of a more recent nature. These challenges are the focus of the new STI strategy, Innovation 2020, and of the new enterprise strategy, Enterprise 2025¹⁵⁴, of which it forms an integral part.

Dual nature of the Irish enterprise sector

As mentioned earlier in the report, Ireland has an enterprise sector that comprises, on one hand, a small number of large FDI companies operating in medium and high technology sectors who are almost exclusively export oriented and, on the other hand, a large number of small and medium sized indigenous enterprises operating in a wide variety of low to medium technology sectors, some of whom are focused on the domestic market and some of whom are focused on both domestic and export markets.

Data published by the Central Statistics Office (CSO)¹⁵⁵ show that foreign owned enterprises accounted for approximately two-thirds of all R&D expenditure in 2013, with just over €1.2b being spent on current expenditure which represented 93% of all expenditure of foreign owned enterprises. The remaining 7% or €90m was spent on capital expenditure. Irish owned enterprises in comparison spent just over €0.7b on R&D with current expenditure at €645m accounting for nearly 92% of this expenditure. The remaining 8% or €58m was spent on capital expenditure.

The largest 100 enterprises in terms of R&D spend accounted for 70% of BERD in 2013. Of these top 100 enterprises, 80% of the spend can be attributed to foreign owned enterprises.

FDI firms are responsible for the development of a significant amount of new intellectual property. Despite the patent performance of overseas companies has been decreasing since 2008, still almost 40% of the patents filed in Ireland over the 2009-2011 period accounted for by foreign-owned enterprises.

Official data shows, however, that over half (54%) of FDI companies based in Ireland are not engaged in any R&D activities.

A report published by the Department of Jobs, Enterprise and Innovation (DJEI, 2015)¹⁵⁶ indicated that a commonly given reason for the non-R&D activity among FDI companies is that their Ireland-based managers do not hold decision-making powers with respect to R&D&I, which are, for the most part, controlled outside Ireland. As a consequence, these companies were more likely to have pre-existing/incumbent R&D sites and other sites acting as internal ‘competitors’ for future investment.

The R&I structural challenges arising from indigenous companies are of a different order. Here the challenges are to grow the numbers of exporting SMEs that innovate. Research has indicated that indigenous companies have a low technology absorption capacity and have low awareness of formal methods for protecting their intellectual property.

¹⁵⁴ <https://www.djei.ie/en/Publications/Enterprise-2025.html>

¹⁵⁵ Central Statistics Office (2015), *Business Expenditure on Research and Development 2013-2014*, CSO Statistical release. Available from the CSO web site:

<http://www.cso.ie/en/releasesandpublications/er/berd/businessespenditureonresearchdevelopment2013-2014>

¹⁵⁶ Department of Jobs, Enterprise and Innovation (2015), *Optimising Policy Intervention to Strengthen the Impacts of Enterprise RD&I in Ireland*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Publication-files/Optimising-Impacts-Enterprise-RDI.pdf>

The Medium Term Economic Strategy¹⁵⁷ (DOF, 2014) stressed the need for indigenous SMEs 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. Business representative organisations have highlighted weaknesses in the innovative capacity in particular of service enterprises.

The lack of access to finance for R&D&I is a challenge faced by indigenous enterprises. This difficulty is reflected in Innovation Union Scoreboard results which show this to be a dimension where Ireland performs less well compared with the EU average and against comparator countries. Ireland's performance on "Finance and support" is 67% of the EU28 average, with Venture capital investments being 80% of the EU average; R&D expenditures by the business sector are closer to the EU28 average at 88%, implying that while there is an appetite from firms for making investments, the availability of appropriate risk and innovation funding is less positive¹⁵⁸.

Weak linkages within the R&I system

Enterprise 2025, the national enterprise strategy, states that although progress has been made, there remains considerable scope to increase the number of enterprises engaging with and the level of engagements with research institutes. The strategy acknowledges the challenges faced in stimulating increased interaction and collaborations between SMEs and the research infrastructure. SMEs often experience challenges, both managerial and capacity-wise, to fully engage with knowledge providers in the publicly-funded research system and to absorb new innovations into the business.

Funding by the enterprise sector of research performed in the higher education sector is low in Ireland compared to EU averages; in 2014, the enterprise sector accounted for 2% of the funding of the research performed by the higher education sector in Ireland while the equivalent EU28 statistic (for 2013) was over 6%. An OECD research paper¹⁵⁹ shows relatively low levels of multinationals in Ireland reporting links to the higher education sector.

The OECD paper also noted that the share of Irish owned enterprises engaged in any type of innovation cooperation with outside partners (government, higher education, other firms) was below that of foreign-owned firms and below the EU medians for their counterparts.

Concerns have been expressed by representative organisations such as IUA and IBEC as a result of the potential disconnect between the type of R&I activities being undertaken in the enterprise sector which are primarily driven by market forces and the research being carried out in the HEI/PRO sector which is significantly influenced by the National Research Prioritisation Strategy. While the prioritisation strategy was developed following an extensive consultation process with industry the Irish University Association noted in its submission to the STI strategy consultation process¹⁶⁰ that there was a concern that its subsequent implementation has largely focused on issues and processes internal to the publicly-funded research eco-system.. Direct and indirect support measures for industry are not covered by the research prioritisation strategy. The review of the NRPS noted that progress in two of the 14 Action Areas, Manufacturing Competitiveness and Innovation in Services and Business Processes, had lagged behind the other priority areas. It pointed out that there was no SFI research centre dedicated

¹⁵⁷ Department of Finance (2013), *A Strategy for Growth: Medium-Term Economic Strategy 2014-2020*. Available at: <http://mtes2020.finance.gov.ie>

¹⁵⁸ Innovation Union Scoreboard 2015 (page 51): http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015_en.pdf

¹⁵⁹ Haugh, D. (2013), *"From Bricks to Brains: Increasing the Contribution of Knowledge-based Capital to Growth in Ireland"*, OECD Economics Department Working Papers, No. 1094, OECD Publishing. Available from: <http://dx.doi.org/10.1787/5k3wd358lj8r-en>

¹⁶⁰ Op. Cit.

to either area despite the fact that they underpinned two of the most important activities in the Irish economy.

Commitment of the public sector investments in R&D

The Innovation 2020 strategy document points out that direct public spending on R&D in Ireland fell from a peak of €930m in 2008 to €722m in 2013 (a reduction of 22%), and although it is now slowly recovering, Ireland is still behind leading international comparator countries.

Another challenge in respect of public R&D funding is to increase the provision of investment funding in research infrastructures, particularly in terms of finding a successor programme for the Programme for Research in Third Level Institutions.

Human capital

Ireland has traditionally scored highly in relation to a range of STI human capital development indicators. However, there are structural issues relating to the development of a comprehensive researcher careers framework. Funding constraints and employment arrangements within HEIs present difficulties for early to mid-career researchers in pursuing career opportunities within the publicly-funded research sector. Innovation 2020 is seeking to have these issues addressed, via, for example, the new IRC Frontiers Programme.

More recently, the available data indicates a decline in the number of students registering for Masters and PhD programmes within the university sector.

Other issues

The issue of R&I systems governance has come to the fore following the standing down of the Advisory Council for Science, Technology and Innovation and the incorporation of the policy unit of Forfás, the policy advisory board for Enterprise, Trade, Science and Innovation, into the Department of Jobs, Enterprise and Innovation. With the dissolution of these two bodies, the formal channels for key systems stakeholders, particularly the enterprise sector, to provide independent R&I policy advice inputs to Government has been removed. The review of the National Research Prioritisation Strategy noted that there were no representatives from the enterprise sector, the investment community or the research performers on the Prioritisation Action Group. It said that these stakeholders had no formal involvement in the research prioritisation strategy since the publication of the Research Prioritisation Steering Group report in 2012. Innovation 2020 commits to convening fora on a regular basis to obtain feedback from industry, academia and civil society on implementation of various policies. A stakeholder group will be established to examine the continuing relevance of the 14 priority areas (now grouped under six thematic areas) identified under the National Research Prioritisation Exercise and advise on future priorities.

Overview

Ireland is ranked 8th in the Innovation Union Scoreboard, 2015, up one place on the previous year. In the Innovators dimension of the IUS 2015, which looks at innovation in SMEs, Ireland was in lead position.

Dual nature of enterprise sector

FDI	54% of foreign owned enterprises do not do any research Falling patent performance
Indigenous	Low capacity to innovate/absorb technology/innovation Low awareness of value of IP protection

Weak linkages between industry and knowledge providers/producers

- Low knowledge spill overs
- Disconnect between industry R&D activities and 14 Prioritisation Action Areas

- Concern over innovation capacity of services enterprises

Public funding for R&D

- Reverse decline in public spending for R&D
- Increase investment in research infrastructures

Demand-side policies and innovation procurement initiatives

- Cautious approach to use of innovative public procurement

Human capital

- Researcher career framework
- Falling numbers of Masters/PhD students

Other issues

- Lack of independent STI policy analysis and advice input.

6.2 Meeting structural challenges

Addressing the structural weaknesses in the Irish R&I system is currently being pursued through a multi-faceted, multi-policy mix approach. The new Innovation 2020 strategy and the enterprise strategy, Enterprise 2025, continue this comprehensive policy systems approach with an increased focus on whole-of-government governance structures.

The Innovation 2020 strategy has been influenced by a number of reports commissioned by the Department of Jobs, Enterprise and Innovation. One such report on how to optimise policy intervention to strengthen the impacts of enterprise RDI which suggested that while Ireland's policy mix was broadly in line with comparator countries, Irish policy-makers needed to increase the focus on commercialisation and translation of research and to take a wider view of innovation beyond R&D. The report also recommended that Ireland should further exploit opportunities for enterprises in societal challenge areas. Additionally, it stressed the importance of developing new ways to create linkages between enterprises and the science base and of doubling the number of researchers in the enterprise sector.

Following on from a recommendation in the review of the National Research Prioritisation Strategy, the Innovation 2020 strategy says that a market-led horizon scanning exercise will be undertaken in order to identify strategic areas of commercial opportunity in global markets for Irish-based enterprises as the basis for the next cycle of research prioritisation which is due in 2018.

Innovation 2020 takes cognisance of the need to integrate research strategies for societal objectives and for economic objectives to form a stratified set of national priority areas: areas in which Ireland intends to become a world-leader; areas needed to support key societal goals; and areas where it would be prudent to maintain capacity in anticipation of future opportunities.

Attracting FDI projects with an R&D component to Ireland and incentivising existing foreign companies in Ireland to carry out or to increase their R&I activities are important national priorities.

Developing linkages among key actors within the R&I system has long occupied policy-makers. A key policy response has been the development of SFI-funded HEI-based research centres which seek to encourage research collaboration between industry and knowledge producers in the higher education sector (a legacy of Ireland's late R&I development is an under-developed PRO sector though Teagasc, the agriculture and food development authority, is an exception to this in the agri-food sector). Thinking in relation to research centres continues to evolve and now the policy focus is on a smaller number of large-scale centres where industry not only co-funds but also has can have a

key influence in directing the research agenda. The Enterprise Ireland funded Technology Centres programme is focused on mid Technology Readiness Level (TRL) R&D. The Centres are formed around an agreed common research programme for a number of companies. As with the SFI Research Centres the companies working with the technology centres are expected to match the State investment with cash and cash in kind co-funding. The Directory of Innovation Supports, Research Centres and Technology Centres 2016¹⁶¹ contains detail on the research work taking place in all SFI and Enterprise Ireland centres as at December 2015. A study commissioned in 2015 by the Department of Jobs, Enterprise and Innovation highlighted the need for research centres to focus more on applied research areas and in upper-middle and high Technology Readiness Levels and in short-term applied and contract research.

The Innovation Voucher scheme has been successful in encouraging small companies to develop links with knowledge providers in the HEI and PRO sector. The IRDG believes there is potential scope for increasing the funding provided under the Innovation Voucher scheme (currently €5,000 per project) to cover larger knowledge/tech transfer projects.

Although it is too early to assess the effectiveness of these recent measures, the regular reporting by KTI using knowledge transfer metrics and indicators (including the subjective assessment provided by businesses) will allow monitoring the progress of business-academia cooperation in Ireland in the coming years.

The introduction of employer-based Masters and PhD programmes funded by the Irish Research Council have a number of desired outcomes, one of which is the development of key technical skills within indigenous companies, and thus may also assist to increase their capacity to absorb new technologies.

Increasing awareness among companies — particularly indigenous companies — of the value of protecting their Intellectual Property is a key policy objective. A report published by the Department of Jobs, Enterprise and Innovation in 2015 recommended the establishment and implementation of a national IP statement that would take a holistic view of IP, and the creation of an IP champion to raise awareness of IP among the enterprise sector.

Attention continues to be placed on how the R&I policy framework can assist service companies to enhance their innovation capacity. Business services are one of the 14 research prioritisation areas and a review of support measures in this area found that there was no single off-the-shelf good practice approach that Ireland could adopt but rather that a country-specific approach was needed, taking account of existing R&I supports and company needs and building on an integrated portfolio approach comprising business and applied RDI; research programmes; clusters/networks; and policy and strategy supports. The Innovation 2020 strategy places particular importance on innovation in services given the importance of the service sector to the Irish economy as does Enterprise 2025.

As indicated in the National Reform Programme, the Government adopted an R&D intensity target for Ireland of 2.5% of GNP (2.0% of GDP), to be achieved by 2020. Within this was a commitment to renewing the pattern of annually increasing public investment in R&D from 2014 onwards. The Innovation 2020 strategy pledges that Ireland will increase public investment in R&D, which will in turn leverage increased private investment in order to reach the 2.0% GDP target by 2020.

The Innovation 2020 strategy also points to the importance of innovation in the public sector and notes that Enterprise Ireland in collaboration with the Sustainable Energy Authority of Ireland and the ESB launched Ireland's first SBIR programme focusing on the development of smart solutions for charging electric vehicles in communal parking.

¹⁶¹ <https://www.djei.ie/en/Publications/Publication-files/Directory-of-Innovation-Supports-Research-Centres-and-Technology-Centres-2016.pdf>

The document said Ireland would explore the potential for extending SBIR initiatives to other areas, including health.

Efforts to develop a researchers career framework have been resurrected by the relevant stakeholders in the higher education sector. A number of funding schemes have been put in place to tackle the difficulties faced by early to mid-career researchers. Innovation 2020 includes a commitment to develop a clear career structure for researchers involved in innovation, and there is also an affirmation to promote gender equality in researcher careers.

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Abbreviations

BERD	Business Expenditure on R&D
BMW	Border, Midlands and Western Region
CSO	Central Statistics Office
DEPR	Department of Expenditure and Public Reform
DES	Department of Education and Skills
DIT	Dublin Institute of Technology
DJEI	Department of Jobs, Enterprise and Innovation
DOF	Department of Finance
ECB	European Central Bank
EI	Enterprise Ireland
EIP	European Innovation Partnership
ERC	European Research Council
ESFRI	European Strategy Forum on Research Infrastructures
FDI	Foreign Direct Investment
FTE	Full Time Equivalent
GBAORD	Government Budget Appropriations and Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Expenditure on R&D
GNP	Gross National Product
GOVERD	Government Expenditure on R&D
HRB	Health Research Board
H2020	Horizon 2020
HEA	Higher Education Authority
HERD	Higher Education Expenditure on R&D
IMF	International Monetary Fund
IOTI	Institutes of Technology Ireland
IP	Intellectual Property
IRC	Irish Research Council
IRDG	Industry Research and Development Group
IRO	International Research Organisations
ISCA	International Strategic Cooperation Award
ISIF	Ireland Strategic Investment Fund
IUA	Irish University Association
IUS	Innovation Union Scoreboard
JEC	Joint Economic Commissions
KDB	Knowledge Development Box
KTI	Knowledge Transfer Ireland
NPRF	National Pension Reserve Fund
NRP	National Reform Programme
NRPS	National Research Prioritisation Strategy
NUTS	Nomenclature of Territorial Units for Statistics/Nomenclature des unités territoriales statistiques
OA	Open Access
OECD	Organisation for Economic Co-operation and Development
QQI	Quality and Qualifications Ireland
R&D	Research and Development
RDI	Research, Development and Innovation
R&I	Research and Innovation
RI	Research Infrastructures
RIS	Research and Innovation Strategy
RPAG	Research Prioritisation Action Group
RTO	Research Technology Organisation
SAEI	Small Advanced Economies Initiative
S&E	Southern and Eastern Region
SBIR	Small Business Innovation Research
SFI	Science Foundation Ireland
SSTI	Strategy for Science, Technology and Innovation
STI	Science, Technology and Innovation
TRL	Technology Readiness Levels
VC	Venture Capital
WEF	World Economic Forum

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Annex 1 – List of the main research performers

List the top 10 R&D performers (public based on publications & private sector based on R&D expenditures)

The main research performers in the Higher Education Sector are:

Trinity College Dublin
University College Dublin
University College Cork
National University of Ireland Galway
University of Limerick
Dublin City University
Maynooth University
Dublin Institute of Technology
Athlone Institute of Technology
Institute of Technology, Blanchardstown
Institute of Technology Carlow
Cork Institute of Technology
Dundalk Institute of Technology
Dun Laoghaire Institute of Art, Design and Technology
Galway-Mayo Institute of Technology
Letterkenny Institute of Technology
Limerick Institute of Technology
Sligo Institute of Technology
Institute of Technology Tallaght, Dublin
Institute of Technology Tralee
Waterford Institute of Technology
Dublin Institute for Advanced Studies
Royal College of Surgeons in Ireland

The main Public Research Organisations are:

Teagasc, the agriculture and food development authority
Department of Communications, Energy and Natural Resources
The Marine Institute
The Health Research Board
Department of Agriculture, Food and the Marine
The Economic and Social Research Institute
Inland Fisheries Ireland
Dublin Institute for Advanced Studies

R&D performing companies in the private sector:

The EU Industrial R&D Investment Scoreboard for 2014 indicates that Ireland accounted for 17 of the top 2,500 R&D performing companies in the world.

The publication identified the following Irish-based R&D performing companies:

Seagate Technology

Accenture

Eaton Corporation

Actavis

Covidien

Kerry Group

Ingersoll Rand

Elan

Mallinckrodt

Alkermes

Pentair

King Digital Entertainment

Bank of Ireland

Allied Irish Banks

Annex 2 – List of the main funding programmes

Name of the funding programme	Timeline	Budget	Target group
Enterprise Ireland: R&D Fund	2014	€24.5m	Enterprises
Enterprise Ireland: Technology Centres	2014	€20m	Enterprises/HEIs
Enterprise Ireland: Commercialisation Fund	2014	€22.3m	Academic researchers
Enterprise Ireland: Innovation Partnership	2014	€8.5m	Enterprises/HEIs
Enterprise Ireland Technology Gateways	2014	€3.1m	Enterprises/HEIs
Enterprise Ireland Innovation Voucher	2014	€3.2m	Enterprises
Enterprise Ireland Technology Transfer Strengthening	2014	€6.1m	Enterprises
IDA Ireland: R&D Programme	2014	€60m	FDI enterprises
Science Foundation Ireland Investigators Programme	2014	€46.6m	Academic researchers
Science Foundation Ireland Research Centres	2014	€44.9m	Academic researchers
Science Foundation Ireland Centres for Science, Engineering and Technology	2014	€25.0m	Academic researchers
Science Foundation Ireland Technological Innovation Development Award	2014	€7.1m	Academic researchers
Science Foundation Ireland Strategic Research Clusters	2014	€5.6m	Academic researchers
Science Foundation Ireland Starting Investigator Research Grant	2014	€5.0m	Academic researchers
Science Foundation Ireland Career Development Award	2014	€3.5m	Academic researchers

(Sources: Enterprise Ireland, Science Foundation Ireland, Department of Jobs, Enterprise and Innovation)

Annex 3 – Evaluations, consultations, foresight exercises

The Department of Jobs, Enterprise and Innovation has commissioned the following evaluations/reviews:

- Review of the National Research Prioritisation Strategy
- Review of Ireland’s membership of international research organisations
- Analysis of the market-focussed element of the Irish research centres landscape in order to identify gaps and opportunities to ensure an internationally competitive market-focussed research centre landscape
- Study of the reasons why indigenous companies are not generating higher returns from their R&I investment

These reviews/evaluations have not yet been published but may be released following the launch of the new STI strategy document.

The Department has published the following consultation documents/reviews:

- Consultation Paper For Successor to Strategy for Science, Technology and Innovation (Inter-Departmental Committee on Science, Technology and Innovation)
- Evaluation of State Supports for Enterprise: Synthesis Report and Conclusions
- Enhancing the IP activities in the firm base in Ireland

Despite increases in business expenditure on Research, Development and Innovation (RDI) in recent years, the RDI performance of the enterprise base in Ireland is still below selected comparator countries. A research report¹⁶² published by the Department of Jobs, Enterprise and Innovation in December 2015 on optimising the impacts of enterprise RDI indicated the need to increase linkages between the science base and the enterprise sector and the number of researchers in industry. It also said there was potential for Ireland to enhance services innovation and to exploit opportunities for enterprises in societal challenges areas. Increasing public policy focus on commercialisation and translation of research was also recommended.

The report noted that while BERD had been increasing in Ireland¹⁶³, the enterprise-related targets included in the previous STI strategy, the Strategy for Science, Technology and Innovation 2006-2013, had not been fully achieved. The report stated that an internal review of Ireland’s STI performance by Forfás in 2013¹⁶⁴ indicated that while good progress had been made in relation to BERD it still lagged the improvements made within the public research system. For example, progress towards the targets set for the number of companies with minimum and significant scale R&D, and business expenditure by indigenous companies and by foreign owned companies was slower than envisaged.

The report concluded that Ireland’s experience to date suggested that the objective of creating capacity in the enterprise base was a greater challenge than building the science base.

¹⁶² Department of Jobs, Enterprise and Innovation (2015), *Optimising Policy Intervention to Strengthen the Impacts of Enterprise RD&I in Ireland*, Dublin, Ireland. Available from: <https://www.djei.ie/en/Publications/Publication-files/Optimising-Impacts-Enterprise-RDI.pdf>

¹⁶³ The report stated that BERD in Ireland rose from 0.93% of GNP in 2003 to an estimated 1.47% of GNP in 2012.

¹⁶⁴ Forfás (2013), *Data Review of RDI in Ireland*, May. Internal Working Document.

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doi:10.2791/133745

ISBN 978-92-79-57812-0

