



Maximising the Environment for Company Research and Development

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Advisory Council for Science
Technology and Innovation
An Comhairle Eolaíochta

Foreword

With the current national focus on developing Ireland into a Smart Economy, this report from the Advisory Council on Science Technology and Innovation on maximising the environment for company research and development (R&D) is very timely and much welcomed.

Following over a decade of sustained State investment in building R&D capability and capacity in higher education institutions (HEIs) and public research organisations (PROs) it is now appropriate that there is an increased focus on reaping economic return on this investment. Business Expenditure on R&D (BERD) is a measure of the level of enterprise engagement in R&D, and this indicator is strongly linked to economic growth. Companies that engage in R&D develop new production processes, improved quality of output and new goods and services and this leads to benefits to the companies themselves and also to the national economy.

Whilst our national BERD has been growing over the past decade Ireland must be proactive in providing an environment that enterprise considers conducive to further increasing the levels of R&D activity. The environment for company R&D in Ireland must be competitive in key areas relative to other locations, including; R&D skills, cost of R&D, relevancy and quality of R&D being carried out in HEIs and PROs and access to and handling of intellectual property. In developing the environment for company R&D, Ireland must look to offer an R&D environment that is attractive to its indigenous base (large enterprises, small-medium enterprises and start-ups), the foreign direct investment companies currently based here, and also to potential new inward investment in R&D from global companies.

It is now very timely to take stock of the key barriers that inhibit companies from engaging in R&D and to develop recommendations on how the State systems can be fine tuned to remove these barriers and maximise the potential for increased levels of BERD. This report clearly identifies the key barriers that require attention in order to encourage increased levels of R&D across the gamut of company activities within the enterprise base. The recommendations have been fully considered with the awareness of the current economic situation in which Ireland finds itself and can be acted on forthwith.

The report also highlights specific barriers encountered in our top industry sectors which are causing a hindrance to increased levels of R&D to the associated enterprises. A series of recommendations is set out to address these sector specific challenges.

I wish to acknowledge the significant level of work that has been undertaken by the Council in producing this report. In particular, I would like to thank Dr. Sean Baker who chaired the task force on this topic, along with his fellow task force members and supporting team for the extremely useful work that they have carried out.

I would also like to thank the many representatives from industry, and the public sector who assisted the Council with their deliberations in this study.

Execution of the recommendations contained within this report will be of the utmost importance in encouraging companies to increase their R&D activities in the future with a subsequent positive effect on the national economy. As such, I support the call for the appropriate stakeholders to take action to implement these recommendations accordingly.

A handwritten signature in black ink on a light blue background. The signature is cursive and appears to read 'Conor Lenihan'.

Conor Lenihan TD
Minister for Science, Technology & Innovation



Chairman's Statement

I am very pleased to present this report which focuses on key barriers that are inhibiting enterprise from further increasing their levels of research and development (R&D). The report identifies three barriers; a shortage of high quality industry relevant skills, the high cost of undertaking R&D activity, and the effectiveness of the interactions between higher education institutions and enterprise. The work of the task force and the report has been informed by a wide-ranging consultation process with industry, industry groups and development agencies.

High quality graduates with R&D skills and knowledge in areas of research relevant to existing industry and growth areas for future industrial development will be essential if the country is to derive an economic impact from State investment in R&D. The Council recommends that the approach to developing these skills involve; greater involvement of industry in developing postgraduate programmes, attraction of R&D leaders to work in industry in Ireland, and the promotion of existing IDA training schemes aimed at facilitating the acquisition of R&D training abroad.

In order for Ireland to be considered a location of choice for enterprise R&D it is imperative that Ireland, among other things, competes on cost of R&D. The Council recommends that companies be allowed to offset the R&D tax credit against payroll costs in order to encourage foreign companies to invest in R&D in Ireland. The Council also recommends that the impact of using 2003 as the base year for the R&D tax credit be investigated to determine if it acts as a deterrent to investment in Ireland as compared with other countries.

The Council believes that there is a need for innovation to drive interaction between higher education institutions and enterprise. This report identifies two areas in need of development; the ease and speed in exploiting intellectual property arising from publicly funded research for local benefit where possible and the facilitation of dual academic-enterprise career structures.

In addition to these generic barriers this report also identifies sector specific barriers in five of the leading industry sectors that invest in R&D.

I would like to thank Dr Sean Baker and the members of the task force which he led for their deliberations on this topic and for their time and effort in producing this report. I would also like to thank the representatives from industry and the development agencies for sharing their perspectives. Research support for the study was provided by Forfás and I would like to thank the Secretariat for their input.



Dr. Tom McCarthy, Chair of the Advisory Council for Science, Technology and Innovation

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Executive Summary

As Ireland focuses on developing into a ‘Smart Economy’, there is a need to continue placing significant emphasis on encouraging the enterprise base to invest in research, development and innovation (RD&I) activities. Investment in RD&I increases the stock of knowledge and the use of that knowledge for new applications. This results in new goods, new processes and new services, and therefore, investment in RD&I is a major driver of technical change, productivity growth and overall economic progress.

Business expenditure on research and development (R&D) in Ireland was over €1.6 billion in 2007, accounting for two-thirds of the total R&D spend in the Irish economy. R&D spending in real terms in the business sector has nearly tripled in the last decade. Business Expenditure on R&D as a percentage of GNP in Ireland was 1.03 % and 0.88% as a percentage of GDP in 2007. However, while Ireland’s business expenditure on R&D has been growing strongly (a 78% increase between 2001 and 2007, from €900m to €1.6bn) it still lagged below the 2007 EU15 and OECD averages of 1.2% and 1.6% of GDP respectively, and thus Ireland must continue to drive for increased investment in R&D by enterprise.

Internationalisation of R&D provides considerable opportunities for companies to access new pools of talent, to drive down costs and to access new markets. With the significant number of foreign direct investment (FDI) companies already based in Ireland, we are in a strong position to compete for global investments in R&D. However, to win such R&D investments, Irish based subsidiaries of multinational companies must be able to offer an environment for company R&D that is globally competitive in terms of human capital, infrastructure and cost. In addition, the environment for company R&D must also be attractive to the indigenous company base in order to retain investments in business R&D and grow new investments by this cohort within the country.

The Advisory Council for Science, Technology and Innovation appointed a task force to identify a small number of key barriers that are inhibiting companies from engaging in R&D; this included identifying overarching barriers that affect all industry sectors and also sector specific barriers for key industry sectors in Ireland. Information, views, opinions and perceptions provided by both indigenous and FDI companies were used as the primary source of input to the study. Further inputs to the study were received from industry representative groups, Enterprise Ireland (EI), the Industrial Development Agency (IDA), the Department of Enterprise Trade and Employment (DETE), Science Foundation Ireland (SFI), the Higher Education Authority (HEA), the Department of Education and Science (DES), and the National Public Procurement Unit in the Office of Public Works.

A number of issues were consistently raised throughout the consultation process, and both overarching and key sectoral barriers were identified by the task force. These overarching barriers apply to both FDI and indigenous companies, while some of the sectoral issues are more relevant to indigenous companies or FDI companies.



Three overarching barriers have been identified as critical factors impacting negatively on levels of company R&D in Ireland. These are (in order of impact):

1. A shortage of high quality industry relevant skills
2. The high cost of R&D and
3. The effectiveness of higher education institutions - enterprise interactions

A series of recommendations is put forward in this report to help remove these barriers. The first seven recommendations are overarching across all industry sectors and the remaining eight are industry specific. It is noted that some of the recommendations that have been associated with a specific sector are more generally applicable and will in fact have an impact across multiple sectors when implemented. Each such recommendation has been assigned to the sector that raised the corresponding issues as a priority for its industry.

It is the view of the Council that implementation of these recommendations will lead to an improved environment for business R&D as a consequence of an increased supply of industry relevant R&D talent, reduced R&D project costs for both FDI and indigenous companies, and more effective interactions between enterprise and higher education institutions (HEIs).

It is also noted that the findings from this study were provided as an input for the deliberations of the Innovation Taskforce.

Recommendations

Barrier 1: A Shortage of High Quality Industry Relevant Skills

Recommendation 1

There should be greater involvement of industry in developing postgraduate programmes. To achieve this, the following actions should be taken:

- Prioritise some of the 4th level funding from PhD programmes towards the development of industry driven Masters programmes.
- Support the development of World Class Masters programmes that are industry relevant, sector specific, and in which industry is engaged. The awards received should distinguish the graduates as the highest quality Masters students for industry relevant R&D. The effective implementation of this recommendation will require attention on how to attract the best students to these courses, and bursaries will probably be required to achieve this.

Responsibility: *Inter Departmental Committee for Science, Technology and Innovation (DETE and DES/HEA), SFI, IRCSET*

- Develop Industrial Postgraduate Programmes, building on the model of the Danish Industrial PhD programme.

Responsibility: *HEIs, DES/ HEA with input from enterprise agencies*

Recommendation 2

Develop a competitive financial incentive to attract industrial R&D leaders to work in enterprise in Ireland. To achieve this, the following actions should be taken:

- Review tax incentives used in other countries to attract industrial leaders in R&D (including Belgium and Singapore).
- Develop a competitive model for Ireland.
- Promote the model to both IDA and Enterprise Ireland clients.

Responsibility: *DETE, IDA, Enterprise Ireland*

Recommendation 3

- Promote the aspects of the current IDA training scheme that provide financial support for staff of Irish subsidiaries of multinational companies to travel abroad for training in RD&I.

Responsibility: *IDA*

Barrier 2: The High Cost of R&D

Recommendation 4

Allow profit and loss making companies the option to offset their R&D tax credit against payroll taxes.

The rules for this R&D tax credit system should:

- Allow companies¹ to elect whether they use the R&D tax credit to reduce corporation-tax, or the tax associated with payroll costs by taking account of the R&D tax credit 'above the line'.
- Be simple and straight forward, so that it can be dealt with as part of normal accounting practice.
- Be timely in relation to issuing of cash refunds.
- Be clearly communicated to companies, and allow a longer timeframe for companies to understand and take necessary actions in relation to their financial planning for R&D.

Responsibility: *Department of Finance*

Recommendation 5

Investigate the impact on companies of the 2003 base year for R&D tax credits, and address the issue for companies where it puts them at a special disadvantage compared to doing R&D in other countries.

Responsibility: *Department of Finance*

Barrier 3: The Effectiveness of Higher Education Institutions - Enterprise Interactions

Recommendation 6

In negotiating IP² contracts the HEI Technology Transfer Offices should prioritise the exploitation of IP toward the long term strategic benefit to the country (for example, the use of technology transfer deals to create clusters of companies closely associated with research groups in the HEI, the more rapid commercialisation of research, and the development of stronger companies in the local economy). While the Council is not calling for the IP to be given away pro bono, it does recognise the need to ensure that technology created out of state funded research is transferred to local benefit where possible and that this transfer must be quick and at reasonable cost.

Responsibility: *DETE*

¹ Profit making and loss making companies

² Intellectual Property

Recommendation 7

Increase the incentives and opportunities for connecting people from enterprise and academia:

- Independently review the output of the current Enterprise Ireland 'Enterprise Innovation Networks' pilot programme and expand it if the initiative is meeting its goals.

Responsibility: Enterprise Ireland

- HEIs to include industrial engagement as an important criterion for recruitment and promotion of academic/research staff. The HEA to explore mechanisms to encourage and enable this to happen.

Responsibility: HEIs, HEA

- At an institutional level and based on a strategic plan, HEIs should select suitable departments within which a number of academics have dual job roles - split between enterprise and academia. The HEA to explore mechanisms to encourage and enable this to happen.

Responsibility: HEIs with input from stakeholder agencies and industry, HEA

Sector Specific Barriers

Food

Recommendation 8

Reduce the complexity of State support for R&D in the food industry by:

- Urgently addressing the issues of fragmentation in State support for R&D in the food industry. This should be addressed through consolidation, and improved co-operation and coordination between the bodies providing State support for R&D in the food sector. The effect of changes in the public system for providing food R&D supports should be monitored and further changes should be made until a working system is in place.
- Streamlining the policy and funding priorities for food R&D supports by introducing a centralised decision making mechanism.

Responsibility: Interdepartmental Committee for Science Technology and Innovation

Medical Devices

Recommendation 9

Prioritise implementation of the actions in the Health Research Group Action Plan to establish:

- A centralised device Ethics Committee, with appropriate insurance for its board members.
- A system that allows parallel approval through the Irish Medical Board and the Ethics Committee.

Responsibility: Health Research Group

Software

Recommendation 10

Undertake a review of the supports available, within the context of the State Aid Rules, to companies to help them take the next steps in their market development based on the opportunities identified in the Business Acceleration Programme.

Responsibility: Enterprise Ireland

Recommendation 11

IDA and Enterprise Ireland to work actively together to initiate linkages between multinational and indigenous companies:

- In a pilot phase, select two indigenous companies that are looking to engage with MNCs³ and work closely with these to identify routes/opportunities for achieving a commercial outcome.
- Based on the learning from these engagements, put in place a more formal set of guidelines/schemes/programmes, and roll these out to a wider set of companies.

Responsibility: Enterprise Ireland and IDA

Recommendation 12

Put emphasis on the implementation of the public procurement guidelines and add the next level of detail to ensure that public contracts are indeed accessible to SMEs⁴, by:

- Provision of training for public procurement officers on working with SMEs.
- Working closely with a number of industry bodies, across different industry sectors, to determine best practice to ensure that Irish SMEs do business with government departments and agencies.
- Putting particular focus on a small group of departments and agencies to test and implement this best practice.
- Auditing of the readiness for innovative procurement within each department and agency, and actions put in place to move each to an acceptable level.
- Ensuring that there aren't incentives in the system preventing SMEs winning tenders - such as comfort/familiarity with existing large system integrators or potential punishment for taking risks.

Responsibility: National Public Procurement Operations Unit in the Office of Public Works (implementation), Procurement Innovation Group - DETE (monitoring of progress)

³ Multinational companies

⁴ Small and medium enterprises

Services

Recommendation 13

Increase the focus on cultivating knowledge and awareness of services innovation by:

- Including teaching of services innovation modules in the HEIs in qualifications such as MBAs and other suitable degrees.
- Development of R&D capacity in services innovation within the HEIs.
- Prioritising funding in order to achieve these.

Responsibility: *HEIs with input from IDA and Enterprise Ireland, DES/HEA*

Pharmaceuticals

Recommendation 14

Determine the specific process development, formulation and synthetic chemistry needs of the small molecule pharmaceutical industry, both in terms of training requirements and in terms of HEI based R&D activities that need to be initiated.

Responsibility: *IDA in consultation with enterprise*

Recommendation 15

The IDA, working with industry, should investigate the need and feasibility of establishing a centre for industrially focused research in process development, formulation and synthetic chemistry for the small molecule pharmaceutical industry. If a centre is deemed to be required, then this should be achieved by:

- Co-locating with a suitable existing facility.
- Leveraging investments in systems, outreach, and training activities already in place.
- Building up the small molecule activities from an initially low base.

Responsibility: *IDA in consultation with enterprise*

Chapter 1: Introduction

The study ‘Maximising the Environment for Company Research and Development’ had as its objective the identification of key environmental barriers that negatively influence the level of activity of business expenditure on research and development (BERD) in Ireland. The subsequent goal was then to determine a small number of actionable recommendations aimed at removing these barriers, in order to make the environment more attractive for company investment in research and development (R&D).

1.1 Benefits of Business Expenditure on R&D

Spending on R&D is vital to continued growth and prosperity, both for companies and the country. R&D performed by business results in new production processes, higher quality of output and new goods and services. Companies invest in R&D in order to stay ahead of the competition and ultimately to achieve longevity of their businesses. R&D in many companies is an investment in the company's future, although in rapidly changing markets, many companies should expect to spend money on R&D just to keep abreast with their competitors.

The OECD has found that BERD is significantly positively correlated with multifactor productivity (MFP) growth.^{5,6} The effect is larger in countries which are intensive in business R&D, and in countries where the share of defence-related government funding is lower. In addition, there is evidence that there has been a growing impact of BERD on MFP over time.⁷

As Ireland continues to develop itself into a Smart Economy, it must create value that can be exported. This means designing and creating new products and services. The key driver of this Smart Economy is the enterprise base, and Ireland must continue to encourage the growth of R&D activities in the enterprise sector by providing an environment that is globally competitive in terms of human capital, infrastructure, and cost.

1.2 Business Expenditure on R&D in Ireland

Business expenditure on R&D in Ireland was €1.6bn in 2007, accounting for two-thirds of the total R&D spend in the Irish economy.⁸ R&D spending in real terms in the business sector has nearly tripled in the last decade. BERD intensity (the ratio of business expenditure on R&D to GDP⁹/GNP¹⁰) is a typical measure of a country's activity in company R&D. Fig. 1 shows BERD for OECD countries, including Ireland, as a

⁵ The OECD found an increase of 1% in a countries business R&D generates 0.13% in multifactor national productivity growth in the long run. Guellec, D. and Van Pottelsberghe de la Potterie, B. (2001), “R&D and Productivity Growth”, *OECD Science, Technology and Industry Working Papers*, 2001/3.

⁶ MFP has been computed as the ratio of domestic product of industry to combined weighted sum of the quantity of labour and fixed capital stock, the weights being the annual labour cost share and the capital cost share, respectively (under assumptions of perfect competition and constant return to scale).

⁷ Guellec, D. and Van Pottelsberghe de la Potterie, B. (2001), “R&D and Productivity Growth”, *OECD Science, Technology and Industry Working Papers*, 2001/3. (an increase in MPF of about 0.005 a year)

⁸ Business Expenditure on Research and Development 2007/2008, Central Statistics Office, July 2009

⁹ Gross Domestic Product

¹⁰ Gross National Product

percentage of GDP (both GNP and GDP are presented for Ireland). BERD as a percentage of GNP in Ireland was 1.03 % and 0.88% as a percentage of GDP in 2007¹¹. However, while Ireland's BERD has been growing strongly (a 78% increase between 2001 and 2007, from €900m to €1.6bn) it still lagged below the 2007 EU15 and OECD averages of 1.2% and 1.6% of GDP respectively.

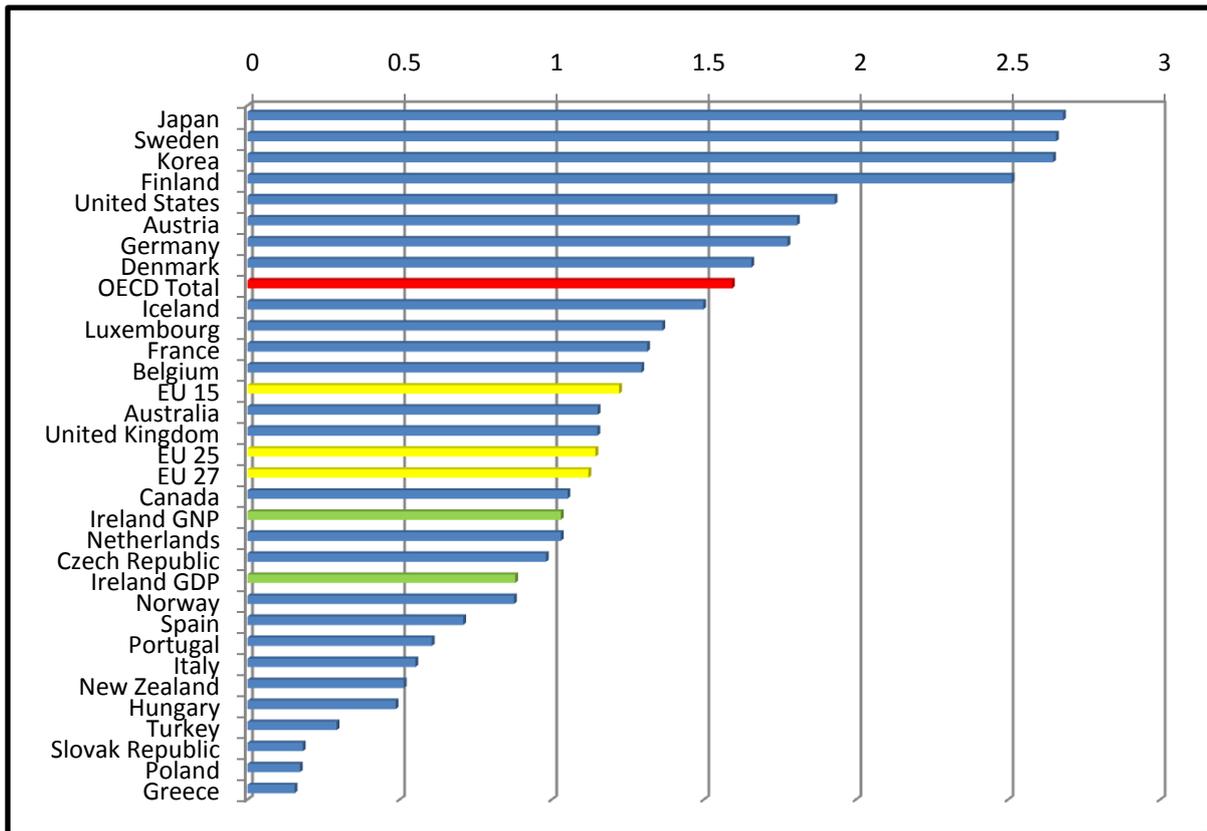


Figure 1. BERD intensity for OECD countries in 2007.¹²

In 2007, the key performing sectors in company R&D in Ireland were Electrical/Electronics, Computer and Related Activities, Chemicals, Instruments, and Food Beverage and Tobacco. These categories are underpinned by the following industries - ICT Hardware, Software, Pharmaceutical, Medical Devices and Food.

In 2007, €0.9bn was spent on R&D in manufacturing related activities, whilst €0.7bn was spent on R&D in services related activities.¹³

¹¹ Derived from the Survey of R&D in the Business Sector, 2007/2008 (CSO/Forfás)

¹² OECD, Main Science and Technology Indicators, 2009

¹³ Services includes Software Services and the R&D Category

1.3 Ireland's Goals and Opportunities for Business Expenditure on R&D

As a response to the Lisbon Agenda, the National R&D Action Plan¹⁴ proposed that BERD in Ireland should reach €2.5 billion in 2010 or 1.7% GNP. In 2007, BERD in Ireland reached 1.03 % of GNP.

The Strategy for Science, Technology and Innovation (SSTI) 2006 - 2013 recognises the need for a transformation in both the quality and quantity of R&D undertaken by industry - both directly by companies and in cooperation with third level institutions. The primary rationale for government investment under the SSTI is to develop a competitive knowledge based economy. It aims to drive innovation in enterprise, build human capital and maximise the return on R&D investment for economic and social progress. To create and sustain high-quality employment it is recognised that there needs to be a focus on the rate of innovation activity in enterprise.

In order to increase levels of BERD, Ireland can look to support the current indigenous and foreign direct investment (FDI) enterprise base to initiate and grow R&D functions. In addition it can look to attract new R&D FDI to Ireland, and support the growth of new R&D based indigenous companies.

When companies related to the automobile, aerospace and defence sectors are removed from the list of the top 50 companies investing in global R&D, close to 70% of the remaining companies on the list have a presence in Ireland. Recent data¹⁵ shows that despite the economic downturn, there was global aggregate growth in enterprise R&D spend of 6.9%, in 2008. The Pharmaceutical, Software/Computer and Electronics/Electrical equipment sectors were all ranked in the world's top 5 sectors for global R&D investment¹⁵ and so there is strong overlap between Ireland's most active sectors in R&D and the sectors receiving the highest levels of global R&D investment. It appears that Ireland has key ingredients in place to capitalise on FDI R&D investment, however, when the global investment in R&D of the top 1350 companies was broken down to allocation per country, Ireland did not appear as a significant winner. Other small countries, such as Finland, Sweden and The Netherlands are faring significantly better in terms of BERD investment.¹⁵ This signals that Ireland is not capitalising on its advantages, and needs to focus on producing an environment for company R&D that is conducive to FDI, both for the existing FDI subsidiaries and for attracting new FDI companies.

For the most part, a big opportunity to increase levels of BERD for indigenous companies is to continue to raise the profile and need for R&D and innovation within existing indigenous companies. In addition, continued focus on developing the entrepreneurial culture and increased numbers of High Potential Start Ups would serve to raise BERD. To drive towards a Smart Economy, it is imperative that the indigenous base continues to grow in terms of its activity levels in R&D.

Ireland has good opportunity for increasing the national levels of BERD both from an FDI and indigenous company perspective, but in order to capitalise on this opportunity it must develop an environment that is more conducive for companies to engage in R&D and that is globally competitive for R&D activities.

¹⁴ Building Ireland's Knowledge Economy, The Irish Action Plan For Promoting Investment in R&D to 2010, Report to the Inter Departmental Committee on Science Technology and Innovation.

¹⁵ The 2009 EU Industrial R&D Investment Scoreboard

1.4 Objectives of the Study

The objectives of the study were:

- a) To identify a small number (no more than three) critically important factors impacting on the environment for R&D, separately for foreign and indigenous companies.
- b) To identify a small number of sector-specific factors impacting on the environment for R&D, separately for foreign and indigenous companies.
- c) To develop actionable recommendations to overcome the barriers identified in (a) and (b) above.

1.5 Methodology

- A task force of the Advisory Council on Science Technology and Innovation was established to oversee the project. The task force included members of the Council and representatives from a range of enterprise sectors, the Department of Enterprise Trade and Employment (DETE), the enterprise development agencies, and Science Foundation Ireland (SFI).
- Dialogues with key senior individuals of indigenous companies and Irish based FDI subsidiaries¹⁶ formed the main source of information and evidence base for the study.
- The dialogues provided information, opinions, views and perceptions of companies, to barriers to engaging in R&D.
- Two professional interviewers conducted the dialogues - one for indigenous companies and one for FDI companies.
- For both foreign and indigenous categories, a range of companies were engaged in dialogue: start-ups, small and medium enterprises (SMEs) and large multinational companies (MNCs).
- The MNCs engaged in dialogues were primarily based in Ireland. However, they did in many cases provide inward looking views representing their corporate headquarters perspective of important factors to be assessed in selecting locations for carrying out global R&D.
- The professional interviewers reported back to the task force at regular intervals, and based on the discussions of the task force, the interviewers received feedback and guidance on areas which required further probing or clarification in the subsequent round of company dialogues.
- The key barriers to company R&D that were identified by industry sector groups were also presented to the task force.
- Inputs from the Industrial Development Agency Ireland (IDA), Enterprise Ireland (EI), and SFI were also obtained via dialogues and the inputs reported back to the task force via the Secretariat.
- The barriers and recommendations identified, through the various mechanisms of consultations and the subsequent task force deliberations, were documented by the Forfás Secretariat, and categorised under three headings.
- This completed the data collection phase. At this point it became apparent that indigenous and FDI companies raised the same issues. Based on this information, it was decided not to separate out the barriers and recommendations for indigenous and foreign companies.

¹⁶ Representatives of 17 Indigenous and 17 Irish subsidiaries of MNCs engaged in the dialogues.

- A sub group of the task force was formed to develop a framework to help in the selection of final recommendations.
- The following framework was developed by the subgroup:
 - The desired output of the study is to increase the quantity and quality of company R&D, over the period 2010 to 2018, to create sustainable enterprise and employment.
 - It is assumed that factors such as competitive tax regimes are building blocks¹⁷ that need to be in place for any country to compete in attracting R&D activities.
 - Selection of the final recommendations were to be made based on the needs of entities that possess the greatest potential to increase the quality and quantity of company R&D, namely:
 1. the existing base of MNCs,
 2. indigenous firms that are already engaged in R&D,
 3. start-ups - in areas where start-ups can have an impact.
- The subgroup used the framework to determine the critical overarching barriers and develop recommendations in order to remove these, based on the inputs that had been received through the consultation process.
- The task force's representatives from the key industry sectors identified the key sectoral barriers and associated recommendations, based on the inputs of the consultation.
- The task force reviewed and provided feedback on the draft recommendations and the subgroup, in conjunction with the task force Chair, finalised these recommendations based on this feedback.
- Further inputs on the recommendations and the report were received through engagement with EI, IDA, SFI, the Higher Education Authority (HEA), DETE, the Department of Education and Science (DES), and the National Public Procurement Operations Unit in the Office of Public Works.

¹⁷ Building blocks relate to specific items or policies that it is easy for every country to put in place and so they are not factors that on their own will attract companies to Ireland to engage in R&D.

Chapter 2: Findings

The feedback from the indigenous and FDI companies consulted was very similar. A series of issues were consistently raised throughout the consultation process, and three overarching barriers were identified as impacting seriously on BERD. These overarching barriers apply to both FDI and indigenous companies, while some of the sectoral issues are more relevant to indigenous companies or FDI companies.¹⁸

The three overarching barriers identified (in order of impact) are:

1. A shortage of high quality industry relevant skills
2. The high cost of R&D and
3. The effectiveness of higher education institutions - enterprise interactions

It is noted that some of the recommendations that have been associated with a specific sector are more generally applicable and will in fact have an impact across multiple sectors when implemented. Each such recommendation has been assigned to the sector that raised the corresponding issue as a priority for its industry.

These barriers and the subsequent actionable recommendations will be discussed in more detail in Chapter 3 and the sector specific barriers and recommendations identified will be discussed in Chapter 4.

This chapter provides a summary of the strong themes that emerged from the consultations, and in particular puts forward a finding from the study that, if not addressed, the Council believes will result in the continued persistence of some of the barriers to companies engaging in R&D.

The most common theme found across all the company feedback was on the importance of a supply of people with the required skills. The issue with the pipeline of students in Science, Technology, Engineering and Maths (STEM) was stressed by most of the companies. The need to promote these subjects from early on in the education system, and to appropriately value them in the Leaving Certificate, was raised on many occasions. It is clear that the enterprise base is fully aware of the lower numbers of students studying STEM disciplines, and enterprise have given a clear message that this will have an impact on their ability to do R&D in the future. The Council agrees that action is required in order to increase the number of students engaging in STEM and urges actions to be taken in the Education system to address this. Whilst this is a topic that is serious and requires appropriate action to be taken, the topic is removed somewhat from the direct objectives associated with this study, and thus no specific recommendations will be put forward to address pre-4th level education.

¹⁸ For the Hardware sector there was no specific sectoral issues. In this particular sector all the issues identified fell under the overarching barriers that had been identified.

There was also a strong message from the companies on the need for more people with high quality industry relevant R&D skills. This has been captured as a key barrier for enterprise R&D in Ireland, and one which the Council will address in its recommendations from the study.

Monetary issues were raised under costs and access to finance. The high costs in Ireland were raised as an issue, including those associated with personnel, energy and rates. These high costs lower Ireland's competitiveness. Whilst they are not solely associated with R&D activities, the high costs act as a disincentive for enterprise to initiate new activities in Ireland. Payroll is the highest cost for many R&D projects. In this regard, reducing these costs would provide MNCs with a stronger position when competing for global R&D projects. In addition, reducing R&D project costs may also be the tipping point to encourage indigenous companies to bring back outsourced R&D work to Ireland, and for more start-ups to be successful here.

Access to finance was raised in relation to state grants, investments in companies and public procurement opportunities. This emphasis was brought up primarily by the indigenous companies. Changes to the Business Expansion Scheme (BES)¹⁹ were raised, including increasing the upper limit available to companies in order to allow companies to increase in scale whilst continuing to invest in R&D activities. The points raised in this regard related to a market failure in providing support for growth in companies. This market failure has a subsequent impact on R&D activities, in that companies divert cash to the operational side of their business rather than investing in R&D.

Whilst not all of the suggestions put forward in relation to financial issues can be addressed, particularly in the current economic climate, some of the issues associated with R&D costs have received focus through recommendations on: R&D tax credits; support for companies to expand into new markets; and through calling for increased focus on public procurement in relation to SMEs.

It is evident from the inputs received that companies see great potential benefit from engaging with higher education institutes (HEIs) for R&D purposes, and many have in fact developed collaborations with HEIs. Companies do want to increase their levels of engagement. However, there was a clear message from enterprise that issues associated with Intellectual Property (IP) were a significant barrier to this happening. Other inhibiting factors that were raised as issues were: lack of visibility/knowledge as to how companies should engage with the HEIs, and lack of enthusiasm of academics to engage with industry. These three specific factors will be addressed under the overarching barrier 'HEI-Enterprise Interactions'. Recommendations are put forward with a view to developing an environment which is more conducive to HEI-enterprise collaborations.

¹⁹ The Business Expansion Scheme (BES) is a tax relief incentive scheme that provides tax relief for investment in certain corporate trades. The scheme has broadly taken the same format over a number of years and, because it is a form of State-aid (at the level of the enterprise), any changes to the scheme require the approval of the European Commission, to ensure that it remains compatible with EU law.



During the dialogues, many companies claimed that the research topics and types of research²⁰ within the public R&D system are not aligned with industry requirements. Based on the nature of the evidence in this study, it cannot be concluded that such claims are fully accurate and fully reflective of the current situation in the HEIs and publicly funded research organisations. However, such inputs do raise questions in this regard. Furthermore it highlights the fact that there is currently no specific national plan or mechanisms in place specifically for aligning the areas of research with important industry needs²¹, nor for controlling the proportionality of research type within a given research area.

It is the view of the Council that publicly funded R&D activities should represent a continuum, stemming from basic research through to near-to-market activities with the level of input from industry being higher for applied activities than for basic research. The Council believes that if we do not have sufficient levels of applied research within the R&D continuum of publicly funded research, then we run the risk of not commercialising our basic research outputs and providing a return on the investment in publicly funded research. That is not to understate the importance of basic research, which is a critical part of building the country's research capability and which will allow Ireland to tap into new opportunities in the future, including attracting new green-field investments in R&D.

The Strategy for Science, Technology and Innovation (SSTI) 2006 - 2013 recognises the need for a transformation in both the quality and quantity of R&D undertaken by industry - both directly by companies and in cooperation with third level institutions. A series of actions have been set forth in the SSTI, which include the action to strengthen measures to increase interactions between HEIs and enterprise. Initiatives have been established towards achieving this, for example Industry Led Networks and Competence Centres. It is the view of the Council, that the next significant step required towards increasing the levels of HEI-enterprise interactions is the development of a strategy that significantly looks to address the industry relevant R&D needs in terms of R&D areas and R&D type being carried out within the nationally funded R&D system.

The first step in this strategy should determine the areas of research that are important to industry. This includes the needs of industry today, indigenous and FDI, and potential new industry that we wish to grow in the future (through indigenous growth, FDI, and start-ups). Whilst it is acknowledged that this will not be an easy task, the Council believes that it is worth pursuing this route.

The Council also believes that it is timely to undertake a new priority-setting exercise at this juncture in order to identify areas in which Ireland should excel. This should take stock of the outputs and impacts of investment since 2000 (by field of science), assess the relevance of publicly funded R&D to the current enterprise base and explore, in consultation with the enterprise development agencies and relevant stakeholders, the areas of research that are most likely to be relevant to the enterprise base in Ireland over the coming 10-15 years.

²⁰ Basic to Applied Research. It is acknowledged that this terminology is rather rudimentary in definition, but for the purpose of this discussion, basic implies discovery driven research, and applied research implies R&D which has a specific end goal in sight.

²¹ The Competence Centre programme is one of the approaches that can be used to help achieve this.

A mechanism should then be put in place to manage the levels of basic and applied research within each of these areas of research, in order to achieve some balance of future looking basic research and applied research that can support the activities of industry and also spin outs and licensing of technology. To realise this, it is imperative that State funding for R&D is available across the spectrum of research type, from basic to applied research, within each of these areas of research.

Managing the levels of basic and applied research will also have the added benefit of producing quality graduates that are expert in basic and applied research.

The strategy must be very adaptive, with periodic reviews of the areas that receive State funding and the balance along the spectrum from basic to applied research. A set of feedback mechanisms will be required to allow that balance to be monitored and changed at the correct frequency.

In addition to the topics and types of research being aligned with industry requirements, the environment in which the R&D collaborative work is carried out is an important factor in ensuring that the outputs of the R&D are successfully moved along a path towards commercialisation. There is a range of infrastructures through which academia and industry can engage;²² and the most suitable infrastructure for a given collaboration is dependent on the type of project and the part of the R&D continuum in which it is operating. In order to maximise the potential for commercialisation of publicly funded R&D, there is a need to ensure that the translational mechanisms between HEIs and industry are populated in the correct manner: the focus on commercialisation of R&D activity should increase as we move away from the HEI environment towards the industrial environment. A strategy is required that determines the appropriate mix of the various infrastructures for HEI-enterprise interactions²³, in order that the potential for maximising the commercialisation of publicly funded R&D is realised.

Ensuring that the publicly funded R&D activities are tuned to the topics relevant to industry, developing the desired balance of R&D activities along the full spectrum of R&D categories, and assigning the desired mix of activity to the various infrastructures, are three of the critical factors for realising economic impact from the national investment in R&D. The strategy required to deliver on these requirements could be developed as an evolution of the SSTI or the Forfás/HEA mapping study that is currently in progress could be used as an input to a new detailed strategy.²⁴

²² industry-academic collaborations in which R&D is carried out in the HEI; industry-academic engagements in which the activity is based in an incubator in the HEI; industry-academic engagements in which the activity is based in an incubator that sits in an environment outside of the HEI and normally with a stronger industrial focus and ethos; industry-academic engagements in which HEI personnel carry out R&D in an industrial setting.

²³ HEI based, incubation centre in the HEI setting, incubation centre outside the HEI centre, in-company based.

²⁴ Forfás and the HEA are currently engaged in a study, which is aimed at mapping the activities of the industry base to the activities in publicly funded research.



Key Finding

A strategy is required that:

- determines the strategically important areas of research relevant to industry, both in the short and long term,
- determines how the proportion of R&D activities for the various R&D categories (from basic research to near to market activities) should be balanced across the national STI system,
- determines the mechanisms that need to be put in place to measure and adjust the balance of the R&D categories in the future,
- determines the appropriate mix of the various infrastructures for HEI-enterprise interactions, in order that the potential for maximising the commercialisation of publicly funded R&D is realised, and
- is reviewed on a regular basis, and modified to reflect the ongoing needs of industry.

Chapter 3: Overarching Barriers and Recommendations

Three overarching barriers have been identified as critical factors impacting negatively on levels of company R&D in Ireland. These are (in order of impact):

1. A shortage of high quality industry relevant skills
2. The high cost of R&D and
3. The effectiveness of higher education institutions - enterprise interactions

3.1 High Quality Industry Relevant R&D Skills

While there may currently be a deficit of employment opportunities in Ireland, it is imperative that we continue to invest in education in order to position ourselves for the future. Within enterprise, future skills needs will include both PhD and Master-level graduates. Thus a balance of graduate numbers with these levels of qualifications needs to be produced in order to supply enterprise in the short and long term.

More specifically, the feedback received from enterprise indicates that there is a need to develop more graduates with high quality R&D skills which are relevant to both the existing industrial base and companies that Ireland will want to attract and establish in the future. The repeated message from companies was that the national focus for public R&D activities should be in the areas of research that are relevant to these two cohorts of companies in order to promote greater alignment of R&D skills with enterprise needs.

Some steps have been taken to address the quality of R&D skills, namely through the initiation of structured PhD programmes. A number of these programmes have started, with the first intakes in 2007. These programmes will enhance the quality of PhD education and provide students with multi-disciplinary skills and enable graduates to pursue careers in academia and in the private and public sectors. However, continued focus needs to be put on ensuring that the R&D skills being developed have relevance to the enterprise base.

The R&D skill levels of company employees also need to be developed to reflect the changing needs of enterprise and this can be achieved through specific in-company schemes, or embarking on industry relevant R&D courses through the HEIs.

3.1.1 Industry Led Masters & PhD Programmes

The SSTI had targeted a doubling of the output of PhD graduate numbers over the period 2006 to 2013. PhDs who embark on a career in enterprise can bring with them not only the knowledge they acquired directly through their research, but also skills, working methods and a network of people to whom they can turn to for support in their professional lives. PhDs' knowledge about recent research and, more importantly, a capacity to solve complex problems, conduct research and develop new ideas makes them

especially valuable to innovative firms. The Council has already acknowledged the importance of the PhD graduate to enterprise, through its study on 'The Role of the PhD in the Smart Economy'²⁵.

Enterprise requires a range of skill levels to ensure they maximise their potential to develop R&D activities in Ireland. While the focus on PhD graduates is important, a parallel initiative towards the development of industry driven Masters programmes is required to ensure that for areas where Masters levels skills are required the relevant skills sets are available. It is essential that courses are identified, supported and marketed appropriately to attract the brightest students in relevant disciplines to follow such Masters programmes. The faster turn-around time of Masters programmes over PhD programmes also allows for a more dynamic response to changes in industry needs. Based on the feedback from industry it is clear that Master level graduate skills are appropriately valued. Indeed, MSc graduates appear to be recruited into industry in Ireland in higher proportions than PhD graduates.²⁶ Therefore, while still retaining a focus on the development of PhD numbers, SFI will seek to increase the proportion of MSc students within its funded teams by modifying its policies to give greater encouragement of MSc students.²⁷

In order for students graduating from a Masters course to develop skills that are relevant to industry, the content of the programmes should be devised in collaboration with industry. In each case an industry advisory board should be put in place to help maintain the industrial relevance of the programme over time. This approach will also have the added benefit of increasing the levels of HEI engagement with industry. In addition, these Masters programmes could feed into the structured PhD Education programmes that are being put in place in the HEIs. Such industry driven Masters courses could also be a vehicle for converting PhD graduates into more industrially attractive individuals.

It is also critical for industry to be able to easily identify graduates who possess recognised high quality R&D skills. The current badge of distinction for Masters graduates is based on the level of degree attained (for taught courses), or simply a pass/fail model for a research project-based Masters. A further level of distinction is required in order to identify the best quality graduates in Ireland; Ireland's 'Elite'. A set of Masters courses which are ranked as world class, and which only admit and graduate the best, would provide this further level of distinction. These courses should be linked to world class research centres and researchers in order to underpin their academic excellence, and they should also be industry relevant, difficult to gain entry to, and students must have the drive and ability to be high achievers in order to graduate.

Postgraduate students who spend a significant part of their time working on an industrial programme will develop a range of skills - both technical and business related - that will be very aligned with industry

²⁵ ASC Report 'The Role of the PhD in the Smart Economy', 2009

²⁶ Recently SFI has found some preliminary, but indicative graduate first destination data that confirms this.

²⁷ Although MSc students have always been a component of Science Foundation Ireland (SFI) funded teams, the focus to date has been on PhD students. SFI has recently amended its Grant Application Budget policy to encourage the inclusion of MSc students into funded teams. Historically postgraduate students in SFI funded awards have been, in the vast majority (>90%), PhD level students.

The Research Frontiers Programme required the inclusion of at least one PhD level student per grant. This has now been amended to allow for one post-graduate research student, either MSc or PhD level. In its upcoming translational research call, in conjunction with the Health Research Board, SFI is encouraging the participation of research MSc students.



needs. Currently no national programme exists to support an employee of a company to earn their Masters or PhD based on research relevant to the company.²⁸ The Council recommends the establishment of such programmes, building on the model of the Danish Industrial PhD programme.²⁹

The Danish industrial PhD programme is a programme whereby an enterprise employee earns their PhD based on research relevant to their enterprise. It currently accounts for 7% of all PhD graduates in Denmark and the target has now been raised to 10%. The main aims of the programme are to:

- Upskill researchers working in enterprise.
- Build know-how, knowledge dissemination and interaction between academic and research institutions and enterprises.
- Ensure commercialisation of new know-how and research, including development of knowledge and technology based enterprises. Over 70% of enterprises that participated in the programme commercialised the research undertaken.

The PhD candidates work full-time on their project, but their time is split equally between the enterprise and the academic institution. This programme involves high levels of ongoing collaboration between the enterprise, the PhD student and the academic institution to ensure that the project is progressing and that it meets the requirements for the award of a PhD in the given area. Thus, the programme provides enterprises with the opportunity to liaise with university staff and use their expertise for the development of enterprise. The programme also fosters an entrepreneurial culture with 8% of the PhD graduates establishing their own business. The cost of the programme including the employee's salary is co-funded by the enterprise partner and the programme promoter.

²⁸ The IRCSET Enterprise Partnership Scheme is an initiative, where IRCSET in partnership with enterprise co-funds postgraduate scholarships and postdoctoral fellowships. The researchers are not company employees and are based in the HEIs, but may spend varying lengths of time within the company during their lifetime of their scholarship.

²⁹ The recommendation put forward here reinforces the recommendation in the ASC report¹ 'The role of PhDs in the Smart Economy', in relation to implementing a national programme based on the Danish Industrial PhD model.

Recommendation 1

There should be greater involvement of industry in developing postgraduate programmes. To achieve this, the following actions should be taken:

- Prioritise some of the 4th level funding from PhD programmes towards the development of industry driven Masters programmes.
- Support the development of World Class Masters programmes that are industry relevant, sector specific, and in which industry is engaged. The award received should distinguish the graduates as the highest quality Masters students for industry relevant R&D. The effective implementation of this recommendation will require attention on how to attract the best students to these courses, and bursaries will probably be required to achieve this.

Responsibility: Inter Departmental Committee for Science, Technology and Innovation (DETE and DES/HEA), SFI, IRCSET

- Develop Industrial Postgraduate Programmes, building on the model of the Danish Industrial PhD programme.

Responsibility: HEIs, DES/ HEA with input from enterprise agencies

3.1.2 Attracting Industrial Leaders to Work in Ireland

The attraction of industrial R&D leaders³⁰ to Ireland is considered a good way to increase the level of R&D activities in companies. Such leaders attract attention and collaboration from HEIs and other R&D active companies and can generate activity through their status as well as their know-how.

In the case of MNCs, industrial R&D leaders hold a wealth of knowledge in the R&D activities being carried out throughout the organisation, and have connections into these activities. Attracting such R&D leaders to an Irish subsidiary can initiate or accelerate existing R&D projects, and help to embed the R&D activities at the local site. Their placement in Ireland can:

- help build relevant high quality skills in the Irish research base through knowledge transfer and through initiation of corporate relevant R&D activities; and
- raise the profile of R&D activities in the Irish based company, with potential knock on effects.

For indigenous companies, attracting an R&D leader in the relevant technology field into the company will have similar effects.

As Ireland needs to compete against other countries in attracting global leaders for R&D^{31,32} we must be competitive in the packages that we can put in place. In essence we must provide attractive tax

³⁰ Technical, management and business development.

³¹ For example the tax incentives provided by Belgium to foreign executives temporarily employed in Belgium- Innovating Belgium, Fiscal measures and innovation premiums for companies, Belgian Science Policy.

³² Singapore have an economic policy which has a focus on attracting foreign talent.

incentives in order to make it a financially attractive proposition for an industrial R&D leader to relocate in Ireland.

Recommendation 2

Develop a competitive financial incentive to attract industrial R&D leaders to work in enterprise in Ireland. To achieve this, the following actions should be taken:

- Review tax incentives used in other countries to attract industrial leaders in R&D (including Belgium and Singapore).
- Develop a competitive model for Ireland.
- Promote the model to both IDA and Enterprise Ireland clients.

Responsibility: DETE, IDA, Enterprise Ireland

3.1.3 Building Industry Relevant Skills through Secondments Abroad

Technical, management and business development staff of Irish subsidiaries of MNCs, who spend time abroad on R&D projects, develop knowledge and skills in leading edge technologies, develop good contacts and build relationships. In addition, they demonstrate to global management the competence of the Irish based employees and subsequently increase the potential for attracting R&D activities to Ireland based on confidence in the ability of an Irish site to deliver.

The IDA currently runs a training scheme which includes support for sending staff abroad for R&D training. There is no time limit on the duration of the stay but there must be structure to the secondment programme, with a clear emphasis on developing new skills. The aim of this scheme is to up-skill a company's staff³³, to undertake or increase RD&I activities within the Irish operation.

Based on the enterprise consultation in this study, there appears to be a lack of awareness of this IDA scheme. Promotion of this scheme amongst the MNCs is paramount in driving this type of initiative.

It is recognised that some of the individuals who embark on such a secondment from their Irish base may not return. However, many will, and those who don't should be looked on as new international contacts.

Recommendation 3

Promote the aspects of the current IDA training scheme that provide financial support for sending staff of Irish subsidiaries of MNCs to travel abroad for training in RD&I.

Responsibility: IDA

³³ Technical, management, business development - graduates through to very senior people.

3.2 Cost of R&D

Many factors contribute to Ireland's high costs, including high salaries, rents, insurance, rates, and so on. Whilst it is acknowledged that some of these costs have been reducing over the past months, it is imperative that, as we strive to develop the 'Smart Economy', we take specific steps to reduce costs associated with R&D, and become competitive globally in this area.

3.2.1 Cost - R&D Tax Credits

The introduction of R&D tax credits for companies has been welcomed by enterprise as a very positive step. However, there is an opportunity to improve the impact that these tax credits can have on driving increased levels of BERD, with negligible increase in cost to the exchequer, especially in the context of the wider economic gain.

Profit-making companies are currently allowed an R&D tax credit against corporation-tax. FDI companies account for this at corporate level, and this credit is acknowledged as very valuable. However, the impact of the R&D tax credit in terms of encouraging FDI companies to invest in R&D in Ireland could be even higher if R&D tax credits could be offset against payroll costs. This would have the effect of improving the cost competitiveness for Irish subsidiaries of MNCs when competing for global R&D projects against subsidiaries at other locations. Indigenous companies, using Irish Generally Accepted Accounting Principles (GAAP)³⁴, do have an accounting method³⁵ that can be used to offset the tax credit against payroll costs. However, MNCs using US GAAP have no clear path that can be used by their Irish-based operations. A legislative change may be required to address this.

The R&D tax credit rules have been enhanced to allow non-profit making companies claim credit against income tax costs. While this is a welcome change, a lot of confusion remains in relation to the longevity of this arrangement and process for participating in this R&D tax credit scheme. In addition, the timeframe for submitting for the R&D tax credits in the first instance was very short and a number of companies missed out on the opportunity for claiming. Feedback from industry is that future tax schemes aimed at the R&D community should be communicated to companies as early as possible, and an adequate timeframe for submission allowed for.

For both profit making and non-profit-making companies there needs to be a clear set of rules that allows companies to account for the tax credit directly against income tax, so that their Profit and Loss A/C can directly reflect this as a reduced cost of R&D payroll. In short, the rules must allow the credit to be taken above the line, rather than below.

³⁴ Note also that some indigenous companies also report in US GAAP, for example, those hoping to raise funds in the US.

³⁵ Information Sheet 04/2009. Accounting Treatment of Research and Development Tax Credit. (May 2009). Institute of Chartered Accountants in Ireland.

For the R&D tax credits to work effectively for both profit making and non-profit-making companies, there must be:

- Choice - the option should be available to use the credits above or below the line.
- Clarity - as to how long the R&D tax credit rules will continue.
- Speed - payments need to be processed in a timely manner: many R&D companies are growing and loss making, and all have cash-flow challenges.
- Simplicity - the current set of rules has led to spin-out work in accountancy firms for claiming the R&D tax credits on behalf of companies. The rules must be simplified to that they can be processed as part of normal accounting practices within a company, otherwise, much of the financial benefit will be deflected from those that should be targeted.

At the same time, strong effort is required to prevent any abuse of the R&D tax credit scheme; any such abuse distracts from the target of the relief and is not in the interests of the country or any company legitimately claiming such credits.

Finally, a small number of companies are affected by the choice of 2003 as the base year for R&D tax credits. This has a negative impact in particular for established R&D performers and we risk losing those companies - or their R&D functions - to countries with more flexible R&D tax credit rules. Further investigation is required to determine which companies specifically are being affected. The extent of the disadvantage must be investigated, and removed if it puts R&D in companies at a special disadvantage compared to doing R&D in other countries.

Recommendation 4

Allow profit and loss making companies the option to offset their R&D tax credit against payroll taxes.

The rules for this R&D tax credit system should:

- Allow companies³⁶ to elect whether they use the R&D tax credit to reduce corporation-tax, or the tax associated with payroll costs by taking account of the R&D tax credit 'above the line'.
- Be simple and straight forward, so that it can be dealt with as part of normal accounting practice.
- Be timely in relation to issuing of cash refunds.
- Be clearly communicated to companies, and allow a longer timeframe for companies to understand and take necessary actions in relation to their financial planning for R&D.

Responsibility: Department of Finance

Recommendation 5

Investigate the impact on companies of the 2003 base year for R&D tax credits, and address the issue for these companies where it puts them at a special disadvantage compared to doing R&D in other countries.

Responsibility: Department of Finance

³⁶ Profit making and loss making companies

3.3 Higher Education Institutions - Enterprise Interactions

It is evident from the feedback provided by enterprise, that companies would fundamentally like to engage in increased numbers of collaborations with HEIs. However, it is also quite clear that IP issues pose a significant barrier to engagement. In addition, the input from the consultation process indicates the need to increase the focus on developing stronger linkages between enterprise and HEIs.

3.3.1 Publicly Funded Intellectual Property

A very strong message was received from the companies that difficulties in the negotiation of IP agreements are a significant barrier to developing HEI-enterprise collaborations. Such issues with IP are not unique to the Irish system, but some companies reported extra difficulties here compared to working with foreign institutions. There is opportunity for Ireland to find an IP solution that is compatible with both enterprise and HEI/national requirements and which would position Ireland competitively for attracting company R&D projects.

The current view of enterprise is that, despite the issues with IP being highlighted and discussed with policy makers for several years, very little has been done to improve the situation and there is a need for this issue to be addressed as an urgent priority. Recent communications with the TTOs indicate that considerable improvements are being put in place and that there is an increasing desire to see license deals being done. However, companies continue to report difficulties in these areas, and it is difficult at this point in time to determine if this is because of previous experiences, delays in the changes working through the system, or because the changes haven't gone far enough. These areas will need to be very closely monitored.

The IP issues that industry has identified are centred on:

- Contract negotiations (which are currently considered lengthy and complex), access issues, the high value that Technology Transfer Offices (TTOs) put on early stage IP, and the short term perspective that the TTOs have in relation to getting value for money for the HEIs. From the enterprise perspective, internal company legal personnel view all contracts in a similar manner - be they for large or small collaborations - so complexity in the contract process makes pursuit of smaller collaborative agreements particularly unattractive.
- IP ownership - the current focus of the TTOs is to licence rather than to sell IP. Whilst, in some cases this is the appropriate approach, there is a preference in other cases for companies to have the option to buy IP outright, so that it can be added to a company's portfolio and thus allow greater freedom to operate. This is particularly true in the pharmaceutical sector. Often an IP purchase deal can be done after lengthy negotiations but this often leads to reluctance to re-engage.

The Council is aware that a review is underway of the IP supports and IP policies currently in place to encourage the wider exploitation of IP emanating from publicly funded research. Whilst this review is welcome, the enterprise base wants to see decisions being made and actions being carried out to address this barrier.

The Council believes that a longer term view on the benefits from publicly funded HEI-enterprise engagements will have the impact of removing some of the IP barriers to HEI-enterprise engagement that

currently exist. Rather than looking only at the potential for a direct financial return from IP developed as part of a collaboration, the Council believes that the new IP policy should reflect the need for a wider ranging view on the potential benefits of IP to the economy. When appropriate, the outcome of IP negotiations should reflect the national desire to develop clusters of companies around the HEIs and to build long term HEI-Enterprise relationships. The TTOs should recognise the need to make deals quickly, and the greatest importance should be attached to getting technology out into the local economy. In this context, the HEIs should avoid placing financial targets upon the TTOs, and instead emphasise the need to create and sustain effective interaction with enterprise through speedy and cost effective technology transfer.

Forfás is currently undertaking a review of IP arrangements on behalf of DETE. The objective of the review is to examine how the IP framework for publicly funded research in Ireland is operating and to put forward recommendations to improve its operation and effectiveness. With the knowledge that this review is underway, the Council is putting forward a recommendation which will be provided as an input to the Forfás review.

Recommendation 6

In negotiating IP contracts the HEI Technology Transfer Offices should prioritise the exploitation of IP toward the long term strategic benefit to the country (for example, the use of technology transfer deals to create clusters of companies closely associated with research groups in the HEI, the more rapid commercialisation of research, and the development of stronger companies in the local economy). While the Council is not calling for the IP to be given away pro bono, it does recognise the need to ensure that technology created out of state funded research is transferred to local benefit where possible and that this transfer must be quick and at reasonable cost.

Responsibility: DETE

3.3.2 Higher Education Institutions-Enterprise Engagements

Developing strong enterprise-academic interactions is an essential component in the challenge to increase BERD in Ireland. Providing opportunities for individuals and groups from enterprise and academia to meet and find connections in their respective areas of interest is essential in developing relationships and forging collaborations.

An initiative has been devised by Enterprise Ireland to give industry groups the resources to promote innovation and R&D in companies. These 'Enterprise Innovation Networks' have a major goal of developing structured relationships between the third level research sector and enterprise (other goals are to increase the levels of R&D and facilitate innovative business practices in their member companies).

Encouraging staff within the HEIs to pursue dual job roles is a further avenue that could be exploited in attempting to improve academic-enterprise connections. For example, an academic who spends part of their time working for a company would significantly enhance his/her knowledge of industry sector issues that require solutions through R&D activities, and increase the partnership levels between academia and

enterprise. The mechanisms by which such dual job roles could be realised requires investigation; however, one suggestion is that academic staff are allowed and encouraged to take sabbaticals from the HEIs to spend time working in companies.

From the academic side, there is currently little incentive for academics in terms of their career path to engage with enterprise. In order to see a significant change in the behaviour of academics towards engagement with enterprise, the HEIs need to place increased value on academic engagement in enterprise R&D activities. Parity of esteem needs to be given to academics who engage in R&D activities with industry and those engaged in solely academic research. Whilst this parity of esteem may be difficult to achieve, it is paramount that we do this so as to help improve the environment for company R&D.

Recommendation 7

Increase the incentives and opportunities for connecting people from enterprise and academia:

- Independently review the output of the current Enterprise Ireland 'Enterprise Innovation Networks' pilot programme and expand if the initiative is meeting its goals.

Responsibility: Enterprise Ireland

- HEIs to include industrial engagement as an important criterion for recruitment and promotion of academic/research staff. The HEA to explore mechanisms to encourage and enable this to happen.

Responsibility: HEIs, HEA

- At an institutional level and based on a strategic plan, HEIs should select suitable departments within which a number of academics have dual job roles - split between enterprise and academia. The HEA to explore mechanisms to encourage and enable this to happen.

Responsibility: HEIs with input from stakeholder agencies and industry, HEA

Chapter 4: Sector Specific Recommendations

4.1 Food

There was strong feedback from the company dialogues that, far and above any other sector, there is an over abundance of public bodies that deal with R&D supports for food companies. This fragmented approach leads to a complex system that is difficult to navigate for the sector. This is a significant barrier to companies, and the time and effort required to determine and avail of the state R&D supports in this sector inhibits company involvement in R&D. Furthermore, companies feel that the involvement of such a large number of public bodies leads to poor coordination of R&D activities between the HEIs and public research organisations.

The food sector needs a state R&D support system that is coordinated, efficient and easy to deal with. This could take the form of a single agency for food R&D supports, or may be developed through a combination of consolidation and organisational changes within the existing configuration. Whichever form the final structure takes, the overriding message from the industry is that the current fragmented approach to State food R&D supports for enterprise must be addressed as a matter of urgency. The impact of any new system for the provision of State R&D support to the food industry should be monitored using feedback from the food industry sector. The system should be retuned until a workable system is in place; one that positively aids efforts to increase levels of enterprise engagement in R&D.

Currently R&D supports for the food sector emanate from a number of government departments and associated agencies. This structure is complex and can lead to difficulties in aligning the publicly funded research activities with the R&D needs of the enterprise base. To reduce this complexity, R&D policy and funding supports for food should be streamlined through an appropriate centralised decision making mechanism. This coordinated activity would act through agreement on food R&D policy and funding priorities. This would result in a more strategic approach to supporting food R&D activities across HEIs, public research organisations and the enterprise base.

Recommendation 8

Reduce the complexity of State support for R&D in the food industry by:

- Urgently addressing the issues of fragmentation in State support for R&D in the food industry. This should be addressed through consolidation, and improved co-operation and coordination between the bodies providing State support for R&D in the food sector. The effect of changes in the public system for providing food R&D supports should be monitored and further changes should be made until a working system is in place.
- Streamlining the policy and funding priorities for food R&D supports by introducing a centralised decision making mechanism.

Responsibility: Interdepartmental Committee for Science Technology and Innovation

4.2 Medical Devices

The future growth and development of the medical device industry in Ireland is dependent on companies engaging in market-led innovation. A key component to achieving this is to enable clinical trials to be carried out in a well regulated and efficient manner. Currently, the clinical trials infrastructure in Ireland is poor, and significant changes need to be made to ensure that industry can pursue R&D activities in a competitive manner. A series of recommendations have been put forward in the Irish Medical Devices Association (IMDA) report on clinical trials³⁷, and there has been some progress made in addressing the issues identified: for example Ireland now has a national point of contact since the Clinical Trials Task Force report was issued.

It is paramount that a clinical trials system has a reasonable turn-around time and allows Irish based companies to remain competitive. Two specific issues identified in relation to this point have previously been identified, and it is imperative that they are addressed as a matter of urgency. These issues and the subsequent recommendations are found on pg 13 and 14 respectively in the IMDA report, and relate to centralised Ethics Committees, and parallel approval paths between the Ethics Committees and the Irish Medical Board. The Health Research Group (HRG) has developed and published an action plan³⁸ for addressing current issues in health research and this plan includes the two issues cited above (Action Area 4, item 7 and 8). This action plan was presented to the Cabinet sub-Committee on Science Technology and Innovation, in July 2009. The next phase is to implement the items listed in the action plan.

Recommendation 9

Prioritise implementation of the actions in the Health Research Group Action Plan to establish:

- A centralised device Ethics Committee, with appropriate insurance for its board members.
- A system that allows parallel approval through the Irish Medical Board and the Ethics Committee.

Responsibility: Health Research Group

4.3 Software

Gaining access to new markets is a key barrier for indigenous software companies. The opening up of new markets to Irish companies would also facilitate opportunities for increased levels of R&D activities within these companies. There are several routes that can be taken in order to achieve this.

4.3.1 Moving into New Geographical and Sector Markets

Enterprise Ireland currently fund a scheme called the Business Acceleration Programme (BAP). This programme enables companies to enlist the help of experienced professionals from around the world, to open doorways to new markets and provide guidance and advice. However, financial support is subsequently required to help a company to enter the identified market and act on the knowledge and advice received in the BAP programme. The Council recognises that there is significant benefit to

³⁷ Enhanced Clinical Trials Infrastructure Required to Benefit Public Health, Irish Medical Devices Association, 2006

³⁸ Action Plan for Health Research 2009 - 2013

companies derived from the Business Acceleration Programme at the early stages of entry into export markets. However, funding to undertake the steps required to action the opportunities identified can be challenging to source from existing resources.

Recommendation 10

Undertake a review of the supports available, within the context of the State Aid Rules, to companies to help them to take the next steps in their market development based on the opportunities identified in the Business Acceleration Program.

Responsibility: Enterprise Ireland

4.3.2 Expanding into International Markets through Linking Indigenous Companies with the Existing MNCs in Ireland

Engagement with MNCs is another opportunity for accessing new markets for indigenous companies. Creating such MNC-indigenous interactions has the potential to create a wealth of benefits such as: market guidance for indigenous companies from MNCs; R&D contracts for indigenous companies from MNCs for specialised work; and access to a large potential client base through MNC global contacts. Given the significant level of FDI companies in Ireland, there is real opportunity for indigenous companies to leverage this to help access new markets. However, there have been previous activities to encourage such linkages, and both IDA and EI have stated that it is difficult to get traction in this space.

Based on this knowledge, a two stage approach is recommended here. In the first pilot stage, it is recommended that two indigenous companies be given individual treatment, to determine what the best tactics are for improving their linkages with MNCs. The second step will be to use this experience to generate a set of guidelines on how best to encourage these linkages, and for these guidelines to be rolled out to a wider set of indigenous companies.

Recommendation 11

IDA and Enterprise Ireland to work actively together to initiate linkages between multinational and indigenous companies:

- In a pilot phase, select two indigenous companies that are looking to engage with MNCs and work closely with these to identify routes/opportunities for achieving a commercial outcome.
- Based on the learning from these engagements, put in place a more formal set of guidelines/schemes/programmes, and roll these out to a wider set of companies.

Responsibility: Enterprise Ireland and IDA

4.3.3 Public Procurement

Public procurement contracts can open up new markets for indigenous companies. The software sector specifically raised a number of issues in this area, but the Council recognises that R&D in other sectors would also benefit from innovative procurement by public bodies.



All public procurement is guided by stringent EU Directives to ensure that there is full access to procurement opportunity, and a series of guides have issued from the Department of Finance in recent years to assist procurers in best practice procurement. However, it is the impression of the enterprise base that current practices by Government Departments and agencies, when tendering for IT solutions, seriously disadvantages small companies. From the enterprise perspective this practice has at least two negative effects:

- Purchasers are unlikely to take advantage of innovative solutions from SMEs, often resulting in starting projects *ab initio* rather than using an existing software product.
- It's a missed opportunity for the country. SMEs would often prefer a €100k order to a €200k grant (without taking anything away from the value of the latter!). References help to make further sales; and the other side of that coin is that there have been many cases where potential foreign customers have expressed serious concerns about Irish companies not being able to sell into their home market.

If purchasers do not actively seek to engage with SMEs then they will miss out on existing software products that do most of what they need. Software works best when the costs of its development and ongoing maintenance are shared by many companies, and this happens only when software products rather than bespoke software is purchased. It is invariably best to commission an SME to extend an existing product than to start from scratch. Finally, Ireland has suffered some spectacular failures in large software projects, so the “large system integrator” approach can hardly be considered low risk. MNCs, for example in finance and telecommunications, use specialist software providers to help them reduce the risks of their software development projects; so should we.

Purchasers should be aware of local SMEs when they draft and process tenders, without making the system unfair. We must not hide behind EU rules when considering these points. We must study what is being done in other countries. The UK, for example, has a much more innovative approach in this area. We must also study what is done outside of the EU (for example, the Small Business Innovation Research Program in the US), and then see what part of that can be made to work in our circumstances.

The establishment in 2009 of the National Public Procurement Unit in the Office of Public works and the publication “Buying Innovation: The 10 Step Guide to SMART Procurement and SME Access to Public Contracts” are steps in the right direction. We need to add the next level of detail to ensure that public contracts are indeed accessible to SMEs.

Recommendation 12

Put emphasis on the implementation of the public procurement guidelines and add the next level of detail to ensure that public contracts are indeed accessible to SMEs, by:

- Provision of training for public procurement officers on working with SMEs.
- Working closely with a number of industry bodies, across different industry sectors, to determine best practice to ensure that Irish SMEs do business with government departments and agencies.
- Putting particular focus on a small group of departments and agencies to test and implement this best practice.
- Auditing of the readiness for innovative procurement within each department and agency, and actions put in place to move each to an acceptable level.
- Ensuring that there aren't incentives in the system preventing SMEs winning tenders - such as comfort/familiarity with existing large system integrators or potential punishment for taking risks.

Responsibility: National Public Procurement Operations Unit in the Office of Public Works (implementation), Procurement Innovation Group- DETE (monitoring of progress)

4.4 Services

Service innovation can be described as a new or significantly improved service concept that is put into practice, and it is an area of significant potential for driving growth in the Irish economy.³⁹ However, a significant barrier exists because there is a lack of knowledge as to how to engage in services innovation and a lack of awareness of the impact that even small innovations can have in the services sector.⁴⁰ A change in culture and approach is required in order to realise the potential economic benefits and champions will be required to spearhead these changes.

There are currently programmes being led by the enterprise agencies that focus on company in-house training in the area of services innovation. To build on this, knowledge of this area should be further enhanced in the graduate population by inclusion of services innovation modules in taught courses. A group of 20-30 graduates with awareness and skills in this area, going out into the workplace each year, could have significant impact on driving services innovation in Ireland and help to maximise the potential in this sector. To underpin this strand of education, there is also a need to develop high calibre R&D capacity in this area within the HEIs.

³⁹ Catching the Wave: A Service Strategy for Ireland, Services Strategy Group: Background Report, Forfás, September 2008

⁴⁰ Based on Feedback from the Enterprise Agencies

Recommendation 13

Increase the focus on cultivating knowledge and awareness of services innovation by:

- Including teaching of services innovation modules in the HEIs in qualifications such as MBAs and other suitable degrees.
- Development of R&D capacity in services innovation within the HEIs.
- Prioritising funding in order to achieve these.

Responsibility: HEIs with input from IDA and Enterprise Ireland, DES/HEA

4.5 Pharmaceuticals

Ireland has a strong international reputation and track record in the manufacture of pharmaceuticals. 24,800 people are employed directly in the well established small-molecule pharmaceutical industry, and this sub-sector accounts for 24.5% of Ireland's total exports. Support services to the sector employ a further 24,000. The large-molecule pharmaceuticals sub-sector is a globally emerging industry sub-sector, and it is estimated that there are 4,000 people employed in this area in Ireland.

The small-molecule pharmaceutical industry is currently undergoing considerable upheaval worldwide and the main challenge faced globally is the imminent expiry of patents and companies lacking sufficient levels of new products emerging from their costly R&D pipelines. In Ireland, a number of manufactured pharmaceutical blockbusters will lose patent protection in the next few years.⁴¹

To compensate for this, there is considerable potential to develop better integration between manufacturing and R&D activities and to create the environment for R&D, pilot and early stage production in Ireland. A key challenge for the small molecule sub-sector in Ireland is for companies to develop the capability within their facilities and the flexibility and skills within their workforce in order to make these changes. Ireland needs to provide the supportive environment to enable them to carry out these steps effectively. It is recognised that companies should negotiate directly with the enterprise agencies in looking for financial support to convert excess capacity in commercial pharmaceutical facilities into R&D and pilot plant facilities. Therefore we are making no specific recommendation in this report.

There has been a national investment in a large-molecule facility in Ireland for the purpose of providing specialised training and R&D capability that will satisfy the growth needs of this emerging sub-sector. However, there is, as of yet no equivalent facility for the small molecule sub-sector and this has been identified as a key barrier to increased R&D activities by this sub-sector. To address this need, a centre is required to host researchers and R&D capabilities that can be leveraged by industry to increase the enterprise R&D activities and to help move the manufacturing base up the value chain. In addition, the centre should provide the industrially specific training that is required for the small molecule pharmaceutical industry. Whilst the sector has previously called for such a facility to be provided, the details of the specific training and R&D activities that need to be developed have not yet been clearly

⁴¹ Health LifeSciences in Ireland - An Enterprise Outlook, Oct 2009, Forfás

identified. In the first instance, the detailed needs of the small-molecule pharmaceutical industry must be clearly articulated, before any move to develop a centre is initiated.

Recommendation 14

Determine the specific process development, formulation and synthetic chemistry needs of the small molecule pharmaceutical industry, both in terms of training requirements and in terms of HEI based R&D activities that need to be initiated.

Responsibility: IDA in consultation with enterprise

Recommendation 15

The IDA, working with industry, should investigate the need and feasibility of establishing a centre for industrially focused research in process development, formulation and synthetic chemistry for the small molecule pharmaceutical industry. If a centre is deemed to be required, then this should be realised by:

- Co-locating with a suitable existing facility.
- Leveraging investments in systems, outreach, and training activities already in place.
- Building up the small molecule activities from an initially low base.

Responsibility: IDA in consultation with enterprise

Appendix A Members of the Task Force

Council Members

Dr. Sean Baker (Chair of the Task Force), Entrepreneur

Ms Bernadette Butler, Good 4U Food and Drink Co Ltd.

Mr. Paul McCambridge, Business Consultant

Dr. Reg Shaw, Chairman, Health Research Board

Prof. Roger Whatmore, Tyndall National Institute

Additional Members

Dr. Mary Collins, Bristol Myers Squibb

Ms. Bernie Cullinan, Clarigen Ltd.

Mr. Flor Healy, Kerry Group

Mr. John O'Dea, Crospon Ltd.

Dr. Ruth Freeman, Science Foundation Ireland

Dr. Martin Lyes, Enterprise Ireland

Ms. Helen Nugent, Department of Enterprise Trade and Employment

Mr. John O'Brien, IDA

Research and Technical Support

Mr. Maurice Dagg, Forfás

Mr. John Dooley, Forfás

Dr. Elizabeth Harvey, Forfás

Appendix B Members of the Advisory Council for Science, Technology and Innovation

Council Members

Dr. Tom McCarthy, (Chairman ASC), Chief Executive, Irish Management Institute

Prof Anita R Maguire, Prof of Pharmaceutical Chemistry, Director, Analytical and Biological Chemistry, Research Facility, University College Cork

Ms Mary Cryan, Cryan Consulting

Dr Sean Baker, Entrepreneur

Ms Bernadette Butler, Managing Director, Good 4U Food and Drink Co. Ltd.

Prof Dolores Cahill, Professor of Translational Science, Conway Institute, University College Dublin

Ms Marion Coy, President. GMIT, Galway

Prof Brian MacCraith, Director, Biomedical Diagnostics Institute, Dublin City University / President Designate of Dublin City University

Mr Paul McCambridge, Business Consultant

Mr John McGowan, ex Intel and Michael McNamara & Co.

Mr Martin Shanahan, Divisional Manager. Forfás

Dr Reg Shaw, Chairman, Health Research Board

Prof Roger Whatmore, CEO, Tyndall National Institute

Head of Secretariat

Mr John Dooley, Forfás



ASC Research and Secretariat support provided by

Forfás

Wilton Park House, Wilton Place,
Dublin 2, Ireland

Tel +353 1 607 3000

Fax +353 1 607 3030

www.forfas.ie



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