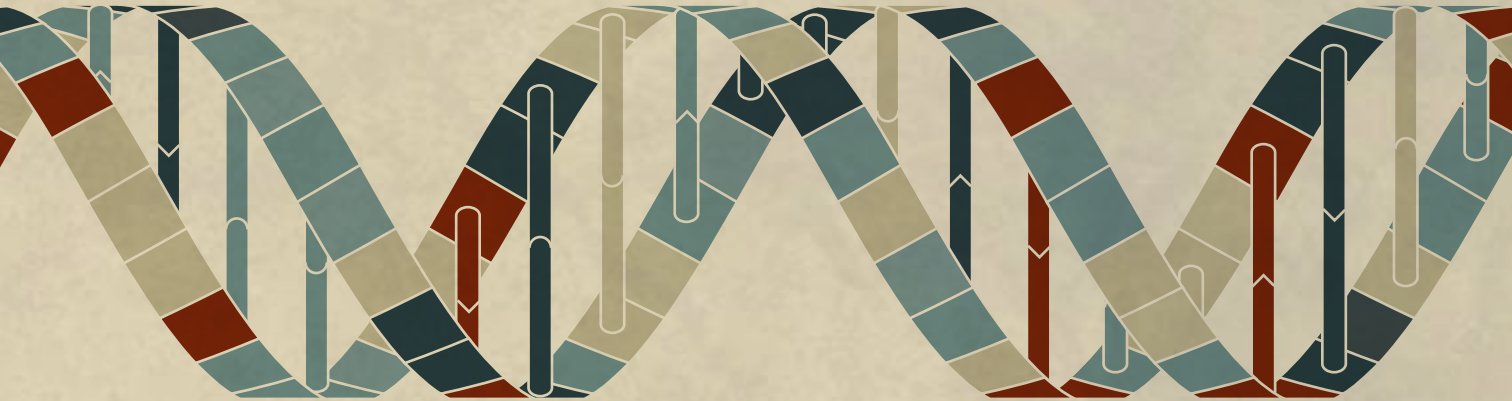
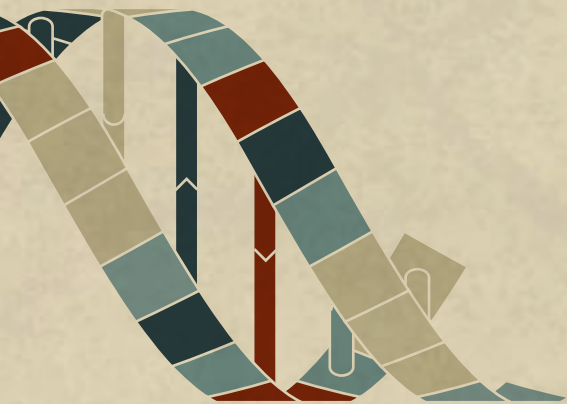


science, technology
and innovation

Delivering The
Smart Economy





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The development of the 'smart' or innovation-based economy is the key challenge facing Ireland, even within the largely uncharted territory of the current financial crisis. This publication outlines the progress made by Ireland in developing the 'smart' economy through strategic investment in R&D and how the implementation of this strategy will serve as a key driver for future growth, prosperity and employment.



Clockwise from top:

Brian Cowen, Taoiseach; **Mary Coughlan**, Tánaiste and Minister for Enterprise, Trade and Employment; **Conor Lenihan**, Minister for Science, Technology, Innovation and Natural Resources; **Eamonn Ryan**, Minister for Communications, Energy and Natural Resources; **Mary Harney**, Minister for Health and Children; **Brendan Smith**, Minister for Agriculture, Fisheries and Food; **Brian Lenihan**, Minister for Finance; **John Gormley**, Minister for the Environment, Heritage and Local Government; and **Batt O'Keefe**, Minister for Education and Science.



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Introduction

In order to achieve recovery we can draw on our identified strengths but economic renewal requires the key policy priorities to be identified and the associated actions implemented.

We require, firstly, to rediscover and embed the fundamental principle that a small, open economy must compete globally and be competitive globally. That reality must shape our responses to the daily pressures we face to sustain efficiency and drive higher value added output across the economy.

Secondly, we must continue to invest in Ireland's research base as an important cornerstone underpinning our future competitiveness and capacity to innovate. A strong science base matched by an evolution in the capacity of our enterprise sector to create knowledge, to innovate, and to exploit new knowledge across global markets is critical to Ireland's future.



one

SSTI Investment – What
Have We Achieved to Date?





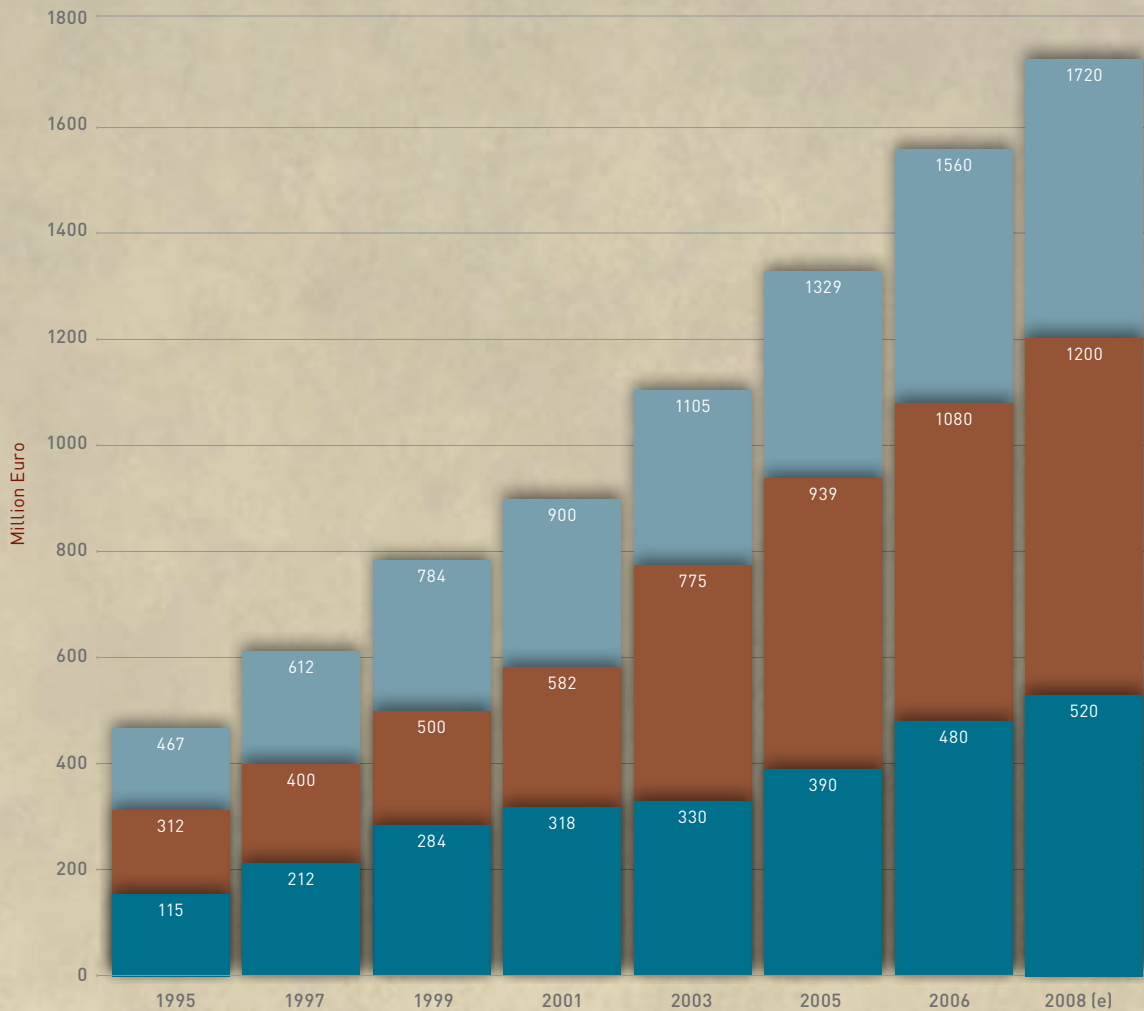
The Government has made a major commitment, through the substantial investment set out in the Strategy for Science, Technology & Innovation (SSTI) 2006-2013 and the National Development Plan (NDP) 2007-2013, to making the transition to a knowledge-economy.

The first report on the implementation of the SSTI was published in December 2008 and is available at www.entemp.ie/publications/science/2008/firstreportonSSTI.pdf. This report, together with the initial findings from the latest Business Expenditure on Research and Development (BERD) survey for 2007 and 2008, confirms that substantial progress has been made in achieving this objective. Both reports provide evidence that the Government's integrated strategy is working, as seen in the following internationally comparable key indicators:

- ◆ Total Research and Development (R&D) spending has almost trebled over 10 years. Total R&D spending across all sectors of the economy – the Organisation for Economic Co-operation and Development (OECD) derived indicator called Gross Expenditure on Research and Development (GERD) – is estimated to climb to €2.6 billion in 2008, which is equivalent to 1.66% of the Gross National Product (GNP).
- ◆ BERD rose to an estimated €1.56 billion in 2006 – a 17% increase on the previous year – almost double the level recorded in 2000. This trend continued in 2007 with BERD climbing to €1.60 billion. It is estimated that BERD will reach €1.68 billion in 2008.
- ◆ The ratio of BERD to economic activity as measured by GNP increased from 0.96% in 2005 to 1% in 2007. It is likely that this ratio will rise further in 2008 to an estimated 1.08% of GNP.
- ◆ Higher Education R&D spending has almost quadrupled in current terms over 10 years and is now at the EU and OECD average levels. This increased investment in the higher education sector is having a significant impact in terms of human capital development, feeding through to attraction of Foreign Direct Investment (FDI) and commercialisation.

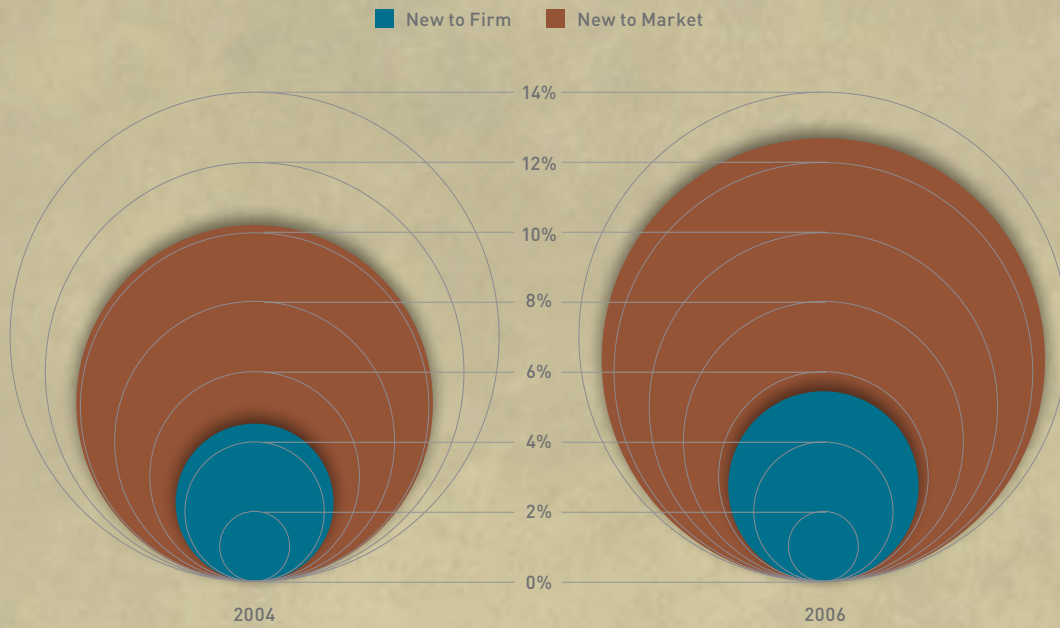
Business Expenditure on R&D

All Foreign Owned Indigenous Owned



- ◆ Through a Strategic Innovation Fund funded project, data is emerging based on international datasets of significant advances by the Irish higher education and research system in its publication record and quality. In 2008, Ireland entered the top 20 list for citations in all fields for the first time (Source; Sciencewatch).
- ◆ A key element of Ireland's success in Research, Development and Innovation (RD&I) is the culture of productive collaboration between industry and academia, which has drawn leading researchers from around the world to Ireland. The number of research personnel employed in R&D activities across the business sector in Ireland rose to 13,861 in headcount terms in 2007, many of them having relocated from the US, Canada, Japan, the UK, Switzerland and elsewhere, attracted by the dynamic Irish RD&I environment.
- ◆ Early estimates of R&D activity levels point to sharp increases in the number of firms performing significant R&D (>€2 million), with 164 significant R&D performers in 2007 compared to 118 in 2005.
- ◆ There also appears to be evidence of firms who were smaller performers of R&D in 2005 stepping up activity to become larger performers in 2007.
- ◆ Ireland has a unique environment that encourages linkage and convergence between all the participants in a collaborative research landscape. Government departments, funding agencies, regulatory authorities, academia and industry are all interconnected creating a dynamic research environment.
- ◆ Enterprise Ireland (EI) has developed a range of schemes to ensure we have the capacity to capture and transform the ideas and advances coming from higher education research into commercial reality. EI and the Industrial Development Agency (IDA) are working closely with companies to strengthen the research and technological base of the enterprise sector in order to drive productivity, competitiveness, exports and jobs. In 2008 EI supported 838 companies to engage with RD&I. Over the period 2000 to 2007, EI supported 430 High Performance Start-Ups, 40% of which were specifically R&D projects. This investment yielded sales of €638 million, exports of €344 million and generated employment for 5,500 people.
- ◆ Science Foundation Ireland (SFI), through its supports for world-class researchers and the creation of world-class research centres in higher education institutions, is creating a stream of highly skilled research talent and building Ireland's reputation as a location for R&D activity. Publications by SFI funded researchers have grown from 1,252 in 2005 to 1,730 at end 2007. This has helped to move Ireland from 647 publications per million population (below EU average) to 1,100 (34% above EU average).

Growth of Total Turnover Attributed to Production Innovation



- ◆ Growth in researcher capacity, led by Science Foundation Ireland, coupled with the enhanced R&D tax credit, continues to be a major attraction for overseas investors and is resulting in a series of significant industrial R&D investments in Ireland by IDA supported companies. Over 40% of IDA investments in 2008 were in RD&I with approximately €420 million of investment. Currently there are about 170 IDA supported companies with a significant R&D mandate with a spend of approximately, €1.7 billion. Significant new R&D announcements in 2008 included investments by many world-class companies including Boston Scientific, Oriflame, Business Objects, Synopsis, EMC, IBM (three separate announcements) ON Semiconductor, AON Corp., and CITI.
- ◆ There is a trend emerging of increased disclosures of inventions, patent applications and start-up companies.

research, development and innovation foreign direct investment

Development & Manufacturing

RD&I and Commercialisation

Collaborative RD&I Centres of Excellence

The background features three stylized molecular diagrams. One is dark grey in the upper left, another is dark red in the center, and a third is teal in the lower left. Each diagram consists of a central sphere connected to several smaller spheres by lines, representing a network or molecular structure.

two

Objectives of Strategy
for Science, Technology
and Innovation 2006-2013

The vision outlined in the Strategy for Science Technology & Innovation (SSTI) is that Ireland, by 2013, will be internationally renowned for its research and be at the forefront in generating and using new knowledge for economic and social progress, within an innovation culture. This vision will be realised by:

- ◆ Building a world class research system.
- ◆ Driving growth through research and innovation in enterprise.
- ◆ Capturing, protecting and commercialising ideas and know-how.
- ◆ Ensuring sound foundations in education.
- ◆ Focusing research in Agriculture, Food, Health, Environment, Marine and Energy.
- ◆ Using research to drive economic and social return in Agriculture, Food, Health, Environment, Marine and Energy.

The SSTI is about competing in a highly competitive global market – Nations with long-term competitiveness make significant investments in R&D.

There is not a simple linear relationship between investment in research, technology and innovation and the resulting economic return. However, the following factors identify why advanced nations make significant investments in R&D:

- ◆ Researcher talent attracts FDI companies and encourages them to stay.
- ◆ Indigenous companies can use the know-how gained through technology transfer to innovate and move up the value chain.
- ◆ Patenting is a means of obtaining a return on the public investment.
- ◆ Research in universities leads to the formation of new businesses by academics or graduates.
- ◆ Students who have participated in advanced research can bring new skills and knowledge into existing enterprises.

The Government reinforced the importance of the investment in the SSTI in *Building Ireland's Smart Economy – A Framework for Sustainable Economic Renewal*, which prioritised continued investment in science and engineering infrastructure and research. Building a Smart Economy is about the development and application of human capital – the knowledge, skills and creativity of people – and our ability and effectiveness in translating ideas into valuable processes, products and services. Ireland's knowledge output in terms of publications per million has gone from well below the EU average in 2000 to almost 46% above the EU average in 2006¹. Publications and Citations data are not only an indicator of academic excellence in research, but a pull factor for venture capital, as investment seeks to draw on academic excellence to enhance product and process outputs.

The framework for sustainable economic renewal stresses the need to restructure our economy so that we can be in pole position when the global recovery begins. The actions in *Building Ireland's Smart Economy* both reflect and build on the objectives of the SSTI with regard to growing and realising our enterprise, knowledge capital, education, innovation, intellectual property and competitiveness goals.

1 Commission Science, Technology and Competitiveness key figures report 2008/2009

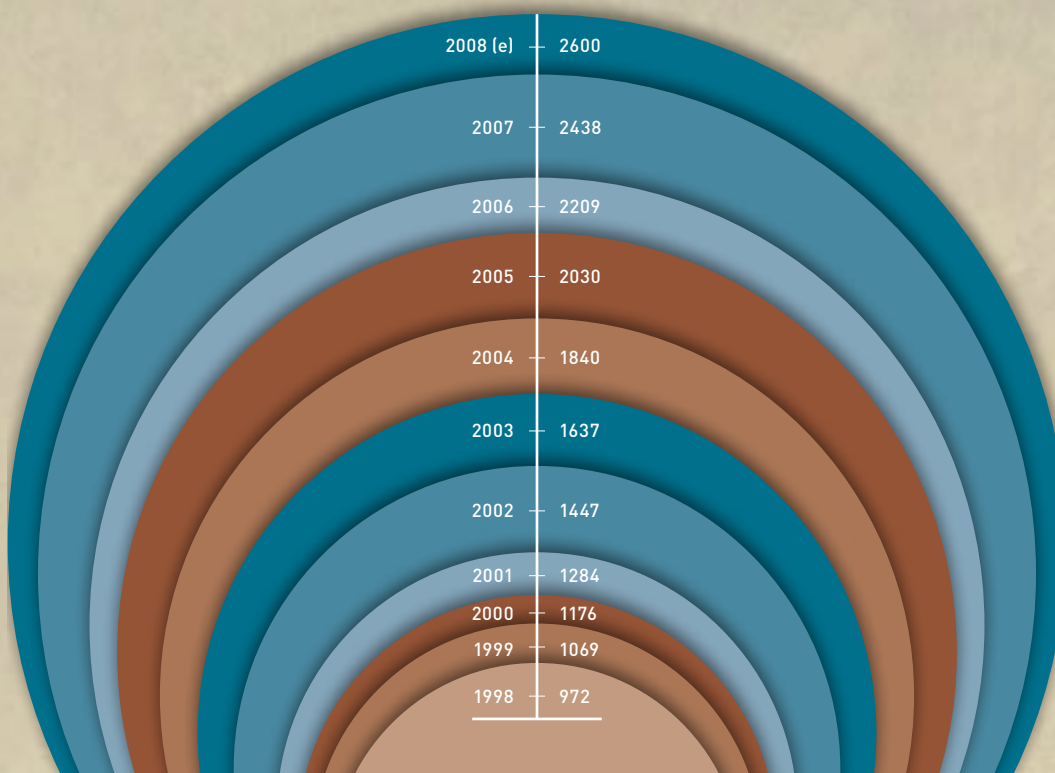
An Taoiseach, Brian Cowen T.D., subsequently announced the setting up of an Innovation Taskforce to advance the development of Ireland as an international innovation hub and to assist in making the Smart Economy a reality. The intention is that the Innovation Taskforce will draw on international experience and successful national models such as the International Financial Services Center (IFSC) in order to develop Ireland as an International Innovation Development Hub. It will examine options to increase levels of innovation and the rates of commercialisation of R&D on a national basis with a view to accelerating the growth and scale-up of indigenous enterprise and to attract new knowledge-intensive direct investment. It will also identify specific policy measures that assist these goals.

The significant infrastructure investment underpinning the SSTI over the period to 2013 is central to economic recovery. The commercialisation of our research investment and the generation of a strong reputation for higher education and research, as well as output of quality graduates at both undergraduate and postgraduate levels, will allow us to build a sustainable enterprise base underpinned by productive innovation activity across the economy.

In order to bring the SSTI through to fruition, the necessary graduates from third-level and increasingly nowadays, fourth-level, in science, engineering and technology will be required to come on stream. The SSTI focuses strongly on ensuring sustained development of human resources in science, technology and innovation to meet the needs of a rapidly growing knowledge society.

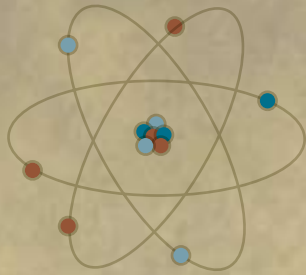
Strong progress is being made in implementing the key actions in the SSTI. We are building strong linkages to ensure diffusion and commercialisation of an increased flow of new ideas and knowledge to produce innovative products and services that will win export markets and create much needed sustainable employment. The establishment of a strong research base and culture in Ireland is proving to be a vital driver of major investment decisions by both overseas and indigenous companies and has also led to significant industrial and academic research collaborations.

Total R&D Expenditure 1998–2008 (€ million)



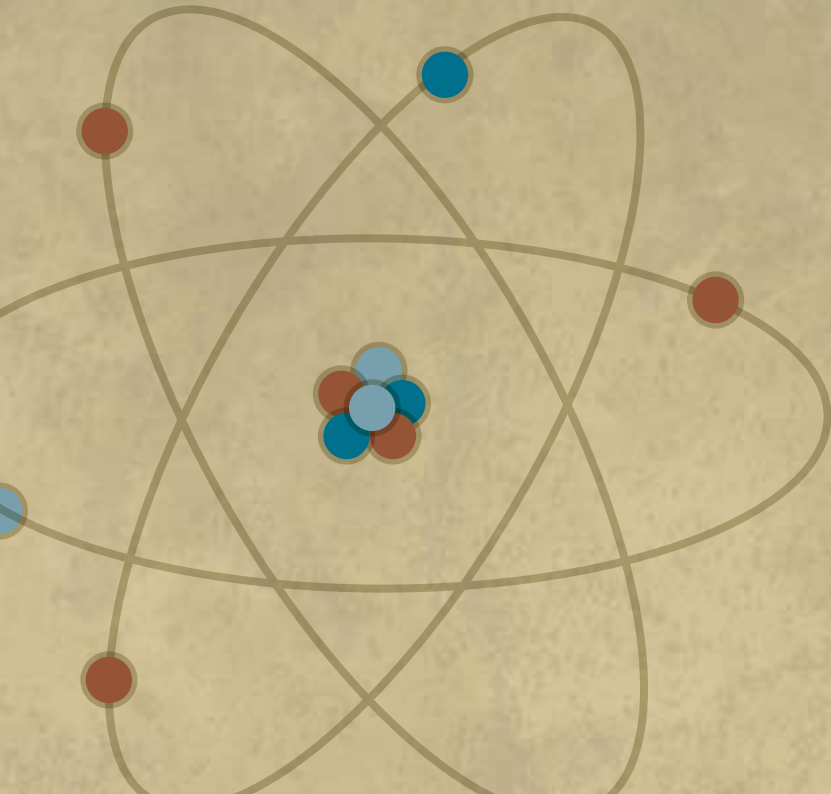
how investment in research and development results in job creation

On March 10 2009, An Taoiseach, Mr. Brian Cowen, T.D., announced that Hewlett-Packard (HP), a world-leading information technology company, were to expand the Global Service Desk (GSD) operation at its Liffey Park Technology Campus in Leixlip, Co. Kildare. A substantial part of the growth plans will include the creation of a research, development and innovation capability for HP's global service desk environment. An €18 million investment will see 500 highly skilled multilingual technical support positions created over a 12 month period.



three

World Class Research



higher education investment

The Programme for Research in Third Level Institutions (PRTL), and investments through the Irish Research Council for Humanities and Social Sciences (IRCHSS) and Irish Research Council for Science, Engineering and Technology (IRCSET), have established state of the art physical infrastructure and an enhanced pipeline of PhD students. These funding instruments are also establishing national/ regional structured PhD programmes so as to enhance the education of PhDs and broaden their skill base to enhance employability across all areas of the economy and society.

Investments in PRTL have been made on the basis of institutions focusing on particular areas of strategic interest to the economy and society and on the basis of track record in R&D. Importantly, the PRTL has led the way in engendering a culture of collaboration at a strategic level in higher education institutions so as to develop critical mass around research activity and education provision.

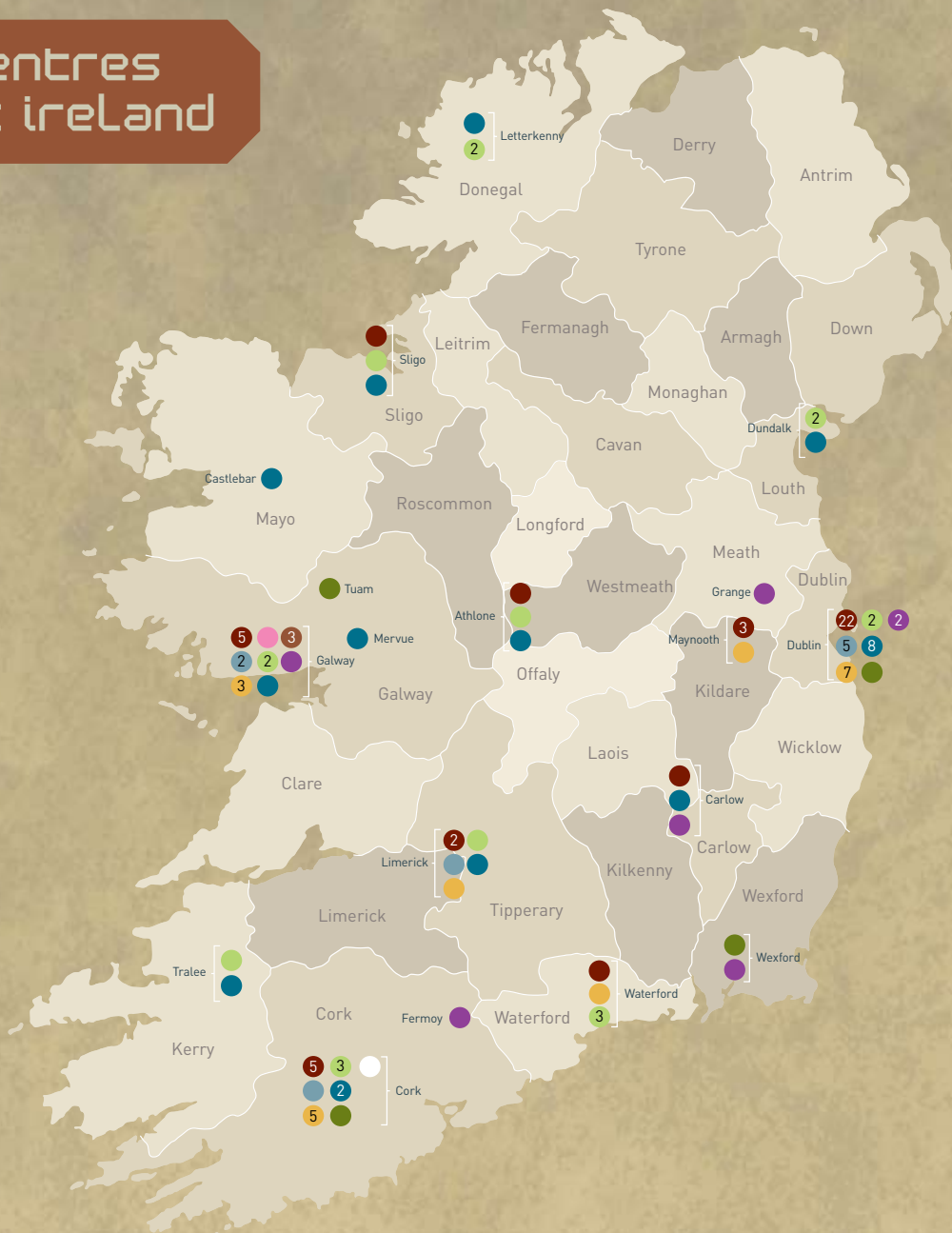
There are many examples of this such as Molecular Medicine Ireland, the E-Irish National Infrastructure (E-INIS), and the Integrated Nanoscience Platform for Ireland (INSPIRE which brings the Centre for Research on Adaptive Nanostructures and Nanodevices [CRANN] and Tyndall together) etc. The recent announcement by University College Dublin (UCD)/Trinity College Dublin on the formation of an Innovation Alliance is a direct consequence of this policy emphasis on institutional co-operation which is at the heart of PRTL and the Strategic Innovation Fund (SIF).

PRTL has also been very successful in attracting significant levels of matching private sector investment. Of the approximately €600 million expended under PRTL, one third of the funding has come from private sources.

A further €60 million from private sources and €130 million from EU programmes has been leveraged off these investments. Private sector engagement with these strategic collaborations is significant with 40 different companies currently engaged with these initiatives.



research centres throughout ireland



PRTL I Centres

Science Foundation Ireland CSETS

Science Foundation Ireland SRCs

Irish Centre for High End Computing

Enterprise Ireland Applied Research Enhancement Centres

Enterprise Ireland Incubation Centres

Marine Institute

Environmental Protection Agency Centres

Teagasc Research Locations

Tyndall National Institute

The investment in strategic world class infrastructure as a key prerequisite for quality R&D has progressed significantly through the strategic investment in successive cycles of the PRTL. To date 30 high quality research centres have been physically established (100,000m² – the equivalent of four Croke Parks) in addition to some priming funding being provided to make these centres operational.

These centres and investments enable the programmes of other funders, for example two thirds of the Centres for Science, Engineering and Technology (CSETs) and Strategic Research Clusters (SRCs) are hosted in such facilities, as are over 70% of SFI funded researchers.

SSTI Success Stories

Of the 25 PhD students that have left Professor Anita Maguire's group in **UCC's Chemistry Department** in the past decade, the majority have progressed on to successful careers in the pharmaceutical sector. 13 are employed in the pharmaceutical sector in Ireland, 6 are employed abroad, and more are involved in start-ups in the UK. Companies such as Pfizer, Novartis, GSK and Eli Lilly are among their employers. Availability of PhD graduates with the relevant skill sets is essential in enabling many of these companies to attract strategic R&D activities to Irish sites.

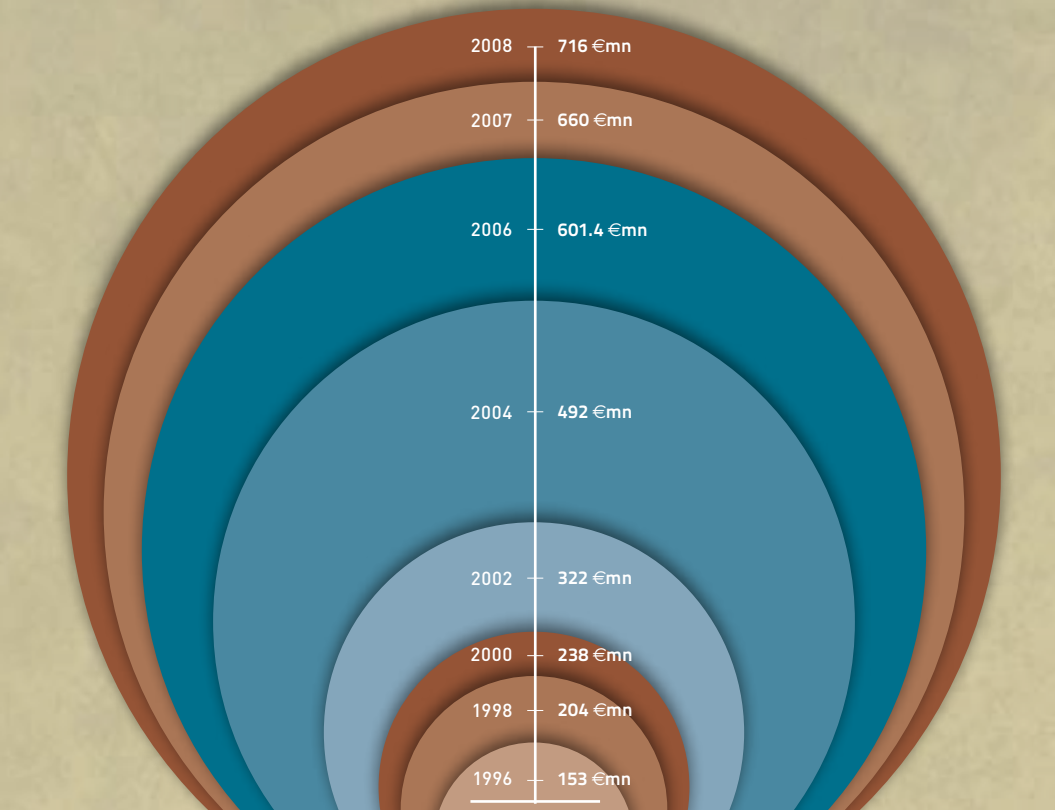
Professor Brian McCraith of the Biomedical Diagnostics Institute in DCU, based in the PRTL funded National Centre for Sensor Research in DCU, is part of a research team that have made significant discoveries in biomedical sensing. The investigators at the Biomedical Diagnostics Institute have developed a novel device for the early detection of cardiovascular disease and are currently in discussions to license the novel technology to a major multinational corporation. The group are also working on a chip test for mastitis.

These facilities are also supporting other funders, such as clinical research centres underpinning the Health Research Board (HRB) funded research and the upgrading of Mace Head environmental monitoring centre in Galway, which enables the Environmental Protection Agency, Marine Institute and others to conduct research. The forthcoming establishment of a national Good Manufacturing Practices (GMP) facility for food production in Cork will support Department of Agriculture, Food and Forestry objectives.

A key objective of the SSTI is to increase the output of PhDs, while maintaining quality, and to see this knowledge intensive capacity spread through all sectors of the economy. It is aimed at substantially growing the current figure of 357,000 people employed in knowledge-intensive services out of the total labour force of 2.28m. To progress this objective, the higher education institutions are engaged in a process with key educational and business stakeholders to progress the development of Structured PhD programmes. The latest data available shows that the number of researchers overall within enterprise increased from 6,937 in 2001 to 8,304 in 2007, an increase of 20%. However, the number of PhD-qualified researchers has increased from 420 in 2001 to 1191 in 2007 (an increase of 183% over the same period). There was a 43% increase between 2005 and 2007. Half of all research personnel employed since 2001 were PhD qualified researchers.

Higher Education R&D has been transformed over the last 10 years and this physical infrastructure has played a critical role. The most recent cycle of PRTL, PRTL-5, announced in January 2009 with a projected investment of €300 million over the period 2009-2013, will further enable national objectives through the provision of strategic and targeted infrastructure in addition to achieving a system-wide step change in PhD education.

Trend in Higher Education R&D expenditure, 1996-2006
(current prices millions Euro)



The National Institute for Cellular Biotechnology

The infrastructure, personnel and expertise provided by PRTLl allowed the National Institute for Cellular Biotechnology (NICB), with DCU as lead institution and NUI Maynooth and the Institute of Technology Tallaght as partner institutions, to develop niche expertise in animal cell fermentation and molecular profiling technology. This was recognised by Wyeth Biopharma who have established its world-leading Biopharmaceutical production plant in Grange Castle in Dublin. In addition, a strategic alliance was formed between Wyeth Grange Castle, Wyeth R&D in Andover, Massachusetts and the NCIB.

The National Centre for Biomedical Engineering Science

The National Centre for Biomedical Engineering at NUIG was established in 1999 under the inaugural cycle of the PRTLl. The initial investment which put in place state-of-the-art facilities, instrumentation and operational support was further enhanced by PRTLl in 2001 when the first Gene Vector Core Facility in Ireland was established. Prof. Tim O'Brien of the Mayo Clinic arrived at this time, and building on PRTLl investments, secured a SFI CSET award to establish the Regenerative Medicine Institute (REMEDI). International collaborations expanded, as did the attractiveness of the centre with 50 new appointments in the area of Biomedical Engineering Science, being made in the following years. In 2006, the spin-off company Triskel began commercialising new therapeutics emerging from the programme related to clinical trials on targeting cancerous tumours. In 2007 as a partner in the Clinician Scientist Fellowship Programme and Molecular Medicine Ireland, the centre was awarded further PRTLl funding and in the same period the Centre was also awarded an SFI SRC for a Network of Excellence for Functional Biomaterials. The HSE & HRB also made an award of €21M to construct and manage a Clinical Research Facility on the UCHG-NUIG campus. These investments are enabling the NCBES to develop significant industry collaborations, e.g. with Beckman Coulter who are embarking on their first collaborative research project undertaken in Ireland in 2008.

Return on Investment by Science Foundation Ireland

Science Foundation Ireland (SFI) has maintained its focus on investing in high quality research relevant to the Irish economy. The economic return from investment through SFI award programmes manifests itself most visibly through the associated company collaborations, primarily with larger projects such as the Centres for Science, Engineering and Technology (CSETs) and Strategic Research Clusters (SRCs), with Enterprise Ireland playing a key role in commercialisation supports.

In addition, primarily through its Principal Investigator (PI) programme, SFI is also investing in building world-class teams to conduct research which will underpin the future competitiveness of industry and enterprise in Ireland. At the end of 2008 SFI was supporting 322 PI teams and it is through these teams SFI is contributing significantly to the Government's goal of *Building Ireland's Smart Economy* by generating new knowledge and the highly skilled personnel required by high-tech industry in the science and engineering field.

SSTI Success Story

Smith & Nephew, the global medical technology company, and the Regenerative Medicine Institute (REMEDI) at NUI Galway, established a four year R&D collaborative programme for the development of treatment for bone and joint diseases. The Smith & Nephew Research Centre in York (UK) is working in partnership with REMEDI to develop new therapies using adult bone marrow stem cells to promote the re-growth of healthy cartilage and repair damaged joints. REMEDI, recognised as Ireland's primary centre for stem cell and gene therapy research, was established as a Centre for Science, Engineering and Technology (CSET) in 2004 by Science Foundation Ireland. It has a core expertise in arthritis research and a particular emphasis on the translation of its research findings in the delivery of new therapies in orthopaedics, cardiovascular and neural diseases. The project involves the use of the REMEDI laboratories in NUI Galway and its manufacturing laboratory for the production of clinical batches of adult stem cells for clinical trials.

Ireland's commitment to scientific research and to producing world class people under the SSTI, led by SFI, is a major attraction for overseas investors and is resulting in a series of significant industrial and academic research collaborations. Forty percent, or 56, of the 114 new projects negotiated by the IDA in 2007 were R&D investments. In 2008, 43% of IDA investments were R&D investments. These investments are valued at €420 million. SFI groups were integral to 19 of the 58 IDA RD&I client wins in 2008.

The best enterprise relevant research is performed in a mixed academic/business environment, where the current and future needs of enterprise influence the academic activities and vice versa. Collaboration between SFI researchers and industry increased significantly during 2008. SFI researchers now collaborate with 279 distinct companies, 173 multinational corporations and 106 SMEs. These include many blue chip multi-nationals, which employ over 56,000 people in Ireland.

In the nine SFI CSETs, clusters of top class researchers from academia join with multi-national companies and SMEs to conduct oriented basic research in areas as diverse as nanotechnology, web technology, sensors, gut biology and software localisation. SFI CSETs have been a key reference selling point for IDA Ireland in generating research led foreign direct investment by multinational over the past number of years. The nine SFI CSETs now collaborate with 83 distinct companies.

Since 2007, the SFI funded Strategic Research Clusters (SRCs) – smaller groupings of academic researchers and scientists from enterprise – have been established to conduct research directly related to industry needs. In February 2009, the Tánaiste and Minister for Enterprise, Trade and Employment, Mary Coughlan T.D., announced the establishment of five new SRCs. A total of seventy-eight companies are currently collaborating with the 18 SRCs now in operation. These companies range from proven global research and innovation leaders to SMEs with ambition, expertise and strategic thinking.

Examples of the companies engaged with SFI through the CSETs and SRCs include the following: Intel; Hewlett-Packard; Proctor & Gamble; GlaxoSmithKline; Alimentary Health; Becton Dickinson; Analog Devices; Hospira, Inverness Medical Innovations, Enfer Technologies, Amic AB; Biosurfit; Medtronic Vascular; Smith & Nephew; Lucent Technologies (Bell Labs); Xilinx Research Lab; NEC

Communications Systems; Socowave; TDK; IBM; Nortel; Ericsson; Cisco; Fidelity; OpenLink; Storm Technologies; Celtrack; Cyntelix; Robert Bosch; Fidelity Investments, IBM Ireland.

SFI investment in research is also beginning to bear fruit through the commercialisation activities supported by Enterprise Ireland (EI). SFI researchers are contributing significantly to the increase in commercialisation activities (invention disclosures, patent applications & approvals, license agreements, spin out companies, etc.) undertaken by the Technology Transfer Offices supported by EI in the HEIs.

During 2008 SFI researchers established three spin out companies – Evolvability (Dr. Conor Ryan University of Limerick); Socowave (Dr Donal O'Mahony, CTVR CSET at Trinity College Dublin) and Heystacks Technologies Ltd (Prof. Barry Smyth, UCD). Many more are beginning to emerge as the investment by SFI in research in recent years is reaching market potential.

In 2008, SFI researchers generated 135 invention disclosures, 95 patents were pending (up from 82 in 2007), 13 patents were awarded (up from 11 in 2007) and 22 licenses were generated (up from 8 in 2007).

The Tánaiste and Minister for Enterprise, Trade and Employment, Mary Coughlan, T.D., announced in June 2008 that Business Objects, an SAP (**Systems Analysis and Program Development**) Company, was to invest €29 million in establishing an R&D Centre in Ireland. The centre, which will be located at the SAP facility in CityWest, Dublin will recruit a R&D team of 100 people, over a 4-year period, with the support of IDA Ireland.

Justin Holmes and **Michael Morris** (Principal Investigators's, **CRANN** and **Tyndall National Institute**) have developed a unique processing technology that allows the controlled synthesis of highly monodispersed silica particles in the 0.2–10 micron range. By simple control of the reaction parameters, appropriate sized particles can be synthesised. Holmes and Morris have licensed their invention to Irish spinout Glantreo Ltd. It is possible that significant royalties be generated from successful implementation of this very high grade manufacturing process.

Ireland's reputation as a centre for conducting world class research continues to be enhanced. SFI researchers have driven Ireland's bibliometric output from well below the European average in 2003 to well over that average currently. More importantly, the quality of that output has driven Ireland from a global citation ranking of 27th in 2003 to 17th in 2008. SFI funded researchers published 1,483 refereed original papers, 146 refereed reviews, 24 books, 129 book chapter and 1,440 conference proceedings in 2008.

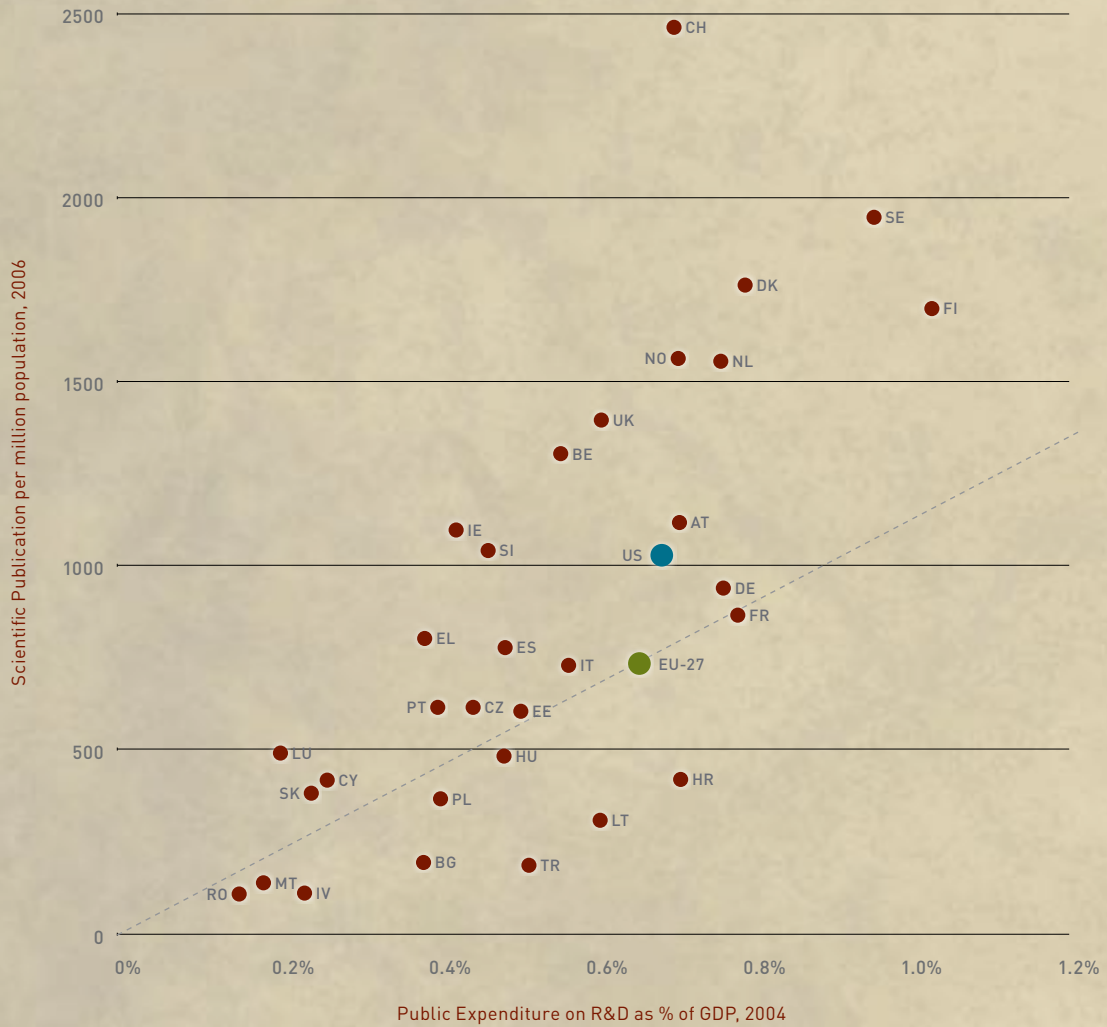
Also, in 2008, SFI supported teams included 688 Post Doctoral Researchers and 1,156 PhD students. By years end SFI was directly supporting 2,812 research jobs in teams based in Irish Education Institutions where the leaders leverage a further 3,076 jobs from other sources. This support has retained and attracted these highly skilled individuals to into the Irish research system. This investment in people will provide the backbone of human capital required to drive Ireland's Smart Economy.

In line with the programme for Government SFI's remit was formally extended in 2008 to include research in the fields of science and engineering underpinning sustainable energy and energy-efficient technologies (Energy). This extension essentially enables SFI to generate high-quality research in these fields. In July 2009 SFI published its strategy for research investment in Energy that will result in economic benefits in the medium and longer-term.

SFI Centres for Science, Engineering and Technology



Collective National Impact of SFI – Impact on Publications



New Therapies for Intestinal Inflammation – The APC and Align Story

Alimentary Health (AH) is a development stage speciality biotechnology company located in Ireland. The company is focused on the discovery, development and commercialisation of proprietary probiotic and pharmabiotic treatments for gastrointestinal disorders and other inflammatory conditions. Alimentary Health is the foundation industry partner of the SFI funded Alimentary Pharmabiotic Centre (APC) CSET based at University College Cork. Alimentary Health have recently launched a product called “Align” in collaboration with Proctor & Gamble, onto the US market. Align contains Bifantis®, a probiotic strain that has been clinically proven to naturally defend against five signs of digestive imbalance.

Bifantis is a unique patented probiotic strain known to be isolated from a healthy human colon and is only found in the Align product. Research to prove the efficacy of Align, by Alimentary Health researchers such as Dr Liam O’Mahany, has been carried out in conjunction with the APC.

How the Body Protects Itself – The Opsona Story

SFI funded researchers, the world renowned Professors Luke O’Neill and Kingston Mills in Trinity College Dublin, have been working on fundamental aspects of immunology, i.e. how the body protects itself from disease. Their research gave rise to significant intellectual property from which evolved into a start up company called Opsona Therapeutics, which was founded in 2004.

Opsona is a drug development company which focuses on novel therapeutic and preventive approaches to autoimmune and inflammatory diseases such as rheumatoid arthritis, lupus and solid organ transplant rejection whilst Opsona is also identifying new ways to prevent certain cancers. Professors O’Neill and Mills, with SFI funding subsequently established a Strategic Research Cluster and the continuation of their research has involved Opsona and linked in with other companies, most notably Wyeth.

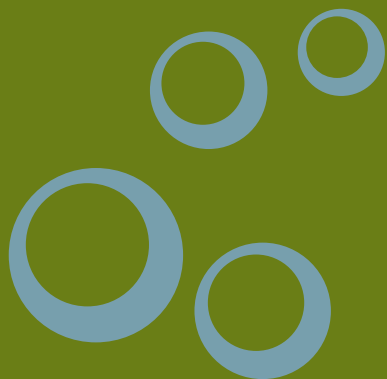
As a high potential start up company Opsona, with necessary assistance from Enterprise Ireland has evolved, to the stage where recently, in May 2009, they announced the latest round of external financial investment in their clinical trials. This round of funding now exceeds €21 million and involves significant investment from partners such as Roche, Novartis Fund, Fountain Healthcare Partners as well as funding from Enterprise Ireland. Overall this level of investment is a very substantial sum for an indigenous start up company which has evolved from strategic SFI research investment at the outset. Opsona is now strongly placed to further develop its clinical development pipeline and become a significant product focused company.

IT Systems Helping Our Hospitals and Patients – the DERI CSET at NUI Galway

The Digital Enterprise Research Institute (DERI) established in 2003, is a SFI CSET based in NUI Galway. DERI is fast becoming recognised as a leading international web science research institute which interlinks technologies, information and people to advance business and benefit society. There are numerous diverse research projects currently underway at DERI which span financial, e-learning, health and data management systems to name just a few.

One of the prominent breakthroughs DERI has made already involves developing technology to allow diverse hospital IT systems to share important patient related information. In recent years healthcare professionals have been concerned that Electronic Patient Records systems have become islands of information where little or no interoperability exists and where there are significant factors involved such as cost, complexity, and maintainability. The impact is that patient details are often held on paper, sometimes resulting in missing files, possibly leading to bad patient outcomes due to incomplete information and, in the extreme, even patient deaths.

DERI's *Plug and Play Electronic Patient Records* (PPEPR) is a data integration tool that allows hospital IT systems talk to each other. University Hospital Galway, and Tallaght and Beaumont Hospitals were on the advisory board for the project which has been in development for three years now. It is currently being used in clinical trails at the Mater Hospital in Dublin. It is anticipated that PPEPR will be available as a full working product in 2010 to the benefit of the Irish health system and patients. The technology arising from this SFI funded research in DERI has been licensed to Slidepath, a start-up company based in Nova UCD.



four

Capturing, Protecting
and Commercialising Ideas
from Research



key to competitiveness for indigenous companies

Enterprise Ireland works closely with companies to strengthen the research and technological base of the enterprise sector in order to drive productivity, competitiveness, exports and jobs. R&D activity levels point to sharp increases in the number of firms performing meaningful R&D (>€100,000), with 704 “meaningful” R&D performers in 2008 compared to 515 in 2005.

There is also evidence of firms who were smaller performers of R&D in 2005 stepping up activity to become larger performers in 2008.

Enterprise Ireland (EI) and IDA are working closely with companies to strengthen the research and technological base of the enterprise sector in order to drive productivity, competitiveness, exports and jobs. In 2008 EI assisted 794 companies to perform R&D. Between 2000 and 2006 Enterprise Ireland supported 430 High Potential Start-Up (HPSU) companies. Enterprise Ireland invested a total of €219 million in these companies during this time. Critical to the growth of HPSUs is their ability to bring new sustainable products and processes onto the international market. 40% of Enterprise Ireland’s total investment was funding specifically for R&D projects. This R&D investment by EI leveraged a further spend on R&D of approximately €262 million by these companies during this time. Enterprise Ireland’s investment in HPSUs between 2000 and 2006 has contributed to sales of €638 million, exports of €344 million and generated employment of 5,500 with 1,300 employed in R&D specifically. In 2007 and 2008 EI supported a further 140 new high potential start up companies. In 2008, 21% of EI supported HPSUs were created by individuals who had been previously employed in Multinational corporations in Ireland. The HPSU’s that EI supported in 2008 will create 1,000 new jobs over the next three years with total sales over the same period to reach €615 million and exports will account for almost 75% of this. Despite the current economic environment EI expects to support a further 66 innovative HPSUs in 2009.

Commercialisation

Enterprise Ireland continually drives the commercial return on the State's research investment through direct funding to researchers to commercialise their research and supports to institutions to help build the commercialisation system. EI also operates a range of supports to help companies engage with third level researchers to undertake collaborative research for the benefit of the company.

- ◆ In 2008, through the Commercialisation Fund, EI supported 138 new projects
- ◆ Technology Transfer activity has also shown an increase in outputs. Metrics reported under the Technology Transfer Strengthening Initiative with additional data from Forfas, show the total number of invention disclosures in 2007 was 270 from all HEIs and research institutes. This increased by 51% in 2008 to reach 407. The vast majority of disclosures come from the Universities but the Institutes of Technology (IoTs) are also showing an increase in research commercialisation activity.
- ◆ 145 priority patent filing applications were made in 2007 by all HEIs and research institutes. This increased by 57% to reach 227 in 2008.
- ◆ In 2007, 56 Licences, Options or Assignments for intellectual property (IP) were concluded between HEIs/research institutes and companies and in 2008 this number increased to 67.
- ◆ 2007 saw the creation of 13 spin-out companies from the Universities and IoTs. The number of spin-out companies created in 2008 was 7 but interim figures for 2009 show a substantial increase with 14 already created in the first 6 months.
- ◆ Enterprise Ireland's campus incubation programme provides a supportive environment on Third level campuses where new companies can grow significantly in their formative years. The programme is designed to foster entrepreneurship and drive campus company creation, to support balanced regional development and to help realise the commercial potential of Ireland's research community. More than €50 million has been invested under this programme over the last decade in the establishment of business incubation centres on the Institute of Technology campuses across Ireland, as well as a mix of business and more specialised bio-incubation space in the universities. 20 centres are now operational and home to over 230 companies employing over 1,000 people, over half of whom are based outside Dublin. A recent impact evaluation of the programme demonstrates the strong alignment between a typical incubating company and the Government's "Smart Economy" vision:

- ◆ They are predominantly knowledge-based, with three quarters already reporting R&D activity.
- ◆ They are export-oriented: export sales of nearly €60 million were reported by the companies for the 2005-7 period.
- ◆ Competence Centres are collaborative entities established and led by industry that are resourced by highly-qualified researchers associated with research institutions who are empowered to undertake market focused strategic R&D for the benefit of industry. Focused on research with a direct impact on industry, these centres are a joint initiative of Enterprise Ireland and IDA Ireland and a key element of Government plans to build a smarter, greener economy. In May 2009, the Tánaiste and Minister for Enterprise, Trade and Employment, Mary Coughlan, T.D., announced that Government funding is being provided of up to €1 million per initiative for this initial research phase.
- ◆ The All-Island Innovation Voucher initiative was announced in May 2008. This initiative provides Irish SMEs with access to a further 10 knowledge providers based in the North, and will allow Northern Ireland based SMEs use Invest NI innovation vouchers (Stg€4,000) to access expertise in research institutions based in the Republic of Ireland. To date 5 ROI companies have completed projects with NI knowledge providers and 3 NI companies have completed projects with ROI knowledge providers. The knowledge providers have a number of additional cross border projects underway which will be completed in the coming months.

Biopharmaceuticals – research in Ireland can improve the manufacturing process worldwide

A €2.3 million Enterprise Ireland funded research programme for the biopharmaceutical sector in Ireland was launched on 2nd June 2009. The aim of the programme is to deliver more efficient, reliable and cheaper processes for manufacturing biopharmaceutical medicines. There are fifteen companies involved in the project, eight are Irish companies – BioUETIKON, Stokes Bio, Valcon Consulting, Luxcel Biosciences, Cellix, DPS Engineering, Pharmeng and Technopath. Seven multinationals are also involved – Wyeth, J&J (Centocor), Genzyme, Pfizer, Schering Plough, Eli Lilly and Elan.

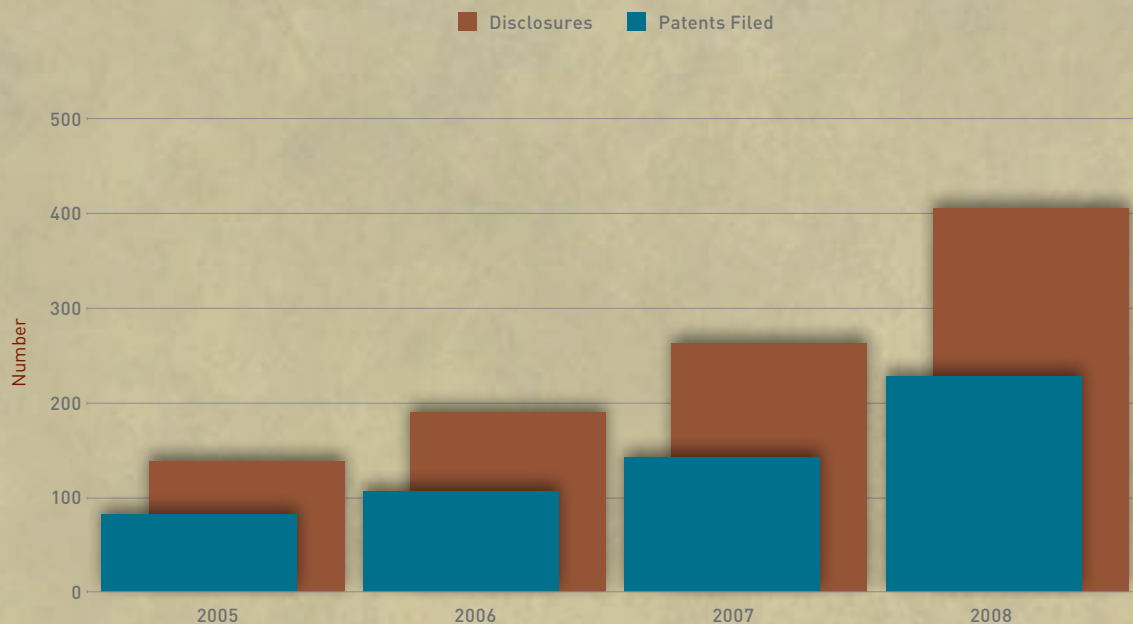
Enterprise Ireland has already worked with the companies to identify specific developments required to improve the production systems used to manufacture these drugs. The application of these developments will allow precise quality control throughout the manufacturing process. This will be an advance on traditional methods which use laboratory analysis to measure quality

after the drug has been manufactured – an inefficient and expensive process with high levels of waste and unnecessary energy consumption.

The team that will carry out the research is led by University College Dublin, with support from Dublin City University, the National Institute of Bioprocessing Research and Training and the Tyndall National Institute in University College Cork. ABB, which employs over 450 people in Ireland, will support the academic research team with analytical and commercial aspects of the research programme.

Eight industry-led research networks have been supported to date in the areas of process analytical technology, veterinary health, wireless sensors, IP multimedia for services, e-learning, power electronics, bioprocess monitoring and point of care immunotechnology. A total of 93 companies were involved in IIRps in 2008.

Invention Disclosures and Patents Filed (2005–2009)



commercialisation of research

Examples of Companies Assisted By Enterprise Ireland

Stokes Bio Ltd

Spun out of the University of Limerick in 2005, Stokes Bio Ltd develops microfluidics technologies for Gene Expression measurement and Gene Target Detection. The products arising from these technologies are used for discovering markers for cancer that will lead to a new approach to the diagnosis of cancer, and pathogen detection. The platform technology can also be applied across the Food and Agriculture sectors and the company has recently signed its first contract to supply instruments to a US based multinational company (name currently undisclosed publicly). Stokes Bio Ltd currently employs 20 people full time, 12 of whom have PhDs, at their Limerick City base.

Powervation Ltd, Limerick

In 2007, a University of Limerick campus company, Powervation Ltd raised €7 million in venture capital. The company is built around innovative digital power control technology developed using Enterprise Ireland's commercialisation funding. Powervation aims to become the leading global supplier for energy control management in information processing systems. The company currently employs 23 and has recently announced 118 jobs to be created at their facility in Limerick.

Outcomes from EI support


In a recent independent survey of 203 companies that had received R&D support from Enterprise Ireland, on average 4 products were newly introduced or significantly improved as a result of R&D funding. Both productivity and sales increased for the majority as a direct result of the funding with average growth of 18% and 24% respectively and over 70% of companies employed new staff as a result of R&D funding.



five

R&D for enterprise,
innovation and growth





Direct investment in enterprise yields a positive return to the company and to the economy, generally within a relatively short time frame. Some recent examples of how state agencies are assisting enterprise, both large and small, to invest in R&D for the purpose of creating employment and enhancing Ireland's competitiveness include:

Surface Power Solar, Co. Mayo

Surface Power Solar, based in Tourmakeady, Co. Mayo has used R&D to create the world's most efficient solar hot water panel. The company won a €20 million deal to have their breakthrough solar power product distributed throughout the Republic of Ireland in June 2009. The company has signed a deal to supply the Moritz Group with its SP501 Solar Hot Water Collector over a five-year period.

Established in 2003, Surface Power has been engaged in R&D since it was founded and has amassed a significant product portfolio in advance of targeting key world export markets for solar and wind renewables. Surface Power Solar has already achieved product approval in over 25 countries and expects to add the USA, Canada and Australia to this list. The company is a client of Údarás na Gaeltachta and has received R&D funding from Enterprise Ireland.

ERGO Ltd, Dundalk and Dublin

ERGO Ltd opened an R&D facility at the Regional Development Centre at Dundalk Institute of Technology (DkIT) in February 2009. In a venture supported by Enterprise Ireland's R&D Fund, Ergo has committed €1.1 million over two years to establish a R&D division for the further development of a thriving business that delivers software solutions to the financial services sector.

Research activity will focus on developing the next generation of Ergo's financial services software technology platform. The technology will provide a number of important tools which will assist the financial services sector to simplify complex business processes and assist in its decision-making.

Glaxo Smith Klein (GSK) is one of the largest pharmaceutical companies in the world. In its Irish RD&I activities, GSK is establishing a ground breaking research project into gastrointestinal diseases, in collaboration with the Alimentary Pharmabiotic Centre (APC) in University College Cork. This project is jointly supported by IDA Ireland and Science Foundation Ireland (SFI). The company is also investing in a unique collaboration with the Trinity College Institute of Neuroscience (TCIN) and NUI Galway, on a major Research & Development programme for the discovery of new therapies to treat Alzheimers Disease.

In May 2008, it was announced that **Pfizer Inc.**, the world's largest pharmaceutical company, is to invest €190 million, with the support of IDA Ireland, in establishing a biologics facility at Shanbally, Co. Cork. The new plant will create approximately 100 high quality Pfizer jobs over 3 years. The investment is a key milestone in realising Pfizer's corporate ambition to become a global leader in the bio-therapeutics space.

IDA Ireland announced in February 2009 that Intel is to invest over €50 million in a major expansion of its R&D facility in the Shannon Free Zone in Co. Clare, with the support of Shannon Development. The investment has the possibility to grow Intel's Shannon workforce by up to 134 new jobs over the next 4 years, bringing the total employment to approximately 300.

Enterprise Ireland, through support for Houghton Mifflin Harcourt, contributed €15 million to an investment of €350 million in e-learning R&D, thereby creating 450 high-value jobs. The exchequer payback will be surpassed within 4 years.

Citi, one of the world's largest financial services companies, is to base a €35 million investment in a next generation eBanking platform at its Dublin operation for RD&I. The investment, supported by IDA Ireland, will establish a new Centre of Technology Excellence (CTE) and will lead to the creation of 30 high calibre positions, such as project managers, technology architects, business analysts and software/hardware engineers.

Finance Minister Brian Lenihan TD announced in September 2008 that the **Boston Scientific Corporation**, specialising in medical devices for use in minimally invasive surgical procedures, is to invest €50 million, with the support of IDA Ireland, in strategic R&D at its Galway facility. Boston Scientific was established in Galway in 1994 and is the largest manufacturing site within the corporation with over 3,000 people employed in the R&D and manufacture of cardiology and peripheral vascular products. This is a major investment for the company and an integral part of its strategic plans.

KCI Athlone

KCI with an employment grant of €2 million, will create 350 jobs and generate additional expenditure of more than €13 million in the economy. The Exchequer payback period is just over 9 months.

Microsemi Ennis

Microsemi, with an employment grant of €2 million, will create 200 jobs and generate additional expenditure of more than €11 million. Exchequer payback is little over 5 months.

Banagher Concrete, Offaly

Banagher Concrete has invested in R&D since the Nineties, developing new product lines that led to opportunities in export markets, namely its concrete 'w' beam, which rivals steel in terms of its load-bearing capabilities. In April 2009, Banagher Concrete provided a bridge for the Edinburgh Trams and it is currently working on the N80 in Glasgow. Because road building projects have slowed, Banagher Concrete is looking at ways to diversify with EI support. One option is to look at alternative energy products and Banagher Concrete is looking at bio-gas tanks; sealed tanks for farmsteads that use effluent to produce gas as a renewable-energy system.

Socowave Ltd., Cork and Dublin

Socowave, an Irish technology start-up that is supported by EI, is headquartered in NovaUCD, the Innovation and Technology Transfer Centre at UCD, part of the national technology transfer system managed by EI. Socowave has made a wireless technical breakthrough which is attracting the attention of global wireless infrastructure vendors. This breakthrough has the potential to transform how cellular network operators deliver video-rich services to mobile customers, in the future. Socowave's technology dramatically improves the quality of the wireless link between mobile user and cellular network and increases effective data rates by up to ten times. This improvement will reduce video upload and download times to/from the internet. Socowave estimates that the new APA technology has an annual market potential of over €2 billion.

The technology underlying Socowave's breakthrough is based upon a pioneering base station system architecture controlled digitally over fibre optic cable which incorporates some enabling technology licensed from NUI Maynooth and UCD, with support from EI's commercialisation specialists.

case study - assistance for smes

Enterprise Ireland

Enterprise Ireland's Innovation Vouchers are worth €5,000 each. Small businesses that have a business opportunity they wish to explore can use the vouchers to facilitate knowledge transfer from the public research sector to small businesses. The total grant awarded through the innovation voucher initiative to date is in excess of €7 million.

Island Seafoods, Killybegs, Co. Donegal

When Island Seafoods, Killybegs was established in 1986 by Michael O'Donnell, the primary business of the company was processing mackerel and herring. Now, due to the fall in the volumes of fish being landed, the company needs added-value products to keep the business growing. In particular, it would like to supply supermarket chains both here and in Europe.

During discussions with supermarket contacts in Germany, the company discovered the Germans were interested in new product ideas such as smoked mackerel with stuffing and honey-smoked mackerel. They subsequently applied for an innovation voucher to conduct research into potential new products. The application was approved and the voucher was used at St Angela's College in Sligo to look at a new range of glazes for smoked mackerel products and at new packaging that would help prolong its shelf-life.

R&D Tax Credit Scheme

Upon introduction in 2004, a 20% tax credit was allowed against Corporation Tax on incremental qualifying R&D expenditure. A separate R&D tax credit was also available for capital expenditure on R&D building facilities. The Finance No.2 Act 2008 provides for an increase of the rate to 25%, applying to accounting periods commencing on or after 1 January 2009. It also provides for the base year to remain as 2003 for all future accounting periods, greatly enhancing the attractiveness of the scheme.

- ◆ Costs incurred by a company subcontracting R&D to a third party are considered as qualifying expenditure in the current R&D tax credit scheme.
- ◆ Expenditure by companies on sub-contracting R&D work to unconnected parties qualifies to a limit of 10% of qualifying R&D expenditure in any 1 year and sums paid to universities or institutes of education in the European Economic Area (EEA) to carry out R&D qualify for relief up to a limit of 5% of R&D expenditure incurred by the company or group.
- ◆ The Finance No.2 Act 2008 also enhances the credit to provide the full benefit of the credit to companies (including small and start up companies over 3 years).
- ◆ Companies will have options for the carry-back of unused tax credits for set-off against corporation tax paid in the previous year and to allow for any remaining unused credit to be refunded in instalments over a 3 year period by way of a payable credit.
- ◆ The Scheme will also now allow for a proportion of the expenditure on new or refurbished buildings used **in part** for R&D purposes to qualify for a tax credit.

The R&D tax credit scheme undoubtedly assists, along with other incentives, in making Ireland a very attractive location for companies to carry out R&D and also helps Ireland retain existing activities in an increasingly competitive international environment, and encourages growth of R&D-intensive indigenous companies.

A graphic design featuring five stylized human figures arranged in a circular path. The figures are colored in a gradient from light blue at the top to dark brown at the bottom. They are connected by a series of parallel, curved lines that form a circular path. The background is a solid dark brown color.

SiX

Science, Education
and Society

encouraging greater interest in careers in science and technology

The actions in *Building Ireland's Smart Economy* both reflect and build on the objectives of the SSTI with regard to growing and realising our enterprise, knowledge capital, education, innovation, intellectual property and competitiveness goals. If the vision in the SSTI is to be realised, it is essential that there is a steady “pipeline” of young people who chose to study science, technology, engineering and maths disciplines at third level.

At an earlier stage of the human capital pipeline, our Science and Maths Awareness Programme, Discover Science and Engineering (DSE), is supporting and prioritising initiatives to advance science and maths literacy and grow the pipeline to third level Science, Technology, Engineering and Maths (STEM) disciplines.

The Department of Education and Science (DES) is also in the process of rolling out the Project Maths initiative which will see a much greater emphasis being placed on student understanding of mathematics concepts, with increased use of contexts and applications that will enable students to relate mathematics to everyday experience. The changes will be phased over 3 years, initially in the project schools, which began in September 2008.

Project Maths has, as an overarching goal, the objective of increasing those taking Leaving Certificate Honours Mathematics from 17% to 30%.

Urgency is required to reinforce the human capital pillar of the Smart Economy. Progress has been made by the DSE Programme in encouraging young people to pursue careers in science and technology. However, recommendations arising from the conclusions of the evaluation of the DSE Programme that was conducted in 2008 together with the findings of the Expert Group on Future Skills Needs and the Services Strategy Group, support the case

for taking further actions to encourage young people to pursue careers in science, engineering and technology and to raise the number of students taking higher level maths at Leaving Certificate. The Enterprise Feedback Group² (EFG) has also identified what it sees as a crisis in Maths skills, which they see as occurring at second level, but with a knock on impact on third level output. The EFG is calling for urgent remedial action to incentivise the study of honours level Maths in secondary schools. This challenge has been the subject of further discussions between DES and the Department of Enterprise, Trade and Employment. A meeting with the presidents of higher education institutions will be convened shortly on the matter, and a report to the government will be submitted following the outcome of these discussions.

Dublin European City of Science 2012 – Leveraging the investment in R&D

Dublin has beaten off strong competition to host the City of Science in 2012. This event will provide a platform to showcase the best of Irish science and research across all disciplines. Dublin City of Science will provide the opportunity for Ireland to exhibit the fruits of its substantial investment in research through the SSTI. It will grow Ireland's international profile as a premier location for carrying out world class R&D and assist in expanding Ireland's R&D base. A network of leading international experts across all disciplines will be harnessed to develop and implement scientific, outreach and business programmes that are second to none.

The core "City of Science" event will be held in Dublin from 12th-16th July 2012. However, it is intended that the "City of Science" branding will be utilised throughout that year in order to maximise the benefit to Ireland from a scientific, cultural and economic perspective. In the longer term, the aims and objectives of the City of Science will aid in the establishment of Ireland as an "Innovation Island" and help to contribute to future economic and social progress.

2 The Enterprise Feedback Group (EFG) was established by the Tánaiste and Minister for Enterprise, Trade and Employment in December 2008 to enable stakeholder representatives have a sustained dialogue with the Interdepartmental Committee (IDC) on STI. The intention is to incorporate feedback from the EFG into the continuing development of policy and programmes for achievement of the targets in the Strategy for Science, Technology and Innovation (SSTI) 2006-2013.

how innovation and research benefits society - case study

The Dublin Fire Brigade is using mobile communication technology, originally developed for astronauts on the International Space Station, to get crucial information about emergency situations while en route to accident scenes. The new system allows an emergency crew travelling to a fire to download the layout of the building, identifying where the hydrants are located and what chemicals may be inside and where. In the case of a car crash, the crew on the way to a scene could download information about the types of vehicles involved. With explosives in airbags, high-voltage batteries, liquefied gas tanks and other new hybrid car technologies, removing an injured person from a crash scene can be extremely hazardous to both the emergency crew and the victims.

The Irish company **Skytek** adapted the Advanced Procedure Executor (APEX) system, originally developed to assist astronauts in managing the International Space Station (ISS), for use by the Dublin Fire Brigade. The technology behind the APEX system is Skytek's own International Procedural Viewer (iPV) software, development of which began eight years ago. Through a contract with EI, Skytek started working with European Space Agency (ESA), leading to the development of core technology for the operation of ESA's Columbus laboratory.

Today, the APEX system and Skytek's iPV technology are used regularly by astronauts on the ISS. Skytek is now in a position to transfer this space technology to other industries, a process it started in close collaboration with the Dublin Fire Brigade.



SEVEN

Research in the Public Sector





A fully developed national system of innovation has the capacity to contribute not just to economic progress, but also to the overall welfare of society. Across the sphere of government, there are important areas of civil and sectoral research which are contributing to economic and social progress.

health

The Department of Health and Children is taking action to ensure that the contribution of health research to the Smart Economy can be optimised. Two specific measures are currently being put in place. The first entails the development of an Action Plan for Health Research to exploit the opportunities for stronger linkages between our health sciences and related Foreign Direct Investment and indigenous sectors such as medical devices and bio-pharma. In accordance with the Programme for Economic Renewal and the development of the Smart Economy, the Department of Health and Children, through the Health Research Group, is currently preparing

a Health Research Action Plan. The Action Plan will provide national leadership on the health research agenda and specify a coordinated programme of targeted measures to achieve agreed deliverables over a particular time frame. This will ensure a more rigorous approach to health research planning and spending that is underpinned by maximising the strategic outcomes value of all applicable health research expenditures.

The Department recognises the critical importance of maintaining the highest ethical standards in health research and thereby ensuring public confidence in essential health research and its benefits

both for individual patient care and the health system generally. The Health Information Bill, which is currently being drafted, will address a number of matters related to health research which are designed to support the health research function and at the same time safeguard proper regard for privacy, confidentiality and security. In that context, the ethical approvals structures being developed for inclusion in the Bill are regarded as crucial.

The Health Research Board (HRB) provides funding for health-related research, maintains health information systems and conducts research linked to national health priorities (covering biomedical and clinical research, population health and health services research) that funds approximately 300 high quality research projects and programmes and over 100 career support grants, as well as a variety of research infrastructures and networks in order to build capacity for world-class health research in Ireland. Some examples of the impact of HRB funded research projects are provided on the opposite page.

To ensure that translational health research has strong foundations in both academia and the health services and will serve to attract the pharmaceutical and medical devices industry, three Clinical Research Facilities are being developed at Dublin, Galway and Cork to support patient focussed research in a hospital setting.

The Health Service Executive has established an Education, Training and Research Group to progress a programme of work in relation to education, training and research in the HSE and its funded agencies. It recognises the need for an integrated and coordinated approach to education, training and research across the HSE, including medical, nursing, population health, therapies and management.

Impact of HRB funded research projects

A clinician scientist supported by the HRB working in collaboration with scientists in the US, has helped to develop an **early warning test for lung cancer** based on biomarkers that are associated with early onset of the disease. The test is highly accurate and could help to save lives through earlier medical intervention.

An Irish cancer researcher in receipt of HRB funding has **developed and validated a new test that can predict whether a breast tumour will spread to other sites in the body** and therefore help some women with breast cancer avoid unnecessary chemotherapy. The test has been recommended by the respected American Society of Clinical Oncology, which is effectively a worldwide recommendation. The approach is now poised to help tailor the treatments of women who have been diagnosed with breast cancer.

A clinical researcher funded by the HRB has helped to **develop a powerful new indicator for the development of Alzheimer's disease**, which has been validated in a large multi-centre patient trial. The test, which is highly accurate, is hugely important because it provides an early warning of the presence of Alzheimer's and therefore allows the elimination of other causes of mild cognitive impairment.

An international team of researchers led by HRB-funded researchers have **discovered a new genetic mutation that is one of the likely causes of motor neurone disease**, a disease which kills one person in Ireland every three days. The finding is being seen by neurologists as a significant leap forward in understanding the disease and the search for its cure.

Hospital-based clinical researchers funded by the HRB have helped to develop a highly accurate **computer-based screening method for the detection of colorectal cancer called 'virtual colonoscopy'**, the adoption of which would mean patients not having to undergo the invasive colonoscopy examination currently in use.

A HRB-funded clinician scientist has **developed an automated seizure detection system** for high risk newborn babies which could save lives by facilitating early medical intervention.

STRIVE Programme

This Environmental Protection Agency (EPA) programme employs a strategic and targeted approach to protecting and improving the natural environment through the provision and accumulation of scientific research and knowledge across a range of thematic areas:

- ◆ Climate change.
- ◆ Water recourse management and chemicals.
- ◆ Water quality and the aquatic environment.
- ◆ Air quality, atmospheric deposition and noise.
- ◆ Impacts on biodiversity.
- ◆ Soils and land use.
- ◆ Socioeconomic aspects.

The programme aims to exploit growth in environmental technologies and to position Ireland as a leader in this field by building capacity, while simultaneously contributing to environmental protection.

Research carried out under the STRIVE programme plays a valuable role in terms of environmental policy and decision making.

STRIVE has provided direct support and input to Ireland's implementation of EU Directives and other international obligations. Examples include the refinement of inventories of greenhouse gas emissions and the implementation of the Water Framework Directive.

STRIVE was allocated €10 million under the National Development Plan in 2008. This allocation was used to fund numerous research projects covering the thematic areas listed above. 33 research reports were published in 2008, covering topics such as climate change mitigation, air quality, water quality, soil, sustainable tourism and waste management.

Climate Change

In addition to STRIVE, the EPA also runs a dedicated Climate Change Research Programme (CCRP), directed at addressing specific knowledge gaps of direct relevance to the National Climate Change Strategy. Research funded under CCRP ranges from fundamental process studies to the provision of high-level analysis of policy options. The first call for research proposals was announced in June 2007 offering funding for a range of projects in the following thematic areas:

- ◆ Greenhouse gas (GHG) emissions and mitigation.
- ◆ Impacts and adaptation.
- ◆ Technologies and socio-economic analysis.
- ◆ Trans boundary air pollution and environment observation.

Climate change is the key transformational challenge of this century. The CCRP programme provides national understanding of this challenge and options to address this across key policy areas. It is solutions focused, based on the need to sustain an essential national capacity in the climate change research area and focused on issues such as:

- ◆ Measurement, reporting and verification of GHG emissions and sinks
- ◆ GHG mitigation technologies for key sectors
- ◆ The carbon market and use of flexible mechanisms
- ◆ Observation technologies and analysis systems

These will be key elements of the future national and global knowledge economy.

Outcomes of Environmental Research

A survey of €4.7 million invested in 18 large projects awarded by the EPA in 2005/06 found that:

- ◆ 5 patents had been filed, 7 patents were in preparation, 9 Non-disclosure agreements were in place and 1 licence agreement had been concluded;
- ◆ One spin-off company (BIOPLASTIC Ltd) had been formed;
- ◆ The investment benchmarks very favourably against European and US figures;
- ◆ Development and demonstration of technologies at lab, pilot and full-scale (waste & wastewater)
- ◆ 34 researchers had been trained with support provided by 45 others
- ◆ The investment of €4.7 million had leveraged additional funding to date of €12.5 million (= 70 new researchers & jobs)
- ◆ Over 45 papers had been published in high impact journals

Charles Parsons Energy Research Awards

The Charles Parsons Awards scheme was announced in December 2006 for the development of energy research centres, providing funding for 20 Researchers, 34 PhD studentships and 154 undergraduate placements with an estimated investment of €20 million.

In all, 22 applications were received from 11 organisations located both North and South. The awards are designed to increase Irish energy research capacity and a particular design feature is to attract engineering undergraduate students and graduates into a career in research. The output of the scheme will be skilled researchers in a range of priority research areas of relevance to Irish industry.

The Charles Parsons Scheme has a strong All-Island dimension. Two of the seven energy centres funded under the Charles Parsons scheme are from Northern Ireland, one based in Queens University Belfast, the other in the University of Ulster.

Energy Research Strategy

The Minister for Communications, Energy and Natural Resources published the Energy Research Strategy prepared by the Irish Energy Research Council in March 2008. A consultation process on future policy directions in this area was carried out during Summer 2008 with the Council's strategy informing the exercise³. The outcome of the consultation process, is being considered by the Minister with a view to finalising a strategy for adoption by government.

The Council's Strategy recognises that energy research involves a wide range of investigative and knowledge-seeking activities which include:

- ◆ Basic research on the fundamental scientific questions that underpin new energy conversion, distribution and end-use technologies
- ◆ Applied research to develop new or improved energy conversion, distribution and end use technologies, products and services and to assist in their uptake including policy relevant research
- ◆ Pilot and demonstration projects to test the application of energy technology in the field, and to demonstrate the cost-effectiveness of the technology.

3 <http://www.dcmnr.gov.ie/Energy/Office+of+the+Chief+Technical+Advisor/Irish+Energy+Research+Council.htm>

While all of these elements are relevant, the strategy focuses on the basic and applied research phases and proposes a range of actions and initiatives to develop Irish energy research. A strong Irish energy research capability, necessarily to be built up over the long term, will provide a resource for Irish innovators in energy-related products and services. Furthermore, strong links between energy research bodies and industry will serve to increase the relevance of research outputs to the commercialisation agenda. The strategy recognises, however, that existing state agencies already have programmes in place in this area of the commercialisation of research, for example EI and Science Foundation Ireland.

The strategy also emphasises the need to ensure excellence in funding proposals through a competitive approach underpinned

by international peer review and recommends the use of existing agencies wherever possible.

The strategy sets out:

- ◆ A vision for Irish energy research in the mid term.
- ◆ An overall framework for energy research and development.
- ◆ A set of priority research areas for the short and medium terms and criteria for their selection.
- ◆ A set of five Strategic Lines designed to implement its priorities.
- ◆ An outline of implementation, institutional and coordination arrangements.
- ◆ Provision for monitoring, evaluation, reporting of progress and review of the strategy.

Wavebob Ltd, an EI client company established by physicist William Dick in 1999, has been developing a unique Wave Energy Converter – ‘Wavebob’, which harnesses the power of the ocean to produce clean, renewable energy. The company has invested significantly in R&D over the past ten years and has just been approved funding of almost €2 million for demonstration of the technology under the EU’s Seventh Research Framework Programme (FP7). Unusual for a small medium enterprise, and making a bold statement of future intent, Wavebob has undertaken to lead the project as coordinator and primary link with the European Commission.

Strategic Lines

The five Strategic Lines for implementation are as follows:

- ◆ Energy systems modelling and analysis.
- ◆ Fundamental frontier and multi-disciplinary research.
- ◆ Energy R&D in a limited number of sector-specific fields.
- ◆ Research support in identifying and mapping Ireland's energy resources.
- ◆ Maintain a 'watching brief' for technologies of potential application in Ireland.

The Strategic Lines are being actioned through SFI and the Charles Parsons Awards in the area of fundamental frontier and multi-disciplinary research, and through Sustainable Energy Ireland in energy systems modelling and analysis, sector specific fields and the area of watching brief. Funding for the area of mapping Ireland's resources was obtained this year and will be progressed by the Department of Communications, Energy and Natural Resources (DCENR) subject to budgetary constraints.

Exemplar Smart Communications Network

The Government's "Technology Actions to Support the Smart Economy" aims to position Ireland at the forefront of the digital and clean technology revolution; creating the investment and jobs of the future. With 6 new and innovative plans for Government action and infrastructure development, the report identifies 30,000 jobs as a baseline target for achievement over the next 5-10 years.

One of the proposed actions is building an **Exemplar Smart Communications Network.**

Network Internet Protocol (IP) traffic is doubling every two years. Unable to contend with this huge increase in the volume of data, the existing switching and routing technologies are becoming bottlenecks across the network. Ireland is establishing itself as a world-leader in developing a revolutionary, technological solution to this problem, deriving from the cutting-edge optoelectronic research that has been funded by Government over the past 20 years.

Founded in 1999, Intune Networks is an Irish company focussed on building a platform for Optical Burst Packet Switching. The founders commenced developing their technology in the early 1990s in UCD and are receiving ongoing support from Science Foundation Ireland backed institutions such as the Tyndall National Institute at UCC. Enterprise Ireland is an investor in the company.

Moving to Optical Burst Packet Switching and Transport, a technology based on transferring images and data using coloured light (tunable laser technology) will unblock the Network and, by lowering the requirement for switches and routers, significantly reduce the energy requirement for running the network. It will also dramatically improve image quality. Until now it has only been possible to transport images and data using fibre optic networks. Intune has succeeded in making the fibre optic network programmable. This breakthrough innovation allows the possibility of sending, switching and collecting digital data and images in a single optical infrastructure.

Ireland now has an opportunity to capitalise on its leadership in Optoelectronics R&D and the emerging solutions from Intune to develop a low energy and ultra-fast *Exemplar Smart Communications Networks*. This will enhance Irish Information and Communication Technology (ICT) capacity and act as a magnet for FDI and research. It presents the opportunity for emergence of an Irish multinational company to emerge onto the global ICT stage and to place Ireland's leadership in Green Technology in the spotlight. The Exemplar Network will also provide a test-bed for the trial and further development of next-generation communications devices and technologies including mobile TV, interactive video and a large range of other applications.

It is estimated that 5,000 direct jobs and a further 5,000 indirect jobs could be established over a 5-10 year period as a result of the Exemplar Network.

By supporting the development of critical mass, capability and capacity within and across linked research institutions which can be accessed by the full range of stakeholders in the agri-food-forestry sector and industry to aid the development of products, processes and evidence-based policy formation, the three competitive programmes administered by the Department of Agriculture, Fisheries and Food (DAFF) contribute actively, if not always visibly, to the development of the knowledge economy. Considerable emphasis is also placed on the dissemination of research results, via academic and more practical media, to a wide range of stakeholders and potential end-users consistent with the need to identify and protect intellectual property at an early stage with a view to its eventual commercialisation. In this regard DAFF works closely with the Technology Transfer Offices of the various research institutions and with EI.

Food Research

The Food Institutional Research Measure (FIRM) funds the training and education of postgraduate students, equipment, and supports collaborative projects between

research institutions engaged in similar areas of research activity and in doing so ensures that critical mass in key areas of the food industry are supported. Through the Food Graduate Development Programme, the first graduate development programme of its kind, FIRM ensures that graduates are equipped with skills, including innovation and entrepreneurship, required to work in a competitive agri-food industry. FIRM has also funded a dedicated food research dissemination service known as RELAY aimed at bringing the outputs of publicly funded research to the attention of Irish food industry companies (which, for the most part, are Small and Medium Enterprises [SMEs]) via website (www.relayresearch.ie), thematic workshops, company visits, email project alerts, etc.

Agricultural Research

By focusing on the modern biosciences and on underpinning the overall sustainability of agriculture policies and farming practices, the Research Stimulus Fund (RSF) also contributes to developing the knowledge economy. This is particularly evident in areas such as genetic improvement of plants and animals, development of rapid tests for and

novel treatments to combat pests and diseases, exploring the potential for non-food uses of agricultural land, finding cost effective ways to comply with ever demanding environmental legislation including, for example, with regard to mitigation of climate change related gaseous emissions, etc. By encouraging inter and intra-institutional collaboration it has also built scientific capacity from a very low base thus enabling researchers in Ireland to develop the necessary skills to compete for EU framework funding.

Forestry Research

The National Council for Forest Research and Development (COFORD) research programme provides the scientific foundation for innovation in plant production and the use of better adapted tree varieties for commercial forestry production, enabling higher yields and building on competitive advantage, better use of indigenous genetic material in afforestation programmes, better advice on tree selection and performance. In addition, the research supports knowledge that will develop better and more cost effective ways to establish and treat forests,

resulting in higher yields and better quality wood in both broadleaf and conifer species. Improved planning systems and better management of forests native biodiversity; establishing the interaction of forest location and forest operations with water quality, particularly in relation to the Water Framework Directive and its implementation in Ireland and establishing the use of forests for recreation in Ireland, quantifying the benefits, and examining better ways to provide forest recreation are outputs of the programmes that also contribute to the development of a knowledge economy.

Impact of research funded under DAFF-operated competitive programmes

Over the period 2006 to mid 2009, €74 million has been committed to FIRM and almost €40 million to RSF. Expenditure to end of 2008 on the Forest Research Programme element of the COFORD budget under the NDP is €5.81 million. This investment is making a strong contribution to the development of the knowledge economy. Highly qualified and skilled graduates to MSc, PhD and postdoctoral level are being educated and trained. High quality scientific peer reviewed publications

are being published in high impact scientific journals. Graduates are being trained in the skills required for working in industry, academia and regulatory authorities as well as developing skills in entrepreneurship, innovation and regulatory affairs relevant to their area of research. Invention disclosures and patents are being filed as a result of the investment. Outcomes of completed projects include development of rapid diagnostic tests for microbial pathogens of food safety concern which can be used by contract

laboratories and food companies, development of a probiotic cheese which has been developed by a company in the UK, development of probiotics for the reduction of *Salmonella* in pigs, antimicrobial peptide patents, novel cheese snack products, development of gluten free convenience foods, formal collaborations with the United States Department of Agriculture (USDA) and 4 North/South collaborations. In addition, three spin-out companies have resulted from research initially funded by DAFF public good research programmes.

For example a spin-out company was initiated based on technology developed through a FIRM project on a novel biotechnology for achieving added value from food waste. FIRM also funds research in food safety and has developed many collaborations with the USDA and FDA which has enabled exchange of scientific knowledge, technologies and samples between Ireland and the USA. Food consumption and dietary pattern databases and information has also been supported by FIRM for many years and continues to be used as the major source of information for setting EU dietary intake values as well as policy for setting maximum dietary levels of food supplements. Ireland is currently the only country to be in a position to provide data on the fortification of foods which will be used to develop the EU legislation in this area in the future.

Outputs from RSF-funded projects enable policy makers within the Department of Agriculture, Fisheries and Food to make informed evidence-based decisions in relation to sustainable agricultural production into the future. Skills developed by working on RSF projects have enabled Irish researchers to compete successfully for EU Framework funding.

As a result of COFORD funded research higher yielding and better quality forests have been achieved. The increased use of IT systems along the value chain have led to a more

competitive forestry sector, with better forest establishment and management. Other achievements include better information for industry and investors on the location of the wood resource, and on future levels of production; improved knowledge of climate change mitigation role of Irish forests and how they contribute to national emission reduction targets and offsetting of need for purchase of credits on international markets; improved contribution of forests to water quality, in line with national policy under the Water Framework Directive, and better ways to establish and manage forests with biodiversity

One notable recent example of how RSF-funded research is having a real sectoral economic impact concerns a Teagasc / UCD / Irish Cattle Breeding Federation (ICBF) collaborative project on dairy cattle genetics. Recent advances in the area of DNA technology and the mapping of the bovine genome have created opportunities for rapid improvement in the rate of genetic gain achievable by national bovine breeding programmes. The project in question sought to harness this new technology and apply it for the benefit of Irish farmers. The result is that suitable breeding animals can now be chosen at a much younger age and their genetics released to Irish farmers much more quickly, thus resulting in higher rates of genetic gain in a much shorter time frame and at a lower cost. This increase in efficiency is worth in excess of €10 million per annum in terms of additional genetic gain over and above the existing levels already being achieved heretofore by Ireland's dairy farmers through our national breeding programme. Ireland is only the second country in the world to include this new technology in their national genetic evaluation system and is leading the way with regard to international collaboration and further innovation in this area.

Sea Change presents a national Marine Knowledge, Research and Innovation Strategy that is fully consistent with the SSTI. It aims to drive development of the marine sector as a dynamic element of the smart economy to include high value-added and knowledge-based products and services.

The strategy targets R&D investment that focuses on:

- ◆ Industry-led and prioritised research that aims to **increase** the marine sector's **competitiveness** and **stimulate** the **commercialization** of the **marine resource** in a manner that **ensures** its **sustainability**—including research aimed at addressing challenges and opportunities in the 'traditional' sectors of fishing and aquaculture, ensuring the protection of existing jobs in these sectors.
- ◆ Building new **research capacity** and capability and **utilising** fundamental **knowledge** and technology to **create** new marine-related **commercial opportunities** and companies—in areas such as advanced technologies (e.g. exploiting the vast market for 'green technology' in the areas of environmental sensors); biotechnology (targeting marine organisms as a source of new drugs and materials); marine functional foods (adding value to marine food and food ingredients); and renewable ocean energy.
- ◆ **Informing public policy, governance and regulation of the sector** and supporting the delivery of more **innovative, customer-driven public services** by applying the knowledge derived from marine research and monitoring—including research aimed at addressing the implementation of significant EU legislation and the challenges posed by climate change.

In the first two years (2007-'08) of implementing Sea Change, €47.5 million has been committed to marine R&D projects and programmes via the Marine Research Sub-Programme of the NDP, managed by the Marine Institute. This investment has led to the acquisition, and provision of access to, significant marine research infrastructure; a portfolio of almost 100 research projects in 11 research institutions and 18 companies; and a significant increase in marine research capability and capacity (including 48 new research positions and 52 PhD scholarships). In addition to this targeted marine research funding, the marine

R&D community (public & private) has secured grant-aid investment totalling €53 million from other competitive research programmes, including €14.4 million via international (principally FP7 and InterReg) sources.

The implementation of the *Sea Change* Strategy will lead to an increased output of economically relevant knowledge, know-how and patents, increased participation in international Science and Technology cooperation and a heightened profile for Ireland as a location for world class research.

public sector cross sectoral research case study - smartbay

The SmartBay pilot project (supported by the Marine Institute and the EPA) reflects an exciting intersection between knowledge, technology and the ocean and could offer Ireland a major niche and competitive opportunity in the global market for smart technologies. The intention is to develop a cluster of marine, environmental and technology projects over time involving multinationals, SME's and third-level groups harnessing a mix of deep skills in scientific, engineering, computational, analytical and data management fields. IBM and more recently Intel are both developing and testing technologies on the SmartBay platform. IBM's involvement in the project since 2007 was a catalyst for the establishment by the company (supported by the IDA) of a Centre of Excellence in Water Monitoring and Management in Dublin in June 2008 creating 18 new R&D related jobs.



eight

All-Island and
International R&D

8

all-island research and development cooperation

The SSTI highlights the opportunities for R&D collaboration on the island of Ireland and significant progress has been made in this regard. This cooperation will lead to sharing of best practice, increasing the complementarities of our respective services and supports and exploring the opportunity for greater, beneficial synergy.

The North / South Innovation Fund was announced by the Minister for Finance and Personnel in the Northern Ireland Assembly in January 2008. The potential contribution to the Innovation Fund from the Republic of Ireland side has been set at €60 million over the lifetime of the fund, to be sourced from within the overall envelope of NDP committed investment in R&D. On the Northern Ireland side there is a global provision of £90 million, comprehending innovation both within Northern Ireland and on a collaborative all-Ireland basis. The fund will run for 3 years. The main strands identified and progressed to date include:

- ◆ The All-Island Innovation Voucher initiative was announced in May 2008. This initiative provides Irish SMEs with access to a further 10 knowledge providers based in the North, and will allow Northern Ireland based SMEs use Invest NI innovation vouchers (Stg£4,000) to access expertise in research institutions based in the Republic of Ireland. To date 5 ROI companies have completed projects with NI knowledge providers and 3 NI companies have completed projects with ROI knowledge providers. The knowledge providers have a number of additional cross border projects underway which will be completed in the coming months.

- ◆ In November, 2008 ten programmes were approved for funding at a cost of £14.5 million. All of these involve strategically focused R&D collaboration from Queens University Belfast and the University of Ulster with major, internationally recognised research centres in the republic in areas of complementary strengths. The aim is to create critical mass in areas of strategic interest to both governments. The approved activities will cover a wide range of priorities that will include Future Energy Systems, Mobile Information and Communication Technologies, Major Chronic Diseases and Infections, Functional Foods, Nutrition and Bone Health, and Safe and Traceable Food.
- ◆ Funding for a further two significant cross border research projects were announced in December 2008. The projects, both of which are partnered by Queens University, will receive just under £3 million in total. The two projects involve the building of an internationally recognised all-Island Research Centre in sustainable engineering and manufacturing and the development of new treatment options for cancer sufferers.
- ◆ The US-Ireland R&D Partnership involves the governments of the United States of America, Ireland and Northern Ireland working together to advance scientific progress by awarding grants for research on a competitive basis in the thematic areas of Diabetes, Cystic Fibrosis, Nanotechnology and Sensors. The Partnership is helping to link scientists and engineers in partnerships across academia and industry to address crucial research questions in these areas, foster the potential for new and existing technology companies, attract industry that could make an important contribution to the three economies and, expand educational and career opportunities in science and engineering.
- ◆ In February 2009, Intertrade Ireland, the secretariat to the US-Ireland R&D Partnership Ireland, announced that a project on diabetic nephropathy will be the first project to be funded under the US-Ireland R&D initiative. The grant will be awarded by National Institute of Health and the National Institute of Diabetes and Digestive and Kidney Diseases in the US, SFI and the R&D Office in Department of Health NI.

The Seventh EU Framework Programme for Research and Technological Development (FP7) 2007-2013

Irish researchers are engaging in pan-European research projects to tackle some of the biggest challenges facing the EU, using funding from the largest European R&D funding programme ever, the Seventh EU Framework Programme for Research and Technological Development (FP7) 2007-2013. In the first 2 years of the programme, researchers from Irish companies and higher education institutions won funding totalling €107 million for collaborative research projects in areas like ICT, health, nano-technology and energy research.

FP7 is designed to respond to Europe's employment needs, competitiveness and quality of life, funding research in priority areas such as environment, health, and IT. The €50 billion fund is seen as a major asset in the EU's fight against the current economic crisis with its ring-fenced budget growing every year by 13% until 2013. FP7 offers Ireland's SMEs, multinationals, and research institutions valuable opportunities to participate in high-calibre research collaborations with our European counterparts. The EU agenda complements our national priorities with an emphasis on moving new discoveries from the research stage to the marketplace, allowing Ireland to play our part in building a low-carbon economy and tackling diseases like cancer and Alzheimer's disease.

Sensl is a young, hi-tech firm that spun out of the Tyndall Institute in Cork almost five years ago. The company is focused on developing novel technology for detecting weak light signals and its target customers include European and US research institutes and analytical instrument makers. Under FP7, Sensl is developing a diagnostic tool for early and conclusive detection of two forms of cancer prevalent in Ireland (some 1,130 men develop prostate cancer each year, and about 1,900 new cases of breast cancer are identified). In both cases, early and reliable detection is vital in ensuring the best outcome for the patient. Advantages of FP7 participation to Sensl include exposure to markets and other partners, as well as access to important know-how from multi-disciplinary teams.



nine

Where are we going?

strategic investment in research and development

The return on our investment in enterprise is dramatically improved when coupled with and underpinned by strategic investment in R&D. As described earlier in this publication, the outputs and impacts of such investment are a significant draw for FDI firms and a significant catalyst for adding volume and value to the activities of indigenous firms. Establishment of a strong research base in Ireland is proving to be a vital driver of major investment decisions by overseas and indigenous companies.

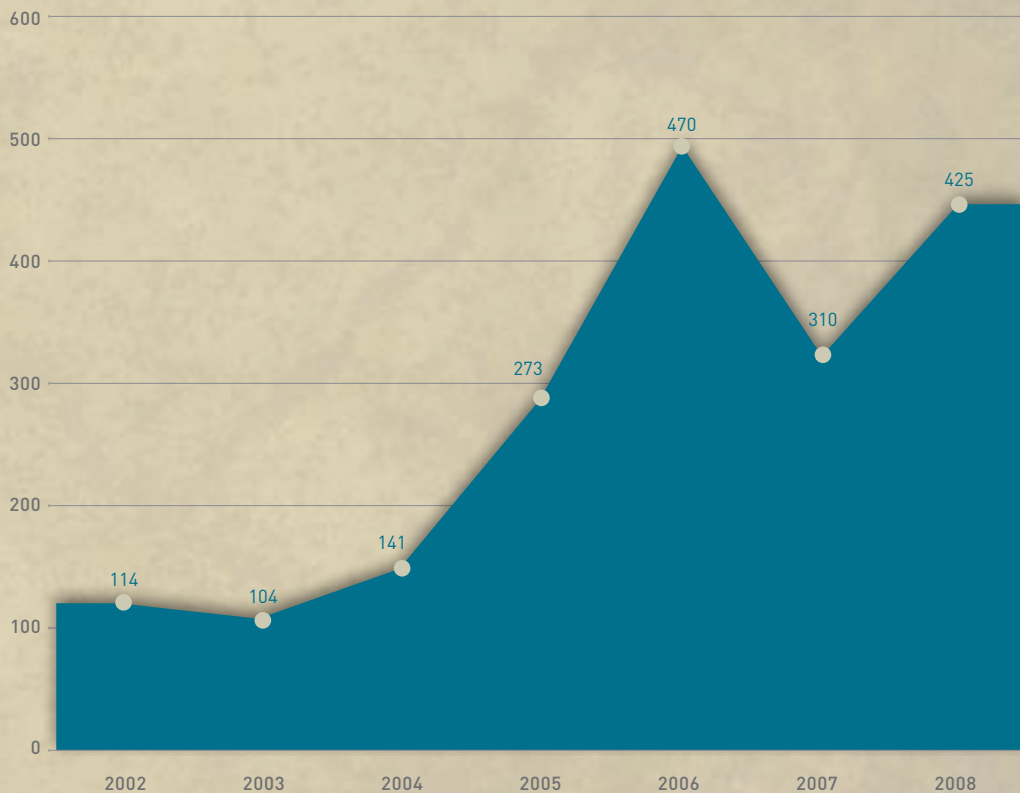
Informed feedback from the enterprise sector on the implementation of the SSTI is being provided by the Enterprise Feedback Group (EFG), which was established by the Tánaiste and Minister for Enterprise, Trade and Employment, Mary Coughlan T.D. late in 2008. This feedback will inform the ongoing management of the SSTI and will assist in the development of future Science, Technology and Innovation (STI) policy.

It is essential that we continue to invest in R&D. Other successful economies, such as the US, Singapore, Finland, Korea and Germany, have recently confirmed that they will increase investment in R&D as such investment will sustain economic growth and competitiveness. It is essential that the vision in the SSTI is realised so that Ireland can compete in an increasingly competitive global economy.

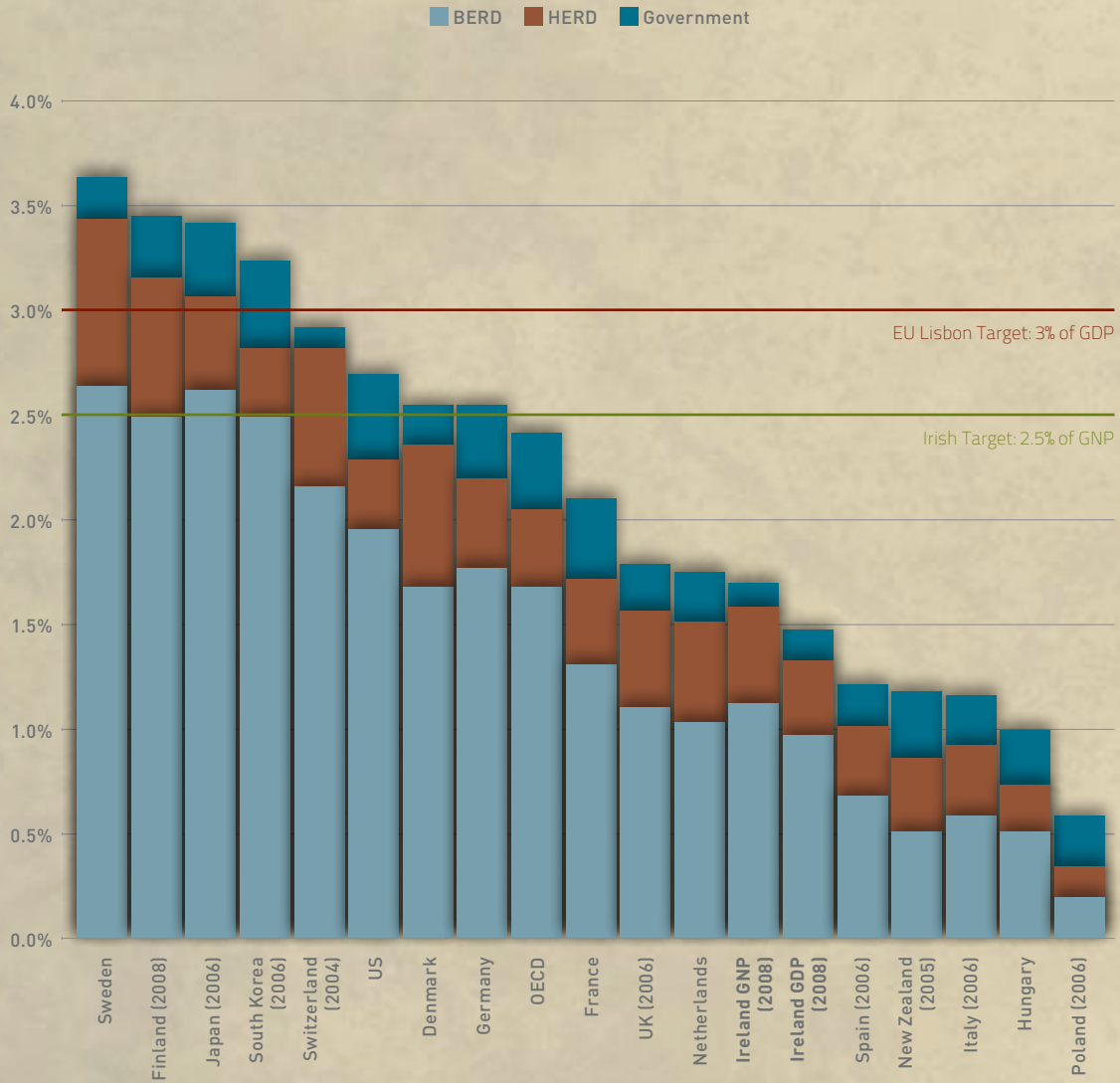
Despite the current global upheaval, the Government is committed to investing in Ireland's science base as one of the key cornerstones underpinning future jobs in Ireland and the lynchpin of our transformation to the Smart Economy. The challenge, for the immediate future, therefore, will be to effectively manage the implementation of the Government's Strategy for Science, Technology and Innovation in a much tighter resource environment.

Knowledge Capital Magnet of FDI Four Fold Increase

IDA RD&I Approvals 2002-2008
Now Over 40% of IDA Annual Investments



International Comparisons R&D Expenditure



glossary

APC: Alimentary Pharmabiotic Centre

APEX: Advanced Procedure Executor

BERD: Business Expenditure on Research and Development

CCRP: Climate Change Research Programme

COFORD: The National Council for Forest Research and Development

CRANN: Centre for Research on Adaptive Nanostructures and Nanodevices

CSET: Centre for Science, Engineering and Technology. Partnerships which link scientists and engineers across academia and industry to address crucial research questions.

CSO: Central Statistics Office. Government body responsible for compiling Irish official statistics.

DAFF: Department of Agriculture, Fisheries and Food

DCENR: Department of Communications, Energy and Natural Resources

DES: Department of Education and Science

DERI: Digital Enterprise Research Institute

DSE: Discover Science and Engineering

EFG: Enterprise Feedback Group. Group established by the Tánaiste to provide a standing dialogue with business and industry on the implementation of the SSTI.

EI: Enterprise Ireland. Government agency responsible for the development and promotion of the indigenous business sector.

EPA: Environmental Protection Agency

E-INIS: E Irish National Infrastructure

ESA: European Space Agency

FDA: Food and Drug Administration

FDI: Foreign Direct Investment

GDP: Gross Domestic Product

GHG: Greenhouse gas

GNP: Gross National Product. The total market value of goods and services produced by all citizens and capital during a given period.

HEI: Higher Education Institutes

HPSU: High-Potential Start-Up

glossary

HRB: Health Research Board. Government agency which supports and funds health research.

ICT: Information and Communication Technology

IDA: Industrial Development Agency. Agency responsible for the attraction and development of foreign investment in Ireland.

IFSC: International Financial Services Centre

INSPIRE: Integrated NanoScience Platform for Ireland

IoTs: Institutes of Technology

IRCHSS: Irish Research Council for Humanities and Social Sciences. Research funding and monitoring body established to promote research in the humanities and social sciences field.

iPV: International Procedural Viewer

IRCSET: Irish Research Council for Science, Engineering and Technology. Research funding and monitoring body established to promote science and engineering research in Ireland.

NDP: National Development Plan

NESC: National Economic and Social Council. Group whose function is to analyse and report to the Taoiseach on strategic issues relating to the efficient development of the economy and the achievement of social justice.

NICB: Institute for Cellular Biotechnology

OECD: Organisation for Economic Co-operation and Development

PI: Principal Investigator

PRTL I: Programme for Research in Third Level Institutions. Programme which provides integrated financial support for institutional strategies, programmes and infrastructure and ensures that institutions have the capacity and incentives to formulate and implement research strategies.

R&D: Research and Development

RD&I: Research, Development and Innovation

REMEDI: Regenerative Medicine Institute

RSF: Research Stimulus Fund

S&E: Science and Engineering

SFI: Science Foundation Ireland. Government Agency with responsibility for investment in academic researchers and research teams who are most likely to generate new knowledge, leading edge technologies and competitive enterprises.

SIF: Strategic Innovation Fund. Multi-annual fund, administered by the HEA, amounting to €510 million over the period 2006–2013, which is directed towards support for innovation in higher education institutions.

SME: Small and Medium Enterprises. Enterprises with fewer than 250 employees and with an annual turnover not exceeding €50 million or an annual balance sheet not exceeding €43 million.

SRC: Strategic Research Cluster

SSTI: Strategy for Science, Technology and Innovation

STEM: Science, Technology, Engineering and Maths

STI: Science, Technology and Innovation

Tyndall: Research Centre based in UCC which focuses on photonics, electronics and networking research.

UCD: University College Dublin

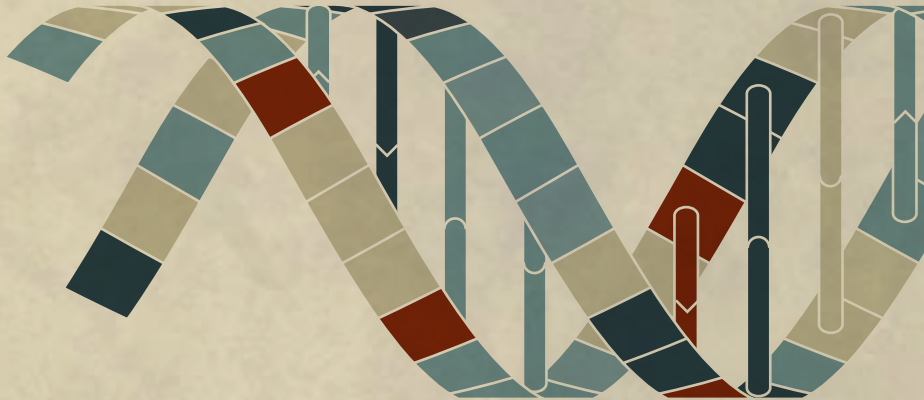
USDA: United States Department of Agriculture

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