



2020

SCIENCE
FOUNDATION
IRELAND

Agenda 2020
Excellence and Impact



SFI VISION

Ireland will be a global knowledge leader that places scientific and engineering research at the core of its society to power economic development and social progress.

SFI MISSION

SFI will build and strengthen scientific and engineering research and its infrastructure in the areas of greatest strategic value to Ireland's long-term competitiveness and development.

Agenda 2020 is an ambitious plan to position Ireland as a global knowledge leader, a society with scientific and engineering research at its core, driving economic, social and cultural development. The plan is to build on the considerable achievements in Ireland's scientific and enterprise communities since Science Foundation Ireland (SFI) was established, twelve years ago, and to realise the tremendous potential for further development and growth by 2020.

Agenda 2020 begins by setting out our vision of a 'preferred future', in which Ireland in 2020 is the best country in the world for *scientific research excellence and impact*. By this we mean that the scientific research carried out here:

- » powers an innovative and enterprising economy;
- » creates high-value jobs;
- » attracts, develops and nurtures businesses, scientists and talented people; and
- » is connected and respected internationally.

In this vision, Ireland is the best country in which to develop effective partnerships between academia, business, philanthropy and government. It is a country in which the public is engaged with scientific enterprise, and educated and equipped to debate and evaluate the issues that will increasingly arise with scientific advances.

The plan sets out four key goals, along with the strategies for achieving them and the performance indicators that will be used to measure progress. Every year SFI will publish a progress report and identify any remedial actions that are necessary to ensure that the targets continue to be met. While *Agenda 2020* is a long-term strategic plan, its execution will require flexibility. SFI has already demonstrated a capacity for adapting to a rapidly changing environment; this core competence must be maintained as *Agenda 2020* is implemented.

“We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next 10.”

Bill Gates

As SFI is a key element in the Irish scientific and enterprise ecosystem, *Agenda 2020* also forms part of the vision for the whole ecosystem. This vision seeks to build Ireland's international reputation, promote expanded success in export markets, start and grow new companies, successfully attract new investment, business and education visitors, overseas entrepreneurs and outstanding scientists. To achieve success will require SFI to engage more broadly with all the other constituents: commercial, academic, political, Government departments, state agencies, the Embassy network, the scientific and commercial diaspora, educational, the arts and humanities, financial, regulatory and the public at large. SFI must work with these constituents as the enabler and catalyst of their actions; it must exert influence and provide incentives to engage them in concerted and complementary endeavours; and it must monitor progress and outcomes to ensure that resources and effort are fully productive.

Agenda 2020 is deliberately ambitious and stretching. Over the past ten years, science in Ireland, led by SFI, has made very significant progress; but the challenge now is to combine scientific excellence with economic and social impact. Implementing the plan will enable Ireland to gain international competitive advantage and ensure that it is one of the first countries to recover from the global recession. This will require concerted, strategically aligned effort by everyone and every organisation in the scientific and enterprise ecosystem. It will require intelligent planning, effective execution, and organisational and financial efficiency.

SFI operates through an annual cycle of planning and accountability at all levels in the organisation. The cycle includes interlocking processes of strategic and operational planning, budgeting, implementation, performance review and accountability to stakeholders. This generates annual operational plans and targets designed to deliver longer-term goals.

The realisation of *Agenda 2020* represents an enormous challenge to all members of the scientific research and enterprise ecosystem in Ireland, but it is a challenge that we face with great confidence and enthusiasm.

Professor Mark WJ Ferguson

Director General

Science Foundation Ireland

EXECUTIVE SUMMARY

Scientific research yields new knowledge that can, in many cases, be adopted by enterprise, incorporated into high-value goods and services, and exported onto world markets, thus leading to increased national income and improved standards of living.

That is the principal rationale behind Government investment in research, and the reason it established Science Foundation Ireland (SFI) 12 years ago.

In those 12 years, the Irish science base has grown significantly, and Ireland has become recognised internationally for both its approach to investment in science and for the scientific excellence that it has produced.

Over the coming decade, SFI is determined to continue to focus on scientific excellence, and to couple that with an equal focus on impact – on realising the benefits of the scientific effort for the Irish economy and Irish society.

In this document SFI articulates a vision for Ireland in 2020 in which the scientific effort makes a significant contribution to national prosperity, in which much of the nation's wealth is derived from knowledge-based products and services, and in which the population is well-educated and comfortable with technology, both as users and as producers.

Agenda 2020 is SFI's strategic plan for realising this vision over the period 2012 to 2020. It has four primary objectives:



A To be **the best science funding agency in the world** at creating impact from excellent research and demonstrating clear value for money invested. This will mean:

- a. Investing strategically and selectively, guided by on-going research prioritisation including the recently completed national research prioritisation exercise;
- b. Investing in SFI's translational research capability to enhance the progression of research from discovery to delivery;
- c. Developing a set of research centres that are recognised internationally, that attract international research talent and capital, and that attract, anchor and spin out related companies in Ireland; and
- d. Increasing the numbers of SFI-trained¹ researchers employed in industry.

B To be **the exemplar in building partnerships** that fund excellent science and drive it out into the market and society. This will require:

- a. Building strategic partnerships; and
- b. Diversifying the funding sources for Ireland's scientific base.

C To have the most **engaged and scientifically informed public**.

D To represent **the ideal modern public service organisation**, staffed in a lean and flexible manner, with efficient and effective management.

The plan set out in this document will enable Ireland to capitalise on its potential over the next decade, to seize the opportunities that arise from the exciting advances in science and technology, and to make the vision for a better future into a reality.

¹ Here and throughout the document, it is acknowledged that SFI does not train researchers, or conduct research directly, rather it funds such training and research using competitive, international merit review processes.

INTRODUCTION

WHY GOVERNMENTS FUND SCIENTIFIC RESEARCH

Nations fund scientific research to further their economic and social interests. By building and using human and knowledge capital capacity, countries can achieve competitive advantage and responsible and sustainable development. This is vital for economic growth and the advancement of society. Economic growth, as measured by Gross Domestic Product (GDP), directly impacts the standard of living of a country, and science plays an important role in driving and sustaining this growth. Based on per capita income, as measured by GDP, it is estimated that world economies grew at a relatively slow rate from the 15th to 18th centuries. However, driven by scientific discovery, the Industrial Revolution saw global GDP grow by 250% in the 19th century and by a massive 850% in the 20th century. In more recent times, the growth between 1995 and 2005 has been largely attributed to advances in Information and Communications Technology (ICT).²

Economists often consider knowledge to be a public good. It is non-rivalrous (use by one individual does not reduce availability to others) and it is non-excludable (individuals cannot be effectively excluded from use). George Bernard Shaw summed up this concept when he said 'If you have an apple and I have an apple and we exchange apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas.' Or as Belfast-born Lord Kelvin said: 'Scientific wealth tends to accumulate according to the law of compound interest.'

These characteristics of knowledge, and the fact that there is a time lag between a breakthrough discovery and the development of an application, explain why the findings from scientific research are likely to 'spill over' – that is, taken up and used by someone other than the original researcher.

'Knowledge spillovers are particularly likely to result from basic research, but they are also produced by applied research and technology development. In some circumstances the creation of knowledge spillovers is intentional on the part of the innovator; the publication of scientific papers is, at least in part, intended to spread new knowledge so that it can be used by the widest possible audience. In the case of patented inventions, society requires disclosure of new knowledge as a quid pro quo for the granting of monopoly rights in the commercial use of an invention. The effect of this disclosure is, in principle, to make the new knowledge available to others for the purpose of facilitating new and different applications, while at the same time protecting the inventor against copying.'³

2 Stephan, Paula E. (2012). *How Economics Shapes Science*. Cambridge, MA: Harvard University Press. Print, 203-204

3 Jaffe, A. B. (1998), The importance of 'Spillovers' in the policy mission of the advanced technology program. *Journal of Technology Transfer*, 23(2), 11–19.

The result is that others, including competitors, might then avail of this knowledge. New applications, therefore, occur after the initial discovery or idea and often as a result of integrating knowledge or ideas from many different sources. This means that the translational phase is just as creative and exciting as the discovery phase and also that the journey from discovery to successful commercial application is not linear. Moreover, significant advances often result from integrating and applying knowledge and ideas from different disciplines, such as pharmaceuticals and energy.

This effect can be observed throughout the knowledge ecosystem. 'Spillovers are great for growth, but they do not induce market-based institutions to conduct considerable amounts of upstream research.'⁴ It is the role of government, therefore, to sow the seeds, to catalyse and build a functioning ecosystem that includes an effective mix of government, private enterprise, academia, finance, regulation and philanthropy, all working together to deliver desirable economic, social and cultural impacts. Indeed, as individual ecosystems develop and mature, they become autocatalytic, success feeding on success, and the private sector assumes an increasingly important role. There are numerous examples of this around the world, most notably the technology ecosystem in Silicon Valley and the Biotech ecosystem in the North Eastern United States.

In summary, government investment in scientific research contributes to:

- » Economic development – starting, growing, sustaining and attracting new companies; growing the sales and exports of new high-value products; growing and sustaining employment; enhancing the absorptive capacity of the economy to rapidly assimilate scientific and technical advances made elsewhere in the world;
- » Education and training of the population – crucial for economic and social development;
- » Developing the country's international reputation – important in an increasingly interconnected and mobile world for attracting and retaining investment and people;
- » Evidence-based policy making;
- » Effective, efficient public services, and other societal benefits – such as better healthcare;
- » Solving major national and global problems and challenges, such as climate change, world hunger and food security, energy security, ageing population;

4 Stephan, Paula E, (2012). How Economics Shapes Science. Cambridge, MA: Harvard University Press. Print, 8-9

- » Enriching our culture and civilisation. Science is a culture: it enriches our minds, it provides a reliable method for analysis, debate and resolution of problems, and it interfaces significantly with the arts and humanities. As Nobel Laureate Sir Paul Nurse said: 'The natural world is fascinating and is even more so if you are prepared to observe, to experiment, to think and to try to understand. That is what scientists do, and there is a little bit of the scientist in all of us, especially when we are children.'⁵
- » A better future – although it is not always predictable; and
- » Military supremacy or defence. Many countries, such as the UK, the USA and Israel, have invested heavily in scientific research for this reason, with considerable spin-off benefits. For example, modern telecommunications are widely attributed to developments from the space race in the 1950s and 1960s. The UK spends approximately 18% of its Government R&D budget on defence.

WHY AND HOW SHOULD THE IRISH GOVERNMENT FUND SCIENTIFIC RESEARCH?

The Irish Government should fund scientific research for all of the above reasons, with the exception of military supremacy/defence. Ireland's success on the world stage cannot be based on low labour costs or mineral resources; it must be based on our human resources and our science.

While military supremacy/defence has been the reason for much investment in other countries, the politics of military spending globally are changing rapidly, and many countries are having to realign these areas of Government Research and Development (R&D) expenditure. This creates an opportunity for Ireland, as we have not traditionally invested in these areas and have no such realignment issues to deal with.

In more recent times, some countries have chosen to invest in scientific research as a direct means of industrial development. Switzerland and many of the Scandinavian countries are typical examples of this approach, with Finland often cited as a relevant comparator for Ireland. In Ireland, we have an emerging high-technology ecosystem in areas such as ICT, pharmaceuticals and medical devices, built over the past decade. Government investment in scientific research, principally through SFI and the Programme for Research in Third-Level Institutions (PRTLII), has upgraded the country's human capital and knowledge base. The presence in Ireland of a strong coterie of high-tech companies, particularly foreign direct investment (FDI) companies, but increasingly also indigenous companies, provides a stimulating environment for the development of Ireland's science base and economy. Of the total business R&D expenditure in Ireland, approximately 72% is by foreign-owned firms, whereas in the UK the equivalent figure is 35% and in Finland 12%.

5 Nurse, P 'The new enlightenment'. The Richard Dimbleby Lecture 2012, The Royal Society. Downloadable from www.royalsociety.org.

Ireland is a small country with, until recently, a rural economy largely unaffected by the Industrial Revolution, and with a recent short but impressive growth in scientific output and high-value companies that are world leaders. The Irish Government's approach to science funding recognises these limitations and opportunities. We cannot do everything well. We must focus on Ireland's unique opportunities - whether they be geographical (such as renewable energy), size (a small high-tech country can be used as a test bed), or existing concentration of expertise or academic excellence (ICT, medical devices, pharmaceutical manufacturing). This has been well articulated in previous reports to Government, most recently the *Report of the Research Prioritisation Steering Group*⁶. Within the unique priority areas we should strive for a balanced portfolio spanning everything from oriented basic research through use/needs inspired basic research, not yet applied research to near market applied research.

The strategy set out in this document, together with the continued development of enabling policies, regulation and financial supports, will position Ireland to overcome its current fiscal and economic challenges and emerge as a significant niche high-tech player over the next decade. It is critical that we recognise the challenges we currently face, but equally critical that we identify the opportunities and the means to seize them. This SFI Agenda 2020 therefore starts with a vision of success, and then outlines the goals and actions that are necessary to make this vision a reality, along with the key performance indicators that will be used to measure progress.

6 Report of the Research Prioritisation Steering Group, launched 1st March 2012 by the Minister for Jobs, Enterprise & Innovation, Mr Richard Bruton TD, along with the Minister for Research & Innovation, Mr Sean Sherlock TD.

OUR VISION OF IRELAND IN 2020

Our vision is that by the year 2020, Ireland will:

1. Be in the top tier of reputable rankings for wealth and living standards;
2. Derive its wealth increasingly from knowledge-based products and services;
3. Derive its wealth increasingly from indigenous companies with strong exports, supplementing our strong FDI footprint;
4. Be a preferred trading partner and European portal for emerging dominant economies, particularly in high technology;
5. Have high take-up of science, technology, engineering and mathematics (STEM) in schools and in third- and fourth-level institutions, and be recognised internationally as a country whose population is comfortable and confident with technology, both as users and as producers;
6. Be a 'leader' in international innovation indices, evidenced by a net inflow of human, knowledge and financial capital;
7. Invest a proportion of GDP in R&D annually that is equivalent to that invested by the countries leading in innovation;
8. Be an exemplar of how a small country develops in the 21st century (for example by continuously building world-class clusters in key sectors of new opportunity);
9. Have near full employment;⁷ and
10. Be the best small country in the world in which to do business.

HOW SFI WILL CONTRIBUTE TO THE REALISATION OF THIS VISION

In the scenario outlined above, Ireland will be a global knowledge leader that places excellent scientific and engineering research at the core of its enterprise development and growth.

SFI recognises that, throughout the world, wealth, and in particular the creation and maintenance of employment, is increasingly derived from and dependent upon advances in science and technology. High-value scientific and technology enterprises create multiplier effects in terms of both employment and wealth throughout society. The capacity to respond to global challenges, such as food security and climate change, also depends critically on science and innovation.

7 'Full employment' is an economic term that references the reality that unemployment rarely falls below 4%, even when surplus employment is available.

Increased interaction between the scientific and commercial communities increases innovation and develops an entrepreneurial culture. Ireland's continued development thus depends on it becoming increasingly technologically sophisticated and increasingly entrepreneurial. Our scientific and enterprise ecosystem should be capable of both generating new knowledge and rapidly absorbing and applying externally-created knowledge. We must not only invest in R&D, we must also boldly seize the opportunities that arise, by putting science and technology to the fullest use for our people.

Our vision requires a functioning ecosystem in which science, technology and innovation are increasingly important parts. They must also be complemented by the appropriate national policies, financial supports and regulatory frameworks that will enable science to drive the transformation. Much of this is already in place, and SFI is ready to capitalise on Ireland's potential over the next decade, to seize the opportunities, and to make the preferred future a reality.

SFI'S STRATEGIC GOALS

For the period from 2012 to 2020, SFI has set itself four primary objectives:

- A. To be the best science funding agency in the world at creating impact from excellent research and demonstrating clear value for money invested;
- B. To be the exemplar in building partnerships that fund excellent science and drive it out into the market and society;
- C. To have the most engaged and scientifically informed public; and
- D. To represent the ideal modern public service organisation, staffed in a lean and flexible manner, with efficient and effective management.

Each of these objectives is elaborated in the following chapter by setting out:

- » The reasons why it is important;
- » The actions that will be taken to achieve it; and
- » The performance indicators that will be used to measure progress.

Due to the highly integrated nature of *Agenda 2020*, some actions and indicators span more than one objective.

2

GOALS, ACTIONS AND KEY PERFORMANCE INDICATORS

A. TO BE THE BEST SCIENCE FUNDING AGENCY IN THE WORLD AT CREATING IMPACT FROM EXCELLENT RESEARCH AND DEMONSTRATING CLEAR VALUE FOR MONEY INVESTED

A1. Invest in research excellence in prioritised research areas⁸ to create the human/knowledge capital bedrock for *Agenda 2020*

A1.1 Why this is important

Scientific and engineering research has transformed Ireland in recent years. As recently as 1980, the nation's research output was ranked with much of the developing world. But as State investment in the area began to have an impact, the country's international scientific standing grew steadily, particularly over the past decade. One of the more striking indicators of this is that Ireland is now one of the top 20 nations for citation – a key measurement of research quality.

But this is not enough. The pursuit of excellence must be maintained and, as resources are limited, they must be targeted at areas more likely to deliver economic and social benefit for Ireland. The 2012 *Report of the Research Prioritisation Steering Group* has identified the areas upon which SFI will initially focus. Our investments will concentrate on these and areas of potential economic importance, where appropriate, in partnership with industry or other national and international funding agencies.

These priority areas were assessed and evaluated following widespread consultation by a broadly constituted independent group, with representatives from the academic, industrial, scientific, financial and economic communities, based on four key criteria:

Table 1:

High-level criteria for assessment of priority areas⁹

1. The area is associated with a large global market or markets in which enterprises based in Ireland already compete or can realistically compete.
2. Publicly performed R&D in Ireland is required to exploit the priority area and will complement private sector research and innovation in Ireland.
3. Ireland has built or is building (objectively measured) strengths in research disciplines relevant to the priority area.
4. The priority area represents an appropriate approach to a recognised national challenge and/or a global challenge to which Ireland should respond.

The 2012 Report of the Research Prioritisation Steering Group represents a snap shot in time and was written to define funding priorities for the Government agencies until 2017. Therefore, over time to 2020, SFI will also fund research in areas where potential economic impact is clearly demonstrable, for example by significant co-funding partnerships. Equally SFI funding policies will continuously reflect national science, technology and innovation policy as it develops to 2020.

Top human, knowledge and financial capital are attracted only to those countries with the most excellent scientific output. SFI recognises the criticality of curiosity-driven research as the seed corn of impact. Hence, within the focus areas, the emphasis will be on excellent research with the potential for impact across the entire spectrum of research endeavours – that is, from oriented basic research through use/needs inspired basic research, not yet applied research to near market applied research.

A1.2 Actions to achieve this objective

- A1.2.1 Shift investment towards the areas identified in the 2012 *Report of the Research Prioritisation Steering Group*, and/or areas of demonstrable potential economic impact for Ireland, and/or areas of significant partnership with major research entities, and/or to support the development of young researchers;
- A1.2.2 Implement a strengthened system of impact analysis and maintain focus on the international peer/merit reviewing process to support the excellence-and-impact agenda;
- A1.2.3 Establish a recruitment initiative to attract iconic research leaders to Ireland;

- A1.2.4 Increase support for early career researchers, including retention mechanisms for top talent within the research system;
- A1.2.5 Encourage cross-disciplinary research in the priority areas identified in the 2012 *Report of the Research Prioritisation Steering Group*, and/or in areas of demonstrable potential economic impact for Ireland, and/or in areas of significant partnership with major research entities;
- A1.2.6 Support the development of European Research Council (ERC) scientists in Ireland and the attraction of more ERC scientists into Ireland.

A1.3 Key Performance Indicators (KPI)

KPI	Direct or Indirect ¹⁰	Target
A1.3.1	Direct	100% by 2015
A1.3.2	Indirect	Remain inside Top 20 over period to 2020
A1.3.3	Direct	By 2015
A1.3.4	Direct	By 2020
A1.3.5	Direct	50% increase by 2015 ¹¹ , sustained thereafter to 2020
A1.3.6	Direct	Exceed Ireland's <i>juste retour</i> level of 1.06% by 2016 ¹²
A1.3.7	Direct	Average of one per year to 2020

¹⁰ The key performance indicators are described as either 'DIRECT' or 'INDIRECT', indicating whether or not the performance in question is within SFI's direct control.

¹¹ Relative to 2012 levels.

¹² Ireland provides 1.06% of EU programme funding (2011 baseline). To ensure return on this investment, this level should be exceeded by the value of grants secured by Ireland, that is, *juste retour*.

A2. Invest in SFI's translational research capability to enhance the progression of research from discovery to delivery

A2.1 Why this is important

Over the past decade, Ireland has built a quality research capability; the time is now right to more aggressively develop the translational part of the discovery-to-delivery continuum. In the past, SFI has not supported such research directly. However, with the maturing of many SFI investments, the concentration of research into priority areas, and the erosion of the boundary between basic and applied research, it is now timely to engage in more direct support across the entire spectrum of scientific research and innovation. There are many opportunities arising from SFI's basic research programmes (some planned, many serendipitous) to translate discoveries into benefits for business and society. In the case of discoveries that have potential commercial application, the objective is to increase the number and quality of these entering both State and private commercialisation systems.

A2.2 Actions to achieve this objective

- A2.2.1 Reallocate SFI funding to the areas identified in the 2012 *Report of the Research Prioritisation Steering Group*, and/or to areas of demonstrable potential economic impact for Ireland, and/or to areas of significant partnership with major research entities, that are clearly aligned with industry (see A1);
- A2.2.2 Support innovative feasibility studies to identify the commercial potential of techniques or technology (in conjunction with suitable partners and investors, such as Enterprise Ireland and venture capital, angel and corporate investors);
- A2.2.3 Invest increasingly in translational research (in conjunction with suitable partners);
- A2.2.4 Integrate fully the assessment of potential impact into SFI's review processes;
- A2.2.5 Facilitate specific, major company R&D partnerships that have clear impact pathways of benefit to the Irish economy and society;
- A2.2.6 Ensure that large-scale programmes, such as the SFI Centres, have the flexibility to simply and rapidly add new industry partners and explore commercialisation opportunities; and
- A2.2.7 Build links with carefully selected partners, appropriate to developing translational capacity.

A2.3 Key Performance Indicators

KPI		Direct or Indirect	Target
A2.3.1	Proportion of invention disclosures, patents, licences and spin outs recorded by Enterprise Ireland that are linked to SFI research	Indirect	By 2020 double the 2011-2015 average
A2.3.2	Ireland's level of public-private co-publications	Indirect	50 publications per million of population ¹³ by 2020

A3 Develop a set of centres that are recognised internationally, that attract international research talent and capital, and that attract, anchor and spin out related companies in Ireland

A3.1 Why this is important

Ireland does not have the resources to be world-leading in every area in which it invests. It is therefore sensible to invest strategically in concentrations of excellence that can achieve the scale and impact required to be truly world-leading. SFI will focus on achieving international research leadership in a small number of research fields. In some such fields, this will require building scale in terms of people, infrastructure, output and international visibility. These centres of research excellence will attract human and financial capital. In particular, they will attract sustained investment from major non-Irish exchequer sources, such as the EU, enterprise, charity and philanthropy, and will thus be preferred partners in mobile, international academic and corporate collaborations. The big research questions addressed in these centres will have international relevance, and the centres will have the standing and capacity to lead major international partnerships to address them, with international funding partners.

A3.2 Actions to achieve this objective

- A3.2.1 Refine the funding instruments used to develop Centres for Science, Engineering and Technology (CSETs) and clusters into a more flexible and scalable model that is better able to deliver performance-based growth and impact in enterprise;
- A3.2.2 Develop instruments that allow companies to engage with centres on a scalable, flexible basis;

¹³ In 2008, the most recent data available from the Innovation Union Scoreboard, Ireland had 25.8 public/private scientific co-publications per million of population.

- A3.2.3 Where appropriate, merge SFI-funded units with each other or with units funded by other agencies to create efficient centres of scale;
- A3.2.4 In partnership with IDA Ireland and Enterprise Ireland, develop initiatives to attract major company investments into such centres;
- A3.2.5 In partnership with IDA Ireland and Enterprise Ireland, develop initiatives to use such centres to target FDI into Ireland and to create and grow indigenous companies;
- A3.2.6 Develop and lead international collaboration on crucial research questions – for example, through Joint Programming Initiatives or Horizon 2020 programmes; and
- A3.2.7 Invest in the research infrastructure, using Exchequer funds and leveraging funds from EU and other sources, and ensure that the infrastructure is sustained through good access/charge models.

A3.3 Key Performance Indicators

KPI		Direct or Indirect	Target
A3.3.1	Number of internationally recognised research centres of scale in Ireland	Direct	15 by 2016 ¹⁴
A3.3.2	Major non-exchequer investment into such centres – for example, from corporate R&D entities and international funders such as the EU	Indirect	Minimum of 50% of the centres' overall funding by 2020

A4. Increase the numbers of SFI-trained researchers employed in industry

A4.1 Why this is important

One of the main reasons that Government invests in scientific research is to upgrade the nation's human capital. People with high levels of training and skills are a key requirement for innovation, leading to higher value products and services, and improved living standards. SFI investments deliver 4th level graduates, the majority of whom are expected over the coming decade to secure/establish employment in high-tech companies and, to a lesser extent, in the public service, while a significant minority will stay within the system to support and refresh the academic community.

This represents a change in focus: over the past decade, SFI invested in building the Irish research ecosystem and, in particular, in building up expertise in the academic sector, whereas over the next decade, SFI will ensure that the majority of the human capital it develops is employed in the private sector and non-academic public sector.

¹⁴ This is based on an estimate of five centres launched in 2012, five launched in 2014 and five launched in 2016.

A4.2 Actions to achieve this objective

- A4.2.1 Prioritise SFI investment into areas that are in demand by industry - for example, through periodic thematic calls for proposals;
- A4.2.2 Consider funding fellowships and/or studentships with industry, where appropriate with relevant public funders;
- A4.2.3 Run specific schemes arising from strategic partnerships for example industry-specific calls;
- A4.2.4 Support short-term internships in relevant companies for postgraduate students and postdoctoral candidates for example industry partners or collaborators in Centres. Introduce an industrial/academic exchange fellowship scheme;
- A4.2.5 Include entrepreneurship, career development and industry modules in PhD and postdoctoral training; and
- A4.2.6 Showcase research talent to industry, in partnership with the enterprise development agencies where appropriate.

A4.3 Key Performance Indicator

KPI		Direct or Indirect	Target
A4.3.1	Percentage of SFI trainees moving to industry as a first destination	Direct	50% by 2020

B. TO BE THE EXEMPLAR IN BUILDING PARTNERSHIPS THAT FUND EXCELLENT SCIENCE AND DRIVE IT OUT INTO THE MARKET AND SOCIETY

B1. Build strategic partnerships

B1.1 Why this is important

Successful entities collaborate, partner and network. They identify other entities whose agendas are synergistic and work together with them to generate multiplier effects, and deliver results that far outstrip what the individual entities would deliver on their own. This principle is observed in all kinds of systems, ranging from biological ecosystems to networks of companies to political environments. It is no different for SFI and the organisations it supports.

Currently SFI funds all of its research activities through the Higher Education Institutions (HEIs) in Ireland. HEIs are therefore a key partner and SFI plans to deepen its partnership approach, especially as the HEIs differentiate their missions and focus on priority research areas. Equally, industry, both large and small, is a key partner for SFI and SFI plans to both broaden and deepen its industrial research partnerships.

Effective partnership has a number of benefits. It:

- »» Enables global scientific and societal challenges to be tackled;
- »» Builds critical mass and shares risk;
- »» Stimulates excellence through competition;
- »» Allows sharing of expensive and specialist research infrastructure;
- »» Enables mobility of researchers;
- »» Provides reputational and other strategic benefits; and
- »» Allows access to new technology pathways and standards.

SFI is committed to leveraging its investment and capability to the maximum extent possible. The partnership model is an efficient and effective means of doing this. It can work at multiple levels, enabling delivery of SFI's strategy across the academic, economic, cultural and public engagement themes, nationally and internationally. The type, mode, structure and duration of partnerships must be flexible and scalable, and they must facilitate different sorts of relationships, from 'seeding' to longer term macro collaborations.

To realise its ambitious vision, SFI must adopt a renewed approach to partnerships. It must strategically identify and target entities with the potential to generate multiplier effects that contribute to the delivery of its objectives.

B1.2 Actions to achieve this objective

- B1.2.1 Develop a model for partnership that will enable SFI to strategically identify and engage in partnerships with the required level of impact;
- B1.2.2 Drive deeper, more content-based relationships with IDA Ireland and Enterprise Ireland (by issuing themed calls, and identifying, pursuing, integrating and exchanging information with appropriate partner companies), and further develop SFI support services to the enterprise agencies;
- B1.2.3 Increase participation with infrastructure funding sources, so as to better align human resources with infrastructure;
- B1.2.4 Build stronger, more direct relationships with research-based industry;
- B1.2.5 Intensify engagement with major international bodies, particularly the EU/Horizon 2020;
- B1.2.6 Selectively target value-add relationships with key countries and their funding agencies;
- B1.2.7 Enhance relationships with key players in areas identified in the 2012 *Report of the Research Prioritisation Steering Group*;
- B1.2.8 Build a network of international impact reviewers to complement SFI's current network of international scientific reviewers;
- B1.2.9 Persuade the Irish scientific diaspora to support outstanding and innovative research capability on the island of Ireland, through advice, collaborations and partnerships; and
- B1.2.10 Learn from other countries (particularly small advanced economies) that have focused on R&D and innovation as key national policies.

B1.3 Key Performance Indicators

	KPI	Direct or Indirect	Target
B1.3.1	Joint funding instruments with key agencies (Irish and international) and companies aligned to <i>Agenda 2020</i>	Direct	A measurable increase in joint funding instruments by 2020
B1.3.2	Relationships developed with Ireland's strategic partners, as identified by Government policy	Direct	Demonstrable increase in collaborations with these partners by 2020
B1.3.3	Level of leadership roles in major European initiatives, in particular Horizon 2020 ¹⁵	Indirect	Exceed level of investment by Ireland into Horizon 2020 ¹⁶

¹⁵ Other examples include Joint Programming Initiatives, Knowledge and Innovation Communities, etc.

¹⁶ Ireland provides 1.06% of EU programme funding (2011 baseline). To ensure return on this investment, this level should be exceeded by the value of grants secured by Ireland – that is, *juste retour*.

B2. Diversify the funding sources for Ireland's scientific base

B2.1 Why this is important

Top-quality research that is scientifically excellent and that brings direct economic and social benefits should have multiple sources of support. Equally, large research projects require a level of funding that can realistically be met only by multiple investors.

Evidence of scientific excellence lies in winning international funding from sources such as the ERC for individuals, or the coordination of EU projects for research teams. Evidence of impact potential lies in attracting partnership requests from major international companies or investors.

A diversified income stream is thus an indicator of both relevance and quality. It also contributes to the sustainability of the system and enhances its capability of delivering strategic goals, as a broad funding base is inherently more stable. A broad funding stream also ensures the resilience and efficiency of individuals and the continued development of research careers.

B2.2 Actions to achieve this objective

- B2.2.1 Incentivise SFI groups, the Higher Education Institutions and other research-performing organisations to secure substantially increased international funding;
- B2.2.2 Develop the theme of 'Ireland as a Testbed' and fund it by allocating a small percentage of the costs of appropriate State-funded infrastructure programmes – for example in areas such as the grid, telecommunications, hospitals, roads, schools, new public buildings and building refurbishments, environment, marine and agriculture;
- B2.2.3 Facilitate companies that wish to sponsor or participate in research, by, for example:
- » More flexible means of engagement, particularly with research centres;
 - » Simpler intellectual property management;
 - » Industrial fellowships and studentships;
 - » Strategic calls with industry co-funding and involvement; and
 - » Partnership programme to co-fund initiatives in partnership with industry, HEIs and charity/philanthropy.
- B2.2.4 Develop strategic partnerships with potential sources of funding where those sources align with SFI strategy;
- B2.2.5 Leverage funding for SFI researchers through participation in European initiatives, such as ERAnets, Joint Programming Initiative, etc;

- B2.2.6 Facilitate and incentivise research performers to engage in networking;
- B2.2.7 Develop and invest in MSc and PhD degrees co-sponsored by industry; and
- B2.2.8 Develop a 'seed funding' system that provides more SFI funding for the establishment of junior researcher positions, with increased requirements for co-funding for established investigators.

B2.3 Key Performance Indicators

KPI		Direct or Indirect	Target
B2.3.1	Research income secured by SFI-funded researchers from international funding entities such as the EU	Indirect	Double the average figure between 2008-2011, to €120m ¹⁷ by 2020
B2.3.2	Major testbeds established in Ireland	Indirect	Average of one major new testbed per year from 2014 onwards
B2.3.3	The funding profile of SFI researchers	Direct	Reduce to 30% the proportion of SFI researchers that rely on SFI for the majority of their funding by 2020 ¹⁸
B2.3.4	Partnership funding with Industry	Direct	Co-fund at least one partnership per year to 2015 and at least two per year to 2016 - 2020

17 The average between 2008-2011 was €60m.

18 The SFI Census asks researchers how dependent they are on SFI funding (100% means completely dependent on SFI funding). The 2011 figures show that 60% of SFI researchers currently rely on SFI for the majority of their funding.

C. TO HAVE THE MOST ENGAGED AND SCIENTIFICALLY INFORMED PUBLIC

C1.1 Why this is important

Science and technology play an increasingly important role in addressing the economic, social and environmental problems faced by the world today. That role needs the support and active engagement of the public who fund the work and are the ultimate beneficiaries of it. An engaged public is one that understands the role of science, can judge between competing priorities and arguments, encourages young people to take STEM subjects, and feels that it has the appropriate level of engagement with, and influence upon, the researchers.

SFI, as the primary investor in scientific research in this country, must form a strong relationship with the Irish people, built on trust.

This relationship and this trust has a number of aspects.

First, the public needs to better understand the scientific process, based on hypothesis testing by experiment with reproducible observations. They need to know that in any field, knowledge is initially often tentative, and that it becomes increasingly secure only after repeated experimentation. They need to realise that it is not always possible to give clear and unambiguous answers to questions that arise in the course of investigation. At the same time, however, they must be equipped to engage with this fast unfolding, not-yet-complete modern science, to debate the issues rationally, and to contribute to prioritisation. Scientific discussion should not be confined to scientists: we should welcome contributions from the arts and humanities in the form, for example, of plays, poems and stories that frame the issues in different contexts. Increasingly, effective politics will require a scientifically literate public.

Second, SFI spends taxpayer's money on scientific research. Around the world, there is a gulf opening up between the public who pay for research and the scientists who execute it. This is unhealthy. There is an opportunity for Ireland to lead the world in public engagement with science. This is not only about general scientific awareness, as suggested above, but also about how much we spend on scientific research and in what areas. It is a real challenge to effectively communicate the long-term nature of research investments, their importance, their potential benefits, and their relevance to society as a whole. But if we succeed in this, Ireland will have far fewer problems than countries that try to develop their science agendas without reference to their public.

Third, SFI should provide unbiased scientific briefings to stakeholders on topics of national and international interest to them, and should also proactively engage with stakeholders on a regular basis to disseminate information, highlight new emerging areas and provide a neutral forum for scientific discussion.

Significant progress has been made in public engagement in recent years, but SFI recognises that a step change is required in its relationship with the public if it is to achieve the ambitious vision set out in *Agenda 2020*.

C1.2 Actions to achieve this objective

- C1.2.1 Integrate the national awareness programme, Discover Science & Engineering, into SFI, broadening its communications objective to embrace *all* audiences;
- C1.2.2 Develop and pilot ways of engaging the public in determining research needs;
- C1.2.3 Make public dissemination of knowledge and impact a core requirement of SFI-funded researchers that is evaluated in research proposals and in grant performance;
- C1.2.4 Catalyse a transformation in scientific coverage and programming across all media platforms, with a high priority on the Irish broadcast media;
- C1.2.5 Develop a contact service to the media which identifies Irish-based experts on topical issues for news reports, discussions, debates etc.
- C1.2.6 Consider the development of an annual SFI award ceremony. Categories could include Researcher of the Year, Innovator of the Year, Communicator of the Year, Discovery of the Year, Best Science News Story of the Year, Best Schools Ambassador;
- C1.2.7 Develop and provide science communications training for SFI-supported researchers; and
- C1.2.8 Develop communications platforms and events that will challenge, inform and effectively engage the public and stakeholders in science and engineering discourse, bringing together different stakeholders (general public, politicians, industry, etc.) and sectors (arts, culture, education, etc.) with the scientific research community.

C1.3 Key Performance Indicators

KPI		Direct or Indirect	Target
C1.3.1	Increased coverage of SFI and science by the media – for example, in news coverage, in documentary coverage, and in entertainment and children’s programmes	Indirect	By 2014, the presence annually of at least one science programme or series in the peak schedule of the national broadcaster Double the 2009-13 average level of SFI coverage (as proxy for mainstream science) in traditional media by 2020, and establish measurable presence in new media/online space
C1.3.2	Level of take-up of STEM subjects at second- and third-level	Indirect	Arrest decline observed over 2007-11 and subsequently sustain a measurable increase ¹⁹

19 It is acknowledged that achieving this target is not within the control of SFI. However, the objective is for SFI to contribute significantly towards its achievement.

D. TO REPRESENT THE IDEAL MODERN PUBLIC SERVICE ORGANISATION, STAFFED IN A LEAN AND FLEXIBLE MANNER, WITH EFFICIENT AND EFFECTIVE MANAGEMENT

D1.1 Why this is important

SFI is a young organisation with an organisational structure that is unique within the Irish public service. Its core scientific staff is employed on a contract basis: this ensures that the organisation has the flexibility to respond quickly to changes in science and technology. It is a lean organisation that can be a model template for the Irish public service. Operational excellence is a core value of the organisation and SFI requires top-class performance from its staff, using a model of high turnover and high employability. In international comparisons, SFI is well respected by international funders and is viewed as best in class.

SFI has built an excellent reputation for transparency and accountability in its operations. In adopting international peer review as its core operating procedure, it changed the research landscape in Ireland forever, and placed it on a respected best-practice footing. However, as much of the annual work plan has shifted to deadline-driven programme calls, SFI has lost some of its operational flexibility and capacity to be opportunistic in furthering its mission. Over the coming years therefore, we will seek to establish clear and transparent mechanisms that will allow us to respond to opportunities that fall outside the scope and timelines of our core funding instruments.

SFI will also monitor, promote, implement and audit international best practice in areas such as: Research Integrity, Health and Safety, Licenced Procedures, Humane and necessary (reduce, refine, replace principles) use of animals in experimentation, Ethics, IP integrity, widespread dissemination of research findings, for example, through open access policies. SFI notes the increasing emphasis on these topics globally, for example, 'The concordat to support Research Integrity'²⁰ published by Universities UK in July 2012, signed by all of the UK Universities, Research Councils and Research Charities and the European Code of Conduct for Research Integrity (2011)²¹. SFI intends to work with other funders and the HEIs in Ireland to adapt and develop a similar concordat to maintain the highest standards of rigour and integrity in all aspects of research, and to ensure that research in Ireland is conducted according to appropriate ethical, legal and professional frameworks, obligations and standards. SFI intends to introduce additional audit procedures to ensure compliance and so provide assurance to Government, the wider public and the international community that research in Ireland continues to be underpinned by the highest standards of rigour and integrity.

20 The Concordat to Support Research Integrity, Universities UK 11/7/12, ISBN 9781840362732 – downloadable free from: <http://www.universitiesuk.ac.uk/Publications/Pages/concordattosupportresearchintegrity.aspx>

21 <http://www.esf.org/activities/mo-fora/research-integrity.html>

D1.2. Actions to achieve this objective

- D1.2.1 Maintain a lean organisation with the flexibility to hire and reallocate resources within a defined budget, and rebalance the organisational structure to facilitate this;
- D1.2.2 Benchmark performance in assessment against other international funders (using metrics such as time-to-assess, time-to-grant) and drive value from our core IT system (reduced cycle times, reduction in manual effort, reduced support needed);
- D1.2.3 Implement partnership and outsourcing arrangements to achieve greater value in operations;
- D1.2.4 Implement secondments to and from industry, academia and other funding agencies (including internationally), internships for junior researchers and fellowships for senior researchers;
- D1.2.5 Develop opportunistic, rapid turnaround capability within SFI, for example, to respond quickly to major, internationally mobile company R&D partnerships, as and when they arise;
- D1.2.6 Implement effective ways of obtaining and integrating guidance, feedback and ideas from academia and industry, for example, in visits, panels, town hall meetings, fora, draft documents and meetings with user groups;
- D1.2.7 Foster integration of R&D and innovative products into public procurement, services and policy;
- D1.2.8 Develop with HEIs and other funders a concordat to support research integrity;
- D1.2.9 Introduce a broadened audit of SFI-funded HEIs to include areas such as research integrity, compliance with legal, ethical and licensing obligations, IP integrity, transparent, robust and fair processes to deal with allegations of research misconduct; and
- D1.2.10 Improve SFI's evaluation system to identify appropriate metrics, set challenging targets and track implementation of *Agenda 2020*.

D1.3 Key Performance Indicators

KPI		Direct or Indirect	Target
D1.3.1	Cost of administration ²²	Direct	Below 5% annually
D1.3.2	Efficiency of grant review and management process (<i>time-to-grant</i> and <i>time-to-manage</i> metrics)	Direct	To be in the top quartile by 2015 by international benchmarks
D1.3.3	Attractiveness of SFI as an employer and employability of SFI staff ²³	Direct	TBD For example: - four internships/year from 2013 - two secondments/year from 2014 - one placement by international funding agencies from 2014
D1.3.4	Develop a concordat to support research integrity	Direct	By 2013
D1.3.5	Developed audit of SFI-funded HEIs to include areas such as research integrity, compliance with legal, ethical and licensing obligations, IP integrity, transparent, robust and fair processes to deal with allegations of research misconduct	Direct	Conducted by 2014

²² Cost of administration = SFI Annual Pay/NonPay Budget expressed as a percentage of total live investment under management.

²³ Based on the assumption that SFI is free to operate within the Employment Control Framework by end of 2012.

TRACKING IMPLEMENTATION

HOW WE WILL OPERATE *AGENDA 2020*

Agenda 2020 identifies the strategic goals for SFI over the period to 2020, along with actions that will enable their delivery. The suite of actions described may change over time as significant flexibility will be required to implement such a challenging plan. *Agenda 2020* constitutes a clear statement of intent for SFI over the coming decade, with measurable outputs defined for transparent reporting and accountability.

Agenda 2020 articulates some actions that are directly under SFI's control and some that depend significantly on external bodies for their implementation. The Key Performance Indicators used to track performance are thus categorised as Direct or Indirect. It is important that, during the implementation of *Agenda 2020*, SFI maintains the capability to rapidly identify actions that are not being progressed, so that action can be taken, directly by SFI or otherwise, to keep them on course.

THE ANNUAL REVIEW

Each year, we will publish a review of progress towards implementing the goals set out in *Agenda 2020*. The purpose of this review is to report the extent to which SFI met its planned targets across the four goals of *Agenda 2020*. The review will provide SFI and its stakeholders with realistic and, where possible, quantitative measures of SFI's performance over the previous year, and will provide the SFI Executive and Board with the data needed to assess management and governance structures.

The annual review will be accompanied by an analysis of the operating environment, to provide the context for the findings. This will necessarily involve an assessment of risks and opportunities, and will provide a framework for identifying any necessary changes to the plans for implementing the strategic goals. But the strategic goals themselves will remain constant, as will the Key Performance Indicators used to monitor progress towards them.

THE ANNUAL PLAN

Each year, SFI will publish a plan for that year. This will be in January or as soon as SFI's annual operating budget for the year is known. This annual plan will summarise SFI's funding schemes, how they relate to the National Research Prioritisation Exercise, and the research funding calls that SFI intends to make that year.

Through a series of visits and meetings with HEIs, industry, State agencies, Government departments, international partners, charities and other bodies, SFI will consult with the community about forthcoming plans and obtain feedback. SFI is always interested in receiving suggestions for innovative or better ways of achieving its objectives. It is SFI's intention, budget permitting, to support a broad range of initiatives, including large research centres, research projects, individual researchers (particularly at the early stage in their careers), schemes to incentivise successful participation in non-Irish Exchequer funding opportunities, infrastructure, conference and workshops, public dissemination and outreach activities. Some schemes will operate on an annual basis and others on a more infrequent basis, as appropriate – such as Centres, infrastructure, etc.

SUMMARY OF KPIs

KPI	Direct or Indirect	Target
A1.3.1	Direct	100% by 2015
A1.3.2	Indirect	Remain inside Top 20 over period to 2020
A1.3.3	Direct	By 2015
A1.3.4	Direct	By 2020
A1.3.5	Direct	50% increase by 2015 ²⁴ , sustained thereafter to 2020
A1.3.6	Direct	Exceed Ireland's <i>juste retour</i> level of 1.06% by 2016
A1.3.7	Direct	Average of one per year to 2020
A2.3.1	Indirect	By 2020 double the 2011-2015 average
A2.3.2	Indirect	50 publications per million of population by 2020
A3.3.1	Direct	15 by 2016 ²⁵
A3.3.2	Indirect	Minimum of 50% of the centres' overall funding by 2020
A4.3.1	Direct	50% by 2020

²⁴ Relative to 2012 levels.

²⁵ This is based on an estimate of five centres launched in 2012, five launched in 2014 and five launched in 2016.

KPI		Direct or Indirect	Target
B1.3.1	Joint funding instruments with key agencies (Irish and international) and companies aligned to <i>Agenda 2020</i>	Direct	A measurable increase in joint funding instruments by 2020
B1.3.2	Relationships developed with Ireland's strategic partners, as identified by Government policy	Direct	Demonstrable increase in collaborations with these partners by 2020
B1.3.3	Level of leadership roles in major European initiatives, in particular Horizon 2020 ²⁶	Indirect	Exceed level of investment by Ireland into Horizon 2020 ²⁷
B2.3.1	Research income secured, by SFI researchers, from international funding entities such as the EU	Indirect	Double the average figure between 2008-2011, to €120m ²⁸ by 2020
B2.3.2	Major testbeds established in Ireland	Indirect	Average of one major new testbed per year from 2014 onwards
B2.3.3	The funding profile of SFI researchers	Direct	Reduce to 30% the proportion of SFI researchers that rely on SFI for the majority of their funding by 2020 ²⁹
B2.3.4	Partnership funding with industry	Direct	Co-fund at least one partnership per year to 2015 and at least two per year to 2020

26 Other examples include Joint Programming Initiatives, Knowledge and Innovation Communities etc.

27 Ireland provides 1.06% of EU programme funding (2011 baseline). To ensure a return on this investment, this level should be exceeded by the value of grants secured by Ireland, that is, *juste retour*.

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29 The SFI Census asks researchers how dependent they are on SFI funding (100% means completely dependent on SFI funding). The 2011 figures show that 60% of SFI researchers currently rely on SFI for the majority of their funding.

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C1.3.2	Level of take-up of STEM subjects at second- and third-level	Indirect	Arrest decline observed over 2007-11 and subsequently sustain a measurable increase ³⁰
D1.3.1	Cost of administration ³¹	Direct	Below 5% annually
D1.3.2	Efficiency of grant review and management process (<i>time-to-grant and time-to-manage metrics</i>)	Direct	To be in the top quartile by 2015 by international benchmarks
D1.3.3	Attractiveness of SFI as an employer and employability of SFI staff ³²	Direct	TBD For example: - four internships/year from 2013 - two secondments/year from 2014 - one placement by international funding agencies from 2014
D1.3.4	Develop a concordat to support research integrity	Direct	By 2013
D1.3.5	Developed audit of SFI funded HEIs to include areas such as research integrity, compliance with legal, ethical and licensing obligations, IP integrity, transparent, robust and fair processes to deal with allegations of research misconduct	Direct	Conducted by 2014

30 It is acknowledged that achieving this target is not within the control of SFI. However, the objective is for SFI to contribute significantly towards its achievement.

31 Cost of administration = SFI Annual Pay/Non-Pay Budget expressed as a percentage of total live investment under management.

32 Based on the assumption that SFI is free to operate within the Employment Control Framework by end of 2012.

ACKNOWLEDGEMENT

SFI would like to acknowledge and thank everyone who contributed to the consultation process on Agenda 2020, the Action Plan 2013 and Discovery to Delivery. SFI received 59 written submissions and 65 people attended the public consultation meeting. The documents have improved as a result of these contributions and engagements. Further details on the consultation process and submissions are available on the SFI website - www.sfi.ie

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