Value For Money Review of Science Foundation Ireland (Ireland)

1. Introduction

The Review examines the full range of funding programmes operated by Science Foundation Ireland (SFI) over the period 2001 to 2006, but with a particular focus on the two most significant programmes, namely:

- Academia-industry research centres: **Centres for Science, Engineering and Technology (CSETs)**, with €137.7m funding committed by the SFI between 2001 and 2006 (which represents 20.2% of total SFI committed funding over the period);
- Individual researcher grants: **Principal Investigator programme**, with €326.6m committed by the SFI between 2001 and 2006 (47.9% of the total SFI committed funding).

This ex-post evaluation was conducted as part of the Irish Government's Value for Money and Policy Review Initiative. It was commissioned by the Department of Enterprise, Trade and Employment (subsequently 'Department of Jobs, Enterprise and Innovation'), Office of Science, Technology and Innovation (OSTI). The evaluation was carried out externally and within 14 months from the launch of the Terms of Reference by Indecon International Economic Consultants. The final report was published in 2008. The total budget (exclusive of VAT) was €153,230.

The Value for Money Review of SFI is a good example of a large programme evaluation study, focusing on two different types of support measures. None of these measures/programmes were directly ERDF-funded during the period covered by the evaluation. However, since then, the CSET and Principal Investigators programme have been included in the 2000-2006 Operational programme for the Irish Border, Midland & Western region extended for 2007 and 2008, as well as in the 2007-2013 Operational programme. The evaluation makes use of a wide range of methods to assess the effectiveness, impact and efficiency of research and innovation-related funding programmes, comprising a robust use of bibliometrics, the involvement of international experts and benchmarking, extensive consultations with SFI management and staff, programme beneficiaries as well as unsuccessful applicants, higher education/research institutions, leading foreign-owned and indigenous companies, and government stakeholders. The Review is an example of organisational evaluation, as it concerns SFI. However, the focus is placed on two specific innovation-related support measures operated by SFI and not on the agency as a whole. It is worth noting that the two measures reviewed have a different position on the science and innovation spectrum: the Principal Investigator programme is more orientated towards science and research, while the Centres for Science, Engineering and Technology (CSETs) are aimed at partnerships between scientists and engineers and directed towards use-inspired research and innovation.

Overall, the review delivered a positive assessment of future SFI prospects in delivering value for money - granted that the emerging progress is maintained - and reviewed positively the impacts of the programme on the quality of research, human capital development, collaboration activities and inward investment and commercialisation. It concluded that the SFI programmes are consistent with national and EU policies and that the SFI has managed the process of ramping-up the significant increase of public funding that it receives in its first years of operation in a satisfactory manner, even if the monitoring of grant-aided research programmes could be improved on some aspects such as the aggregation of data from individual reports at the central level. Given the first evidences of impacts, the final report therefore

underlines that any discontinuation or reduction in supports could adversely affect the build-up of research capacity in Ireland.

2. Description of the evaluated measure

Science Foundation Ireland (SFI) - the Irish National Foundation for Excellence in Scientific Research - was established in 2001, to develop Ireland as a centre of research excellence in strategic areas relevant to economic development, specifically the areas of Biotechnology and Information Communication Technology (and now Energy). To fulfil its mission, SFI provides grants based upon the merit of proposals from distinguished researchers through its Scientific Directorates i.e. Information Communication and Emergent Technologies (ICET) and Life Sciences.

The review intended to examine the overall effectiveness of the agency support in building a world-class research system in Ireland, with a focus on whether the programmes, as operated, constituted value for money and efficient use of public funds. It is estimated that each year, up to 50 Irish public programme areas are selected for Review across Departments and Offices. The decision for launching a Review is centrally made in every single State Department.

Figure 1 The Irish Value for Money Review and Policy review Initiative

The Irish Government's Value for Money and Policy Review Initiative

The objectives of the Value for Money and Policy Review Initiative - introduced in 1997 as the 'Expenditure Review Initiative' - are to analyse Exchequer spending in a systematic manner and to provide a basis on which more informed decisions can be made on priorities within and between programmes. The Initiative is one of a range of modernisation proposals aimed at moving public sector management away from the traditional focus on inputs to concentrate on the achievement of results.

Source: Value for Money and Policy Reviewers' Network, Central Expenditure Evaluation Unit (Department of Finance), Value for Money and Policy Review Initiative Guidance Manual, 7 March 2007, online: http://www.finance.gov.ie/documents/publications/guidelines/vfmGuidnaceManual.pdf

SFI was at the time of the evaluation a young Agency that had grown very quickly and constituted one of the most significant capital expenditure areas for the (then) Department of Enterprise, Trade and Employment - with a committed funding amounting to €135.2m in 2006. As such it was a natural candidate for a Review.

It was decided when drafting the evaluation approach and the ToR that the Review would focus on the two most significant SFI programmes both in terms of funding and strategic value (and not on the whole bench of supports provided by SFI) in order to direct investigations in an efficient way, as follows:

- Principal Investigator Programmes including Research Professor Awards and E.T.S. Walton Visitor Awards' Grants for outstanding researchers. These programmes support those fields of science and engineering that underpin biotechnology, information and communications technology (and now sustainable energy and energy-efficient technologies). Grants are awarded to individual Principal Investigators and may range from €100,000 to €500,000 direct costs per year and may be 3-5 years in duration.
- The Centres for Science, Engineering and Technology (CSET): grants to create a collaborative research centre of up to €25million (including industry cost share). Distributed over five years, the grant helps cover researchers and equipment costs. The CSET are designed to help link scientists and engineers in partnerships across academia and industry to address crucial research questions, foster the

development of new and existing Irish-based technology companies, attract industry that could make an important contribution to Ireland and its economy, and expand educational and career opportunities in Ireland in science and engineering.

The Review's objectives were twofold:

- Determining to what extent the general public benefit from the investments made by SFI;
- More specifically, finding evidence of the existence of outputs and outcomes arising from the implementation of SFI activities, as well as quantifying the amount of these outputs and outcomes.

Retrospectively, the evaluation also contributed to the monitoring of the Strategy for Science, Technology and Innovation for 2006-2013. At its launch however, this was not one of its first concerns.

3. Designing the evaluation study

The Value For Money process is rather straightforward and was subject to the publication of a guidance document addressed to every Irish Department.[1] This includes guidance on the planning and managing of such Reviews by Departments, as well as on the methodologies to be used. However, at the time when the Terms of Reference (ToR) for the evaluation were drafted, the guidance document had not yet been issued and only a first draft was available for use by the commissioning Department.

The ToR was drafted by the Steering Committee in charge of monitoring and assisting the evaluation process.[2] It was then reviewed by an independent evaluation expert, in charge of assessing the quality of the document. This is in line with the Value For Money Review guidance document, which stipulates that all ToR and all completed Value For Money review reports must be quality assessed before completion. The Department of Finance established a Panel of Independent Evaluation Experts for this purpose in 2003. The panel consists of around 50 evaluation experts, drawn from a range of consultancy companies, individual practitioners and academics. This is a real added value and contributes to bringing coherence into the design of the different Value For Money Review process, that are operated into every single Department and not centrally. Likewise, all draft ToR for Value For Money Reviews are submitted for approval at Assistant Secretary level.

The ToR to the study is rather brief. It gives details of the questions and key topics of the Review but do not elaborate further on the methodology. That being said, implicit leads on the methodology to be implemented are contained in the evaluation questions as they are stated (Figure 2).

Figure 2 Main objectives and lead questions – Value For Money Review SFI (IE)

Evaluation criteria	Question as detailed in the ToR
Relevance of the programmes with regard to SFI long-term objectives	Examine the validity of these programmes in meeting the long-term objective of SFI to create a highly visible critical mass of world-class research excellence in niche areas of ICT and Biotechnology, considered important to Ireland's future industrial development.

[1] Value for Money and Policy Reviewers' Network, Central Expenditure Evaluation Unit (Department of Finance), Value for Money and Policy Review Initiative Guidance Manual, 7 March 2007, online: http://www.finance.gov.ie/documents/publications/guidelines/vfmGuidnaceManual.pdf.

[2] Since the publication of the Value For Money Review Guidance in 2007, a template Terms of Reference was issued by the Central Steering Committee, to be followed in full, and adapted as appropriate.

Evaluation criteria	Question as detailed in the ToR
Relevance of the programmes with regard to the changing context, External coherence of the programme with regard to national and EU policies	Examine the validity of these programmes in changing circumstances and their individual and overall consistency with the objectives of the Strategy for Science, Technology and Innovation (SSTI) 2006-2013, other relevant Government policies and strategies and EU strategies on Innovation, Science & Technology.
Effectiveness of the schemes	Review the individual objectives of each programme and assess the extent to which they are being met. Examine the separate programmes in terms of comprehensive measurement of inputs and outputs.
Efficiency of the schemes (testing alternatives)	Review the effectiveness of the operation of the individual programmes, with reference to their outputs and their impacts where possible, review the quality of projects supported and whether the same objectives could be achieved by alternative means. Determine the probable outcomes, which could result from the discontinuation, reduction or expansion of any programme(s).
Efficiency of the scheme (for beneficiaries)	Review user satisfaction with the management and implementation of these programmes by Science Foundation Ireland.
External coherence of the schemes with regard to other national initiatives	Review the effectiveness and coherence of the schemes in terms of the overall objectives of Government investment in research and innovation (SSTI 2006-2013) and the effectiveness in practice of their links to other related expenditure programmes and supports, particularly those operated by the Higher Education Authority (HEA) and the other research supports to companies provided by the Enterprise Development Agencies.
Future development	Specify whether improvements can be made in the overall agency strategy for supporting outstanding researchers, including analysing relevance of existing and specifying future indicators.

Categorisation by Technopolis, based on the ToR contained in the Final report to the study.

There is no indication of the budget for the Review in the ToR but the duration (9 months) and timescale are clearly stated. Due to constraints on access to required monitoring and other data, and availability of stakeholders during the summer period, some delays were experienced in the completion of primary research and analysis. The overall timeline was therefore extended with the study being completed to the satisfaction of the Department and the report published within a period of 14 months.

4. Implementing the evaluation: methodology and process

4.1 Description of the process to select the external contractor

The work on Value For Money reviews is generally carried out internally by Irish Departments/Offices and reviews are an integral part of their assigned tasks. Reviews conducted internally rather than by external consultants (or by evaluation units) are said to help to ensure a practical focus and to build evaluative capacity within Departments.

However, it was deemed necessary for SFI Review to turn to external consultants. They were judged more able to produce an objective insight on the programmes reviewed, compared to what insiders would have done under similar circumstances given the specific focus of the study and the particular expertise needed in terms of evaluation methodologies. A call for tenders was issued and the contractor was selected by the Steering Committee who issued the ToR.

4.2 The evaluation approach and methodology

The evaluation was organised in a five-step approach:

- Phase 1: Project initiation, data and information gathering, documentary analysis (review of previous research), interviews;

- Phase 2: Examination of validity and rationale of the programmes and objectives (relevance), evaluation of the programmes inputs and outputs;
- Phase 3: Evaluation of impacts and effectiveness, Efficiency of programmes and overall SFI strategy;
- Phase 4: Evaluation of complementarities and linkages (coherence), assessment of organisational and monitoring approach (organisational efficiency);
- Phase 5: Conclusions and recommendations, reporting and presentation.

During the process, data were collected using a wide range of tools that are presented in Figure 3. The tools implemented are conform to the initial methodology planned.

Figure 3 Methodological tools – Value For Money Review SFI (IE)

Tools	Description	Target groups/sources
Use of secondary data (documentary analysis)	Review of existing policy and other documents (i.e. EU and national policy) with the aim of situating SFI in its wider policy context	EU and Irish policy-makers
Use of administrative data	Review of detailed data on staffing, funding, expenditures and outputs at the global level of SFI, at the level of the two investigated programmes and at the level of a number of individual research centres/groups	SFI, research groups and researchers funded by SFI, Other State agencies (FORFAS, IDA Ireland, Enterprise Ireland and the Higher Education Authorities)
Bibliometrics	In-depth analysis of the outputs of SFI researchers and of the quality of this research (i.e. how does SFI-funded research outputs compare with other Irish outputs in similar disciplines as well as with international standards and how SFI funding has impacted on author productivity).	Use of Scopus and Thompson ISI databases[3]
Questionnaire survey	Three questionnaires sought the input and views of the beneficiaries and non-beneficiaries of SFI funding	SFI-funded researchers; Unsuccessful applicants; Leading Irish companies and industry (beneficiaries or non beneficiaries)
Individual interviews	In-depth discussion and site visits	Senior management officials in a number of State organisations, including SFI Centre directors, board members, Irish Universities Association
Focus groups	In-depth discussion and site visits	Principal Investigators in research centres, industrial partners and individual researchers
Case studies	Five case studies based on administrative data and the site visits were conducted on the CSETs, covering staffing, management structure, funding, commercialisation, partnerships and outreach programmes.	Use of administrative data; Interviews and focus groups
Expert panel	Assistance and inputs were provided all along the review by the four international academic advisors who assisted the external contractor (specifically on the international comparative position of SFI)	Involvement of four international academic advisors

Categorisation by Technopolis, based on the Final report to the study.

[3] Scopus and Thompson ISI databases are an abstract and citation database of peer-reviewed literature and quality web sources, usually used in bibliometrics.

The data collected were analysed using a wide range of approaches, in particular:

- Descriptive statistics on administrative data (e.g. Financial analysis of commitments and expenditure data, analysis of the numbers and origin of research staff funded and of research output) and on the results of the surveys;
- The use of a baseline approach in the bibliometrics analysis (e.g. Comparison of the number of publications for SFI funded biology and ICT researchers over the 1998 to 2007 period, i.e. before and after the launch of SFI);
- The use of a benchmark approach in the bibliometrics (e.g. Comparison of SFI-funded research output with other Irish output in similar disciplines, as well as with international standards), and with the international experts panel (e.g.
- Assessment of the international comparative position of SFI by the four international advisors);
- The use of a counterfactual approach in the bibliometrics (e.g. Comparison between the early citation rate of SFI-funded research and the Irish non-SFI funded rates in similar disciplines).

These were complemented by in-depth qualitative analysis from the interviews, focus groups and case studies.

4.3 Organisation of evaluation process

Limited to about 8 members, the Steering Committee was responsible for the design of the ToR and followed the evaluation process from the drafting of the ToR through to the submission of the study's final report. The Committee was composed mainly of one representatives of each of the following: the Department of Enterprise, Trade and Employment, the Department of Finance, SFI, Forfàs[4], the Higher Education Authority (HEA) and the Irish Universities Association (IUA).

The commissioning body – i.e. the Office of Science, Technology and Innovation (OSTI) within the Department of Enterprise, Trade and Employment - chaired the Steering Committee. Inside the Office, the unit responsible for the Review is in charge of corporate governance of SFI and deals with reporting, funding and other administrative-related issues for SFI. Strategically it is also responsible for ensuring that SFI contributes to the national research and innovation strategy. Neither an evaluation unit nor an evaluation officer commissioned the review, the commissioning unit has however participated in different evaluations and studies related to the other programmes that are part of its attribution. The Review was therefore not overseen by a dedicated evaluation officer, but any need in terms of evaluation methodology and knowledge of evaluation conduct was bridged by the general methodological framework provided with the Value For Money Review guidance document.

The reviewed agency - SFI - was associated both as member of the Steering Committee and during the data collection process through interviews. The process was managed inside the Agency by an internal coordinator, who was widely associated to the evaluation process and contributed to shaping the evaluation methodology and approach thanks to its internal knowledge of the programme (e.g. definition of indicators, collect of documentation). This was prompted by the strategic and political nature of the Review for SFI, but overall the evaluation process was also very effective in fostering a close cooperation between the evaluation team and SFI coordinator.

After completion, the report was reviewed by the same independent external expert who first reviewed the ToR. This resulted in some adjustments to the final report to ensure alignment with the agreed ToR.

[4] Forfàs is Ireland's policy advisory board for Enterprise and Science.

5. Effectiveness and efficiency of evaluation

The different participants of the Review assessed that the evaluation results and recommendations were operational and useful to the stakeholders concerned. The Report was endorsed by the Department of Enterprise, Trade and Employment through a response to the Review published online, and the recommendations were accepted. Broadly speaking, the report responds to the evaluation questions and is clear and well structured, based on a robust and straightforward methodology. Figure 4 presents which main methods are used to address the individual evaluation questions detailed in section **Error! Reference source not found.**).

Figure 4 How the methods relate to the evaluation questions? – Value For Money Review SFI (IE)

Evaluation criteria	Documentary and monitoring data analysis	Interviews in State organisations	Biblio-metrics	Surveys	Site visits and case studies	Expert panel
Relevance (to SFI long-term objectives)	√	√				
Effectiveness of the schemes	√	√	√	√	√	
Efficiency of the schemes (testing alternatives)		√	√	√	√	
Efficiency of the scheme (satisfaction of beneficiaries)			√	√	√	
External coherence (to national and EU policies/ initiatives)	√	√				√
Future development		√		√	√	√

Technopolis, based on the Final report to the study.

The Review was however heavily constrained by the very short time period since the establishment of SFI and the commencement of its main programmes (the Agency was established in 2000 but some of its programmes only started in 2003, i.e. some of the programmes had just achieved significant amount of funding in 2006).

The time lag of the evaluation was therefore rather inappropriate and did not allow for drawing reliable and meaningful conclusions on the outcomes and impacts of the programmes, as was expected.

The study team was therefore cautious in drawing definitive conclusions on the two programmes' results at this juncture, as illustrated by the following extract from the final report:

> *"(…) The fact that SFI's activities are still at an early stage of development mean that it is premature to draw any definitive linkages between the funding that has been committed across the agency's research support programmes and developments in relation to inward investment."*

The timing of the Review was therefore considered to be too early in the chain of development of SFI. For example, whereas expectations were high in terms of finding and quantifying evidence of impacts in terms of commercialisation activities. An

inherent limitation in this respect is the difficulty of attributing cause and effect, i.e. assessing to what extent increases in commercialisation activity can be clearly attributed to the CSETs and Principal Investigator programmes. This is further exacerbated by the time lag factor, with the outcomes from commercialisation activities likely to materialise only after a long time period following the initial allocation of funding to research teams. It is generally assumed that the full effect of this type of support measure only becomes measurable after 12 to 15 years.

Furthermore and regarding the evaluation design, the focus of the review on two programmes (i.e. the CSETs and Principal Investigator programmes) proved to be difficult to implement in practice. This was intended to simplify the evaluation process by focusing on the most significant interventions of SFI. However, the focus was on the outcomes and impacts of the programmes, which greatly overlap from one programme to the other and are not identifiable at the level of individual programmes. Indeed it is often the case that over the 6-year period under review, recipients of CSET and Principal Investigator funding from SFI also received other type of SFI support – i.e. Principal Investigators active in a CSET can also receive Principal Investigator funding. As a result it was necessary for the evaluation to assess SFI as a global programme, looking at the strategy at SFI-wide level rather than at the level of specified programmes.

Despite this limitation, the methodology applied involved extensive engagement with and inputs from a wide range of stakeholders and beneficiaries of the two programmes reviewed (i.e. researchers, unsuccessful applicants, industry partners), which results in a strong evidence base for the evaluation. The main tools and their implementation are detailed below.

5.1 Surveys programme

Three questionnaires – to SFI-funded researchers, unsuccessful applicants and leading Irish companies and industry – were implemented. The surveys were designed in a structure that allowed for a joint analysis of the commonly relevant sections with a view to comparing the results for each category of respondents. Data collected from the surveys to non-beneficiaries (i.e. unsuccessful applicants and industrial non-beneficiaries) were not used as a control group. However enlarging the consultation to a wider range of stakeholders provided valuable insights on SFI's impact and organisation from a diverse set of viewpoints.

The surveys comprised around 20 (for unsuccessful applicants) to 40 (for industrials) questions and proposed a good mix of closed and open format questions, the last one calling for more detailed answers and insight.

The surveys were distributed by mail, to be returned in a prepaid, pre-addressed envelope or by fax to the contractor. While mailbox survey are usually more costly and more time-consuming than online survey and does not allow for sending reminder in order to boost the response rate, the overall response rate was satisfactory and close to what one might expect for this type of research (particularly given the impact during the course of the evaluation of the summer holiday period). Overall, 44% of SFI-funded researchers responded, 16% of the unsuccessful applicants and 26% of the Irish industrials. This included returns from some of the largest multi-nationals in Ireland.

The survey to non-applicants provided very insightful comments that were used in the review of the programmes process and management. The methodology implemented also makes a point of gathering the views of Irish industrials.

Although engagement with companies was not at the core of the evaluation framework in the ToR, which focuses far more on the direct beneficiaries (i.e. the academics supported by SFI), the company survey provides an interesting insight into the needs of firms in terms of research links and the testing of alternatives to SFI support measures.

5.2 Site visits and case studies

The findings from the survey and the first interviews with senior officials in State organisations were supplemented by a programme of site visits, completed in five institutions that have been recipients of SFI funding. This led to five case studies on research groups within these institutions, giving a more qualitative insight to the findings from the survey research.

A consistent approach was applied to each site visit, each of which took place over a day-long visit:

- Individual interview with senior management at the institution (e.g. President/ Provost and Dean/Vice-President/Director of Research);
- Individual interviews with the director or leader of the specific research centre/group reviewed in the case study (and if relevant a board member);
- Focus group with the research centre/group's Principal Investigators and researchers (and if relevant industrial partner representatives);
- Tour of the research centre/group;
- Final meeting with the centre director or group leader.

Each site visit and resulting case study was complemented by the analysis of monitoring data on research outputs for each centre/group under scope.

5.3 The use of bibliometrics

Bibliometrics is an ex-post methodology specific to science that provides an objective assessment of the scientific quality of the research outputs through the application of quantitative methods to the analysis of scientific literature. The bibliometric study as implemented in the Review made specific use of the Virtual Impact Factor indicator – i.e. if all the papers published by SFI-funded researchers were gathered in a virtual journal, what would the journal impact be, compared to non-SFI Irish researchers?

The utility and effectiveness of the bibliometric analysis was discussed during the evaluation process, given the need to ensure that this particular approach, which is use widely in similar evaluations internationally, would add significant value to the overall evaluation. A particular challenge concerned the short time period since the launch of the SFI programmes and the evaluation was quite restrictive in order to provide a full assessment of the quality of the research produced. Also, bibliometrics treat publications and patents as the only outputs, and the focus was in the evaluation on longer-term impacts.

Notwithstanding these issues, the approach has proved to be very successful in providing clear insights on the international quality of researchers attracted to Ireland and research outputs funded by SFI in the final report. Most important, it was used to complement other data collection tools and served as a basis for further investigation of longer-term impacts.

5.4 Panel of international experts

The input from four international experts at selected stages of the evaluation was judged as very valuable as part of the review of an Agency of the size of SFI.

They had an input all along the study, and they specifically assisted to the following aspects:

- Design of the survey research streams (surveys of researchers, unsuccessful applicants, and companies), i.e. definition of the questions and potential answers, thanks to their knowledge of the mechanisms of innovation support programmes;

- Views on international comparative position of SFI vs. other research funding organisations (benchmarking to assist in assessing the added value and possible adjustment and alternative to SFI schemes and organisation).

5.5 The definition and use of indicators

One of the main challenges of the exercise however was that it took place within the framework of the Government's Value for Money and Policy Review Initiative, i.e. it had to comply with the established analytical requirements, which apply to the review of all public policies and are not specific to research and innovation activities. This general framework was therefore adapted to the context of SFI during the evaluation process so that it fits to the type of support provided by SFI and to research and innovation schemes generally.

The evaluation team in cooperation with the coordinator of the study at SFI completed an in-depth and comprehensive examination, based on the design and application of appropriate indicators, which were subsequently used to assist in addressing the evaluation questions. As a result, more time and resources were dedicated to primary research than originally planned because of the lack of available monitoring data on some of the issues under review. This is evidence of the robust and thorough construction of the analysis by the evaluator in cooperation with SFI and the final report is quite extensive in terms of research- and innovation-related outcomes and impacts reviewed, as follows:

- Impacts on the academic quality of research is examined (through bibliometrics);
- Impacts in terms of human capital development;
- Impacts on the leading industry and companies in Ireland (i.e. impact on inward investment, on commercialisation and innovation activities).

A long-list of indicators used in the study is however not available in the report. Bibliometric indicators are among the indicators that are used by the Review but a number of other proxies were alo used to measure the effects of SFI programmes. Figure 5 lists a few of these indicators as they are presented in the final report, reconstructing the evaluation framework by linking them to the impact and criteria they are meant to verify and assess.

Figure 5 Examples of an indicator used to assess the outcomes and impact of SFI-funded research - Value For Money Review SFI (IE)

Potential impact to be measured: The quality of the research output produced by SFI-funded researchers has increased

Success criterion 1: SFI researchers generate a greater impact than non-SFI researchers
***Indicator 1:* SFI researchers receive more early citations than non-SFI researchers**
Collection method 1: Bibliometric study, using Scopus and Thompson ISI[5]

Success criterion 2: SFI researchers published in higher quality journal than before being awarded an SFI grant
***Indicator 2*: Signs of increase in the quality of the destination of published articles before and after SFI funding was awarded**
Collection method 2: Bibliometric study, using Scopus and Thompson ISI

Success criterion 3: SFI researchers produce more than before being awarded an SFI grant
***Indicator 3:* Signs of increase in the number of research outputs per SFI researcher before and after SFI funding was awarded**
Collection method 3: Bibliometric study, using Scopus and Thompson ISI

Potential impact to be measured: The programmes generate human capital development in S&T
Success criterion: Increase in the number of high-skilled human capital bases in Ireland
***Indicator*: Signs of net cumulative increase in the annual number of new science and engineering Principal Investigators appointed in Ireland**
Target: 350 new Principal Investigator staff in 2013 in Ireland/240 new SFI-funded Principal Investigators in 2013 (mentioned in the Strategy for Science, Technology and Innovation for 2006-2013)
Collection method: Interviews with IDA Ireland (Industrial Development Agency)

Potential effects to be measured: Users are satisfied with the management and implementation of SFI programmes
Success criterion: Users are satisfied with the overall application process
Indicator: Percentage of SFI-funded researchers and unsuccessful applicants who rate positively the overall SFI funding application process
Collection method: Surveys of SFI-funded researchers and unsuccessful applicants

Technopolis, based on the Final report to the study.

One can also point to the fact that the monitoring system and subsequently the indicators put in place to measure the performance of SFI's programme were reviewed as part of the study. One of the evaluation's recommendations therefore deals with the implementation of a centrally managed database of inputs and outputs relating to SFI funded projects, which would take a range of input, output and impact indicators. Also, the participation of SFI in the evaluation through the help provided in identifying the indicators for the evaluation provided valuable inputs to the Agency. This resulted in the subsequently development and roll-out of an annual Census,

[5] Scopus and Thompson ISI databases are an abstract and citation database of peer-reviewed literature and quality web sources, usually used in bibliometrics.

which collates data on inputs, outputs and impacts indicators such as publications, patents, spin-outs, first destination of departing SFI-team members, etc.[6] The ongoing operation and development of this Census represents a model for how effective evaluation can be informed through focused data gathering.

5.6 Efficiency of methods applied

By way of a conclusion, the set of evaluation methods used are efficient to answer the evaluation questions as they are stated in the ToR.

Additional findings may have been identified, if further time and a greater budget were available. Some aspects which can be highlighted which, if considered, may inform future evaluations of this kind include the following:

- If the Value For Money Review had been undertaken at a later stage (i.e. four or five years later), it would have been easier to assess the impacts of the programme and to give clear and informed evidence of these impacts, that were not identifiable at the very early stage of SFI programme development when the evaluation was completed in 2008;
- If additional monitoring data was available to the evaluator before the Review process, this could have impacted on the time required to conduct new primary research;
- A slightly higher budget would have allowed for more consultations with the different stakeholders and more specifically with industrials, in the view of putting the emphasis on pre-commercialisation impacts;
- In addition, if additional resources were available, further assessment of the probable outcomes which could result from the discontinuation, reduction or expansion of any programme could have been provided as part of the evaluation. This could have been complemented through the use of non-beneficiary survey as a control group in order to compare the situation of unsuccessful applicants to successful applicants including a counterfactual analysis to inform the assessment of deadweight, displacement and other factors. A multi-criteria analysis with different scenarios (i.e. discontinuation, reduction, expansion) and the estimated impact for every scenario may also have provided a useful complement to the assessment.

In relation to the detailed analysis of research outputs, it should be noted that the application of bibliometric analysis requires access to specialist databases of citation records. The leading suppliers tightly control the availability of such databases and access is costly. Normally, a bibliometric assessment such as that conducted for this review would be undertaken as a separate satellite exercise, possibly by a separate sub-contractors of the evaluator. In this case, the bibliometric assessment was fully integrated with the wider report and enabled the realisation of significant efficiencies on the overall study.

6. Conclusions and lessons learned

It was reported that this evaluation gave all the main stakeholders a clear insight into the challenges and issues related to the evaluation programmes focusing on the assessment of the outcomes and impacts of research and innovation public policies. Given the many and varied challenges and limitations highlighted here, the evaluation was a long-run process and the implementation of the methodology proved to be more

[6] SFI censuses are available on the website of the Agency: http://www.sfi.ie/news-events/publications/orgnisational-publications/

difficult than expected due to the timing of the evaluation shortly following the commencement of SFI's key funding programmes.

Most important, this case study highlights the case in point that research and innovation cannot be straightforwardly evaluated within the existing framework of Value For Money Reviews. It requires both specific methodologies and different judgement criteria on the outputs, outcomes and impacts of the programmes than the ones that are commonly designed for other programmes subject to Value for Money Reviews. Indeed, research and innovation activities constitute an iterative process, generating new knowledge that can, by definition, lead to totally unexpected results that are hard to plan or map and have often far-reaching consequences taking place in the long-run.[7] Due to the nature of strategic research, it would arguably be inappropriate to frame the programme's success in purely monetary terms (e.g. in the form of a pure economic impact assessment including a value-for-money element). Nevertheless, it is vital that all publicly-funded expenditure programmes are subject to rigorous value-for-money evaluation; the issue here concerns the methodologies that are most appropriate for evaluating RDI-type programmes.

To summarize what has been asserted in the remainder of this case study, here are the main lessons learnt and limitations that might affect this type of programme evaluation focusing on effectiveness and impacts:

- The assessment of the impacts of research and innovation public support requires a **wide combination of methods** making use of quantitative (e.g. descriptive statistics on monitoring data, bibliometrics, surveys) to qualitative tools (e.g. interviews, focus group, documentary analysis, expert panel). The use of methods depends of course of the budget and availability of data but, broadly speaking, impact studies make use of often complex methodological tools allowing for an extensive triangulation of the evidence and findings from a range of sources.
- Furthermore, evaluating the impacts of research and innovation public policies demands **a certain time lag between the time of the public intervention and the time of the evaluation** – i.e. as noted by Prof. Luke Georghiou, the impacts of research and innovation activities take at least 12 to 15 years before becoming visible and assessable.[8] The Value for Money Review of SFI, with less than five years insight into the programmes, encounters difficulties in identifying clear findings in relation to the commercialisation and other longer-run impacts in this regard.
- **Evaluating two components of a programme enables a more focussed evaluation, but doing so can also impact on the understanding of the wider context and on the capture of wider impacts. In particular,** looking only at individual sub-programmes may enable the evaluator to more easily identify their specific impacts (in relation to their objectives) and mechanisms of actions. However, impacts are often part of a wider context and the individual SFI actions impact/are impacted by other policies and programmes taking place at the level of SFI or even within other agencies (e.g. the Higher education Agency, etc). As was undertaken in the SFI Value for Money Review, impact evaluations should therefore balance carefully the two levels of analysis (e.g. programme-level analysis in the descriptive statistics of staff and funding vs. sub-programmes analysis of collaborations originated by SFI supported Principal Investigator) and make it clear in the analysis what they refer to. Overall, this

[7] This idea is developed by a full range of the evaluation literature, of which: Perrin, B. (2002), How to - and How not to - evaluate innovation, in: revue Evaluation, Sage publication, volume 8 n° 1, January 2002.

[8] Quoted in: Perrin, B. (2002) How to - and How not to - evaluate innovation, in: Evaluation, Sage publication, volume 8 n° 1, January 2002.

should allow for a better understanding of the wider context and the place of the sub-programmes within this context.

- The assessment of impacts and the efficiency of the methodological framework are also highly related to the quality of the monitoring system and to the **pre-availability of data on inputs, outputs, outcomes and impacts to be fed into the evaluation process**. The availability and quality of monitoring data allow for more time to be spent on the qualitative analysis and interviews, where the added value of the independent evaluator is the most significant. In this respect, one might point again to SFI Census implemented since 2008 as a result of the evaluation recommendations, which will undoubtedly facilitate the collation of more comprehensive monitoring data/information to better inform future reviews of this kind.
- The process of the evaluation is important in a Review of this size, carried out externally and led by an administrative body that is external to the organisation evaluated. In this respect, **the overall institutionalisation of the Value For Money practice** across Irish Departments (e.g. through the guidance document and through the panel of experts that are invited to review the ToR of every study as well as the final report to the study) can be singled out as very good practice, contributing to the coherence of the Value For Money Review system and to the methodological quality of the Reviews carried out.
- Likewise, the **wide association of the evaluated body - SFI - to the evaluation** (e.g. in the Steering Committee, support to the evaluation team during the inestigation, design of the study) was a real added value. On the one hand, it served the process of the evaluation and the collection/ analysis of data by ensuring a good understanding of the SFI's organisation by the evaluation team. On the other hand, it contributed to ensuring the appropriation of the evaluation results inside the Agency.

Overall this leads us to the problem of the attribution of potential impacts to a specific policy. As above-mentioned, a robust methodological work was carried out during the evaluation in order to assess the type of outcomes and impacts that might result from the evaluated programme and related indicators. More specifically, the difficulty in defining success criteria and related indicators that would be specific enough to help quantify the outcomes and impacts of the two measures reviewed was mentioned during the interviews. For example the Review measures the development of S&T human capital using the cumulative increase in the annual number of new Science and Engineering Principal Investigators appointed in Ireland, specifically those funded by SFI. This is a global contextual indicator and defining more specific indicators that relate to outputs and outcomes and not only to the far-reaching impacts was judged difficult during the set up of the evaluation framework. Indeed, new appointments are not the only criteria for success and there is a long chain of causation between the delivery of SFI funding (the input) and the creation of new S&T posts (the impact). This illustrates the difficulty experienced in 'going into the black box' and creating a logical evaluation framework based on the intervention logic of SFI programmes, as would have been done in a theory-based impact evaluation. In an ideal world and assuming access to sufficient datasets, a theory-based impact evaluation would have been based on a pre-existing logical framework for the two programmes evaluated (or would have built on the design of such a framework) and would have investigated in depth and in a systematic way the causal chain from inputs to outcomes. Rigorous evaluation techniques however require access to sophisticated datasets, which were not available at the time of this review but could have added value to the overall evaluation. In future reviews of this kind, the ongoing collation of detailed data, including annual Census, additional analytical techniques, causal analysis and the identification of alternative explanations for observed impacts, should form part more extensively of the overall assessment process.

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