Science Foundation Ireland

Phase 3 of SFI Research Centres:

Panel Report

Shaping Our Future **sets out SFI's strategy for establishing Ireland as a Global Innovation Leader in scientific and engineering research for the advancement of Ireland's economy and society. The successful growth and evolution of the SFI Research Centres will be critical to achieving this vision. Aligned with SFI's strategy, the Panel is requested to advise SFI on an appropriate Phase 3 model, or models, that build on the success of the investment to date and supports a coherent, dynamic and internationally competitive research landscape in Ireland that is well positioned to respond to current and future global opportunities and challenges.**

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Table of Contents

1. Overall Vision and Place in the Irish Research Landscape

Research Centres (RCs) clearly already play an important role in structuring the Irish research ecosystem and making it more visible internationally as well as more attractive for business. This should continue and be further reinforced in Phase 3. And while the SFI Research Centre Programme has been successful, the Panel were charged with proposing a model for Phase 3 of the life of the programme to take it to the next level. SFI urged the Panel to think boldly and broadly about what would be possible in this context.

As the Panel engaged with programme stakeholders and reviewed SFI provided background information, it became apparent to the Panel that 1) the SFI RC Programme dominated the research landscape across Irish universities, 2) there were more than expected RCs for a relatively small country, and 3) that there could be potential for optimization not only within the governance structure of individual RCs, but also across the system. In this light, the Panel propose a Phase 3 model that will build on the best of what SFI and the stakeholders have already developed.

This chapter of the report focuses on recommendations around optimising across the SFI RC programme, and more broadly Irish R&I ecosystem, while the next Chapter, Research Centre Governance and Funding Model, provides more recommendations targeted toward the optimised governance and funding models within the resultant consolidated RCs.

The Panel brought significant experience with international Research and Innovation (R&I) Centres to the deliberations to provide exemplar models for consideration. One obvious example would be to get inspiration from Research and Technology Organisations (RTOs) which are well functioning in many countries in Europe and beyond. However, the structure of many existing RTOs is relatively inflexible. The challenge is to create an agile and dynamic RTO system to support Irish needs and be fit for the 21st century impacted by the exponential technologies. Additionally, the Panel consensus is that the RC Programme should stay within the university home, albeit with some governance and autonomy changes in Phase 3 as outlined below.

The transition between the SFI RC Programme Phase 2 and 3 is therefore a significant opportunity for SFI (Ireland) to consolidate existing RCs into broader units and to create a new structural fit for the 21st century with robust and flexible governance allowing more autonomy for individual research programmes, capacity to orient swiftly towards emerging research opportunities, to manage to certain extent the human capital of the centres and fit within the construct of the Irish economy rather than another region's R&I landscape.

The Panel proposes a Phase 3 model in which SFI consider consolidation of RCs coming from Phase 2, and maybe even some entering Phase 1 into new, larger RCs, consolidated along major R&I disciplinary themes that the Irish government feels are critical to the nation's future and in which Irish universities can excel. These consolidated RCs should be expected to be true international leaders, and governed and funded as such as discussed in this report.

New, consolidated RCs should be composed of the best parts of the existing centres, including complimentary R&I themes. Overlaps should be removed and research strategies of newly created RCs should be complementary and matching with the country R&I priorities and goals. The entire process gives an opportunity for being fully transparent and inclusive but at the same time driven clearly from the top – the nation's most critical R&I priorities. Fundamentally, the consolidated RCs should have a strong research strategy and increased autonomy, discussed

more fully in the next chapter. Special emphasis should be put on competence management through international recruitment, which will be aided by the larger consolidated RCs with greater funding. Strong interaction with Irish universities and their infrastructure continues to be a necessity.

The Panel proposes SFI dovetail the process to directly align Phase 3 RCs with SFI's strategy, Shaping Our Future, which, "has been developed to meet current challenges, seize future opportunities and support the priorities outlined in Ireland's Programme for Government: Our Shared Future." More specifically, SFI is going through a process to review current and future programme directions to become a Global Innovation Leader, which includes an aim for "research based in Ireland to be at the forefront of the next phase of disruptive technologies, leading rather than following the technological revolution while also being a centre for foundational research." The strategy goes on to say Ireland's ambition to be a leader rather than follower rests on "ensuring our readiness for this changing world and on the continued development of the knowledge economy." and "SFI aims to grasp the opportunities offered by this rapidly changing landscape to identify niche areas to lead." The Panel feels that RC consolidation in a Phase 3 model must be directly aligned with the entirety of the Irish R&I strategy and so the RC consolidation, especially the key thematic areas around with Phase 3 RCs will be focused, should be closely coordinated with the broader activities of the Shaping our Future / Our Shared Future agenda.

Consolidated and more robust RCs will have a better capacity to deliver excellent research with positive impacts on society and the economy. They will have a larger capacity to engage the citizens as well as spread the excellence across the country and to contribute to the economic and societal cohesion of Ireland. More specifically, as part of this consolidation model, the Panel recommends:

- SFI, in partnership with other stakeholders, should identify key national target areas/challenges where excellent centres are needed and where scientific excellence is envisaged to result in substantial national impact by boosting industrial activity, generation of new growth companies and attracting international talent. This model necessitates a strong top-down approach with analysis of the national needs both from the scientific point of view as well as from the point of view of Ireland's innovation and industrial strategy. Ideally the current centres would be invited to design a consolidation plan matching to the top-down defined strategic challenges.
- Research excellence is absolutely critical as the lynchpin to success in this consolidated RC model and must continue to be prioritized in order to achieve greater international recognition. Research excellence will drive the industry engagement and societal impact that are expected of RCs so it cannot be compromised in this model. However, scientific excellence alone is not in itself sufficient to meet Ireland's expected impacts of these RCs so other programmes (e.g. industry engagement, EPE) should be continued as discussed in this report. As such, Key Performance Indicators (KPIs) should be established to measure the impact of scientific excellence in traditional ways (e.g. publications, citations) but also in how it drives and enables KPIs in other areas (e.g. Commercialisation - technology licenses and spinouts; Impact through industry engagement measured via numbers of MNCs and SMEs and funding – see below).

- The RCs should strongly link to the Institutes of Technology and Technological Universities. Stronger connection of the IoTs and TU's to the RCs would support answering the current industrial needs of higher TRL work funded directly by the industry or by other funding schemes. Strong governance in the RCs is needed to support the transfer of scientific excellence created by curiosity driven research to answer the industrial needs. Recruitment of application-oriented staff alongside the PIs with high academic ambition is a necessity.
- Industrial impact can be achieved and should continue to be assessed via three routes:
    i. Collaborative funding from industry, focused on a precompetitive high risk research portfolio aligned to the RC,
    ii. generation of economic impact through technology licensing and future growth companies through an active spin-off policy, and
    iii. direct industrial funding, that may be matched by the centre or not. SFI should give consideration to the risks associated with this particular measure, not least that the research is likely to be led by the company and therefore may move away from the strategic direction of the centre.

    Measures i) and ii) are a clear recognition of high quality research. Target iii) will provide a measure of the translational impact of a centre, and will require strong links with Institutes of Technology and Technological Universities. Thus, the industrial targets of the centres should continue to include all of these and the responsibilities to achieve them should be clear in the RC governance.
- The generation of spin-off companies (and creation of licence deals) from the research outputs of the Research Centres is dependent on the performance and function of the university technology translation functions, and is influenced by the national position on intellectual property ownership. Some consideration may be needed as to how to balance the needs of the centres in relation to creation of spin-out companies against the needs of the IP-owning institutions, given the importance of all parties to the Ireland research and innovation ecosystem. For example, the Panel proposes that each Research Centre have a clear line of responsibility of senior leadership to work with the university in the IP commercialisation function, not only in spin-off companies, but also in generating technology licenses to larger companies. Licensing financial returns (ie royalties, fees and equity liquidations) that SFI counts toward centre industry funding in a given year will many times not come in for years after the license is consummated, and SFI should work with the universities and research centres to accommodate this through appropriate current-year commercialisation KPIs or other industry funding metrics.
- The resultant significantly smaller number of RCs (with significantly increased funding per centre) with the structure and governance model discussed in more detail in the next chapter may be a good policy example which can serve as an inspiration for other countries.

2: Research Centre Governance and Funding Model

Strategic direction and autonomy

The SFI Research Centres are clearly aligned for national strategic needs, where a focus on research excellence, collaboration and skills development will bring maximal impact for Ireland, its economy and society. For Ireland to achieve optimal benefit from the centres, it is important that they are able to maintain this alignment with national strategic need and direction in Phase 3, as already discussed above. Increasing Phase 3 RC impact requires a greater degree of autonomy for the centres and their Directors, such that they can address several elements that enable the delivery of the Phase 3 centre strategy. The following examples of increased autonomy will require the buy-in and partnership of the RC host universities and other stakeholders to assure that they serve the host universities as well as the RCs:

- The ability to recruit leading researchers and innovators working in the fields of focus of the centre, (rather than being dependent on the appointments of the host HEIs, who may not be strategically aligned with the centre).
- The ability to incentivise and reward PIs employed by a host university to be strategically aligned and engaged with the centre, for example seeking funding and collaborative research partners that contribute to the ambitions and intentions of the centre. This might be achieved by buying out of some time of the PIs.
- A long-term funding commitment, enabling strategic direction as discussed below.
- Some level of financial autonomy for the Director, so that they can invest in new and emerging areas relevant to the strategic direction required of the centre.
- The strategic direction of the RC should be clear and ensured by the RC leadership. At the same time, a certain level of autonomy should be granted to individual projects.

These needs would suggest that SFI might wish to explore the nature and level of autonomy that the Phase 1 and 2 centres have, recognising that currently the majority of the PIs – the leading researchers and innovators – at any centre are appointed by the host institutions (ie the universities) and not the centres.

Complexity and balance in the research and innovation system

There is clear recognition from many, if not all, stakeholders that the SFI Research Centres are an immensely valuable component of the Irish R&I ecosystem, and that the centres are focused on national need, attract excellent researchers and thereby encourage multinational companies to invest in R&D in Ireland. The scale of the financial investment, and the importance of the centres to the universities and SFI, mean that the Panel perceived there is the potential for the centres to dominate the Irish research and innovation ecosystem. This sits alongside the Panel's view that the Irish funding system is complex and overcrowded, which does not necessarily make it easy for partners (e.g. SMEs) to determine how to engage with it.

The Panel suggests that SFI could work with partners across government to explore the issues of balance and complexity within the R&I system supported by the government.

It would be very beneficial for the Irish R&I system if SFI with other government partners find the way to ensure and clarify for all stakeholders complementarity and cooperation between SFI RCs and other Irish government (e.g. Enterprise Ireland) funded programmes.

Funding model

To support many of the elements of the centres that are excellent, maintain their ability to achieve impact, and to ensure the long-term success of the programme, the following elements are suggested for a future funding model.

- The incentive to bring in industry funding is retained, but at a lower level than the current Phase 2 model. This will enable centres to continue to support high-risk research that is attractive to industry, whilst also incentivising the centres to develop industry collaborations and co-created research programmes.
- Funding from the business partners should show the flexibility too. One cannot compare the funding capacities on MNCs and SMEs. Since the research support to SMEs is vital for their development but they are financially weak one may design a more creative way of counting the contribution from SMEs – for instance double counting SME contributions.
- It is important that the centres have long-term funding to support their vision, as this enables a strategic approach to research and innovation. SFI should ensure that the centre review processes are managed in such a manner as to ensure that researchers and PIs have clarity and certainty about the future, so that they can be committed to the centre over the longer-term. For those circumstances where a centre may need to close, sufficient time should be allowed for this.
- Funding should incentivise multidisciplinary research as well as inclusion of social sciences and humanities in technology focused projects.
- Centres should be allowed to include funding leveraged from other government departments, such as Health, Education and Agriculture as part of their funding model, as this recognises the strategic impact of a centre.
- Funding from EU sources should continue to be incentivised.
- There should be some element of discretionary funding for the director, so that they can invest in new and emerging areas relevant to the strategic direction required of the centre.
- There should be some financial or equivalent mechanism for directors to incentivise and reward PIs, for example the capacity to buy out some of their time from their host institution commitments.
- Funding from industry needs to be seen in a number of contexts, and the risks and consequences managed well. There needs to be:
    - Collaborative funding by industry of pre-competitive research where there is the opportunity for co-creation between the research centre and industry. The direction of the research is clearly led by the research centre and will be fully aligned with the strategic purpose and direction of the centre.
    - Industrially driven projects can be either be funded fully by the industry or there can be a demand for co-funding from the research centre that matches cash and/or in-kind contributions from industry. The latter is greatly valued by some companies as it de-risks certain projects and areas. On the whole, such projects will be strongly guided/led by the company with the associated risk that they do not align fully with the strategic purpose of the research centre. SFI should consider what proportion of industry funding to any given research centre should be of this nature.

- PIs involved with a centre should be required to seek funding that supports their continued alignment with the strategic direction of the centre.

A number of stakeholders interviewed felt that the most appropriate pathways to engage with Irish government funded programmes (e.g. RCs, Enterprise Ireland R&D oriented programmes) were not clearly mapped so as to optimize company connections to those programmes that would best suit company specific real-time needs. As such, SFI should work with its partners (e.g. EI) to ensure that it is clear to external partners which are the most appropriate routes for their research and development needs ranging from low to high TRLs.

3: Education & Public Engagement

Education and public engagement (EPE) is seen both as a strategic activity and a strategic output of the SFI funded research centres. Public engagement - the engaging of citizens and technology users - in the creation of research is highly relevant to the development of research outcomes and impacts enabling the translation of science into technologies that are valued by users, promoting technology uptake and enhancing economic outputs and growth. Equally, the promotion of a science and data engaged population from early age through primary and secondary education enables cultural change, motivates skills development and prepares the skills pipeline for both research and science. Supporting higher and further education, the development of research skills and enriching the development of early career researchers are all critical activities to enable and support scientific excellence.

A coordinated partnership approach to both education and public engagement is recommended, leveraging and enhancing the developing importance of public engagement within the higher education and other sectors across Ireland and actively promoting the importance of equality, diversity and inclusion in research. Such partnership working should involve existing social innovation infrastructures and leadership so that SFI work in synergy with existing frameworks. Such partnerships would be envisaged to include relevant organisations and individuals from for example, the 3rd sector, academia, the arts and creative industries and community and other groups. Education and public engagement is a scalable activity and one capable of attracting grant income (particularly from EU and other funders) and philanthropic investment.

The overarching vision statement for education and for public engagement within SFI research centres supports these aspirations and specifically aspires to:

1. "[Develop] scheduled and targeted programmes for postgraduate researchers, early and mid-career researchers [and to]...expand the SFI discovery education programmes to grow participation in science education and bridge career awareness into undergraduate programmes" - SFI strategy 2025.
2. "Grow the SFI public engagement programmes to support engagement with and participation of a broader range of civil society and community groups across SFI's schemes, for example, by prioritising investment in programmes that specifically and appropriately target certain community groups or wider civil society" - SFI strategy 2025.

In order to achieve these strategic goals, the Panel would suggest that the following structure for education and public engagement be considered;

Education should be split into two separate areas;

1. The development and enhancement of higher and further education, PhD and early career researcher skills and specifically the development of educational specific training plans including discipline related educational and training needs and derived public engagement activities incorporating for example, but not limited to, data literacy, science literacy and science communication. Offerings for this audience should also include some focus on "soft skills" such as understanding the fundamentals of business literacy/finance, project management, persuasive communications, ethics, and intellectual property management.
2. The incorporation of science participation at primary and secondary school levels and the development of science and data literacy across these age groups into an education and public engagement portfolio that is appropriate for each research centre individually and coordination collectively across the research centres.

The following aspects for education and public engagement should be incorporated within Phase 3 of the Science Foundation Ireland research centre structure.

For education of postgraduate and early career researchers:

- Independently funded education champions for each research centre with the specific remit to develop in partnership with academic partners training and education for PhD ad early career researchers associated with the Research Centres.
- Associated dedicated budgets for training and education.

For education and public engagement:

- Instigation of RC led citizens' assembly or citizens' jury for some / all research centres to bring society into the heart of research,
- Funded public engagement managers for each centre who are public engagement and/or science communication specialists and have relevant expertise in these areas,
- Separate budget lines to specifically support education and public engagement in an agile way,
- Formation of an effective education and public engagement working group taken from those specialists within the RCs across all centres who will meet regularly to share good practice, celebrate success and share lessons learnt,
- Development of a complementary and synergistic strategic direction and approach which enables the national coordination of education and public engagement activities and approaches,
- Development of social media strategies across education and public engagement both collectively and for individual centres,
- Development of a coordinated approach in partnership with public engagement and social innovation leadership from across the 3rd sector, academia, the arts and creative industries and community and other relevant groups,
- The education and public engagement working group in collaboration with external end users and citizens would be tasked with, for example (but not limited to);
- Understanding what individually and collectively the research centres and their industry partners and stakeholders want to achieve, with whom and how do they want to achieve it?
- Development of an education and a public engagement action plan including a strong understanding and focusing across multiple audiences bearing in mind that each audience will have specific needs and requirements,
- Development of education and public engagement training plans for centre staff with an emphasis on science communication, understanding of engagement, citizen science, social sciences and staff capacity building,
- Developing mechanisms to reward public engagement activities and celebrate successes,
- Development of dynamic and appropriate education and public engagement future strategic planning as part of sustainability and legacy development.

Executive Summary

Science Foundation Ireland is embarking on a process to understand and define optimal model(s) for the SFI Research Centres Programme as current Phase 2 centres are transitioning into their next Phase (Phase 3) in the coming years. As part of this effort, SFI engaged a Panel of international experts in large, multidisciplinary university- and other-based research programmes that involved myriad stakeholders including industry (MNCs, SMEs and the entrepreneurial community), the citizenry, national funding agencies, the national education systems, Institutes of Technology and their equivalents, etc. This Panel was engaged in a focused effort to propose a Research Centre Phase 3 model that would build off the very strong Research Centre Programme the Irish government has built through SFI starting in 2012 and take the programme to new levels in supporting Ireland's current and future economy and international standing in the global research and innovation ecosystem.

As part of this effort, the Panellists engaged in one-on-one interviews with system stakeholders representing the Irish government, academic, industry, citizenry, other sectors critical to programme success. These stakeholder discussions were wide-ranging, but essentially explored three areas, 1) the stakeholder's engagements with the Research Centres programme to date, 2) what the stakeholder felt worked well in the current model (Phases I and 2), and 3) what would the stakeholder suggest to improve the programme going into the next programme phase (Phase 3). The Panel were also provided with substantial information regarding Ireland's economic drivers, today and projected into the foreseeable future, and research and innovation landscape.

While the Panel is focused on proposing a Phase 3 model, which is outlined in this report, the investigation obviously also encompassed discussions of and provided insight into the Phase 1 and Phase 2 models as a background information to the proposed Phase 3 model. A number of universal themes came through in the Panel interviews with stakeholders including:

- The SFI Research Centres Programme is very good and highly valued by stakeholders, having served Ireland well, albeit with some challenges in Phase 2 vs. Phase 1. It was clear that the Centres programme dominated Ireland's government university research funding landscape, raising questions of how this might be impacting the overall higher education research ecosystem.
- Excellence in research, building capacity, international standing, and attracting the best people will continue to be vital in Phase 3. Scientific excellence is absolutely critical and necessary, but not sufficient to meet the Irish government expectations of the Centre Programme's national impact.
- As in any internationally recognized R&I programme, KPIs are critical to programme and centre direction and reporting, and SFI has rightly aligned the RC Programme KPIs to support SFI's KPIs to the Irish government expectations of SFI and the RC Programme. When considered solely by themselves, the Phase 2 KPI's can be problematic and can drive unintended behaviour in some cases. Examples from stakeholder interviews included a perceived lack of understanding of how KPIs were evolved and rigid reliance on a few KPIs. Subsequent discussions with SFI clarified that the KPIs are part of a more holistic approach to measuring success (e.g. a bi-annual Centre review by an external expert panel that feeds a narrative assessment). However, the perception of many stakeholders is still heavily skewed toward the KPIs and so clarity on the more holistic approach for RC performance assessment must be addressed in a Phase 3 model.
- The higher Phase 2 industry funding requirement is seen as problematic (e.g. drive toward applied rather than fundamental research, MNC fatigue with being approached, fit to university and SME needs) and a question of whether more flexible funding models tailored toward e.g. different industries, one that treats Centres dealing more with SMEs than MNCs differently, industrial vs societal impact, should be explored.
- Some existing agencies and groups (e.g. HEA, THEA/TU's/IoT's, EI, social science, community engagement, arts and culture) would invite tighter collaboration between their programmes and the Centres programme.

With this background information and working from the Panel's expertise, the Panel would propose a number of recommendations as foundational to a Phase 3 model which are further detailed in this report, including:

- The Panel proposes a Phase 3 model in which SFI consider consolidation of Research Centres coming from Phase 2, and maybe even some entering Phase I, into new, larger RCs, consolidated along major R&I disciplinary themes that the Irish government feels are critical to the nation's future and in which Irish universities can excel. These consolidated RCs should be expected to be true international leaders, and governed and funded as such. The Panel feels that RC consolidation in a Phase 3 model must be directly aligned with the entirety of the Irish R&I strategy and so the RC consolidation, especially the key thematic areas around which the Phase 3 RCs will be focused, should be closely coordinated with the broader activities of the Irish R&I agenda as elucidated by *Our Shared Future*.
- Centres in this new model should be provided with greater autonomy, specifically in the ability to recruit leading researchers and innovators working in the fields of focus of the centre, the ability to incentivise and reward PIs employed by a host university to be strategically aligned and engaged with the centre, and some level of financial autonomy for the Director so that they can invest in new and emerging areas relevant to the strategic direction required of the centre.
- The scale of the financial investment and the importance of the centres can dominate the Irish research and innovation ecosystem. This, along with the complexity of the Irish funding system can make it difficult for partners (e.g. SMEs) to determine how to engage, and this will need to be addressed with a clear and compelling picture of industry and other stakeholder engagement across a spectrum of offerings from different Irish government agencies.
- The Phase 3 funding model will need to address some of the current system challenges, most specifically the incentive to bring in industry funding should be retained, but at a lower level than the current Phase 2 model, industry funding flexibility should be explored as related to company capacity related to size (e.g. composite MNC vs. SME funding and engagement), the need for a longer-term funding commitment enabling a strategic approach to research and innovation, continued incentivisation of multidisciplinary research as well as greater inclusion of social sciences and humanities in technology focused projects, allowance to include funding from other exchequer government departments as part of their reported funding, etc.
- A coordinated partnership approach to both education and public engagement is recommended, leveraging and enhancing the developing importance of public engagement within the higher education and other sectors across Ireland and actively promoting the importance of equality, diversity and inclusion in research. Such partnership working should involve existing social innovation infrastructures and leadership so that SFI work in synergy with existing frameworks. Such partnerships would be envisaged to include relevant organisations and individuals from for example, the 3rd sector, academia, the arts and creative industries and community and other groups, with greater detail in the third Chapter of this report.

The Panel provides these recommendations for a Phase 3 funding model that will build on the already impressive accomplishments and impacts of the SFI Research Centres Programme as it transitions to its next phase.