

Ireland's Higher Education Research System

A Review by the
Higher Education Research Group

Foreword

The Higher Education Research Group (HERG), the expert advisory group on research policy to the then Department of Education and Skills (DES), is composed of representatives of higher education institutions, the Irish Universities Association (IUA), the Technological Higher Education Association (THEA), the Irish Research Council (IRC) and the Royal Irish Academy (RIA). The Group has been chaired by DES, with a secretariat provided by the Higher Education Authority (HEA) (please refer to Appendix 1 for Group membership).

In 2019, the Group's agenda centred on conducting a high-level review of research activity in higher education ('HE Research'). Evidence gathering for the review took place in 2019, the analysis commenced in late 2019 and progressed into report drafting in 2020. The completion and publication of the Review report was paused in 2020, initially due to the onset of pandemic-related restrictions in March 2020 and subsequently due to the emergence of a new policy landscape with the establishment of the new Department for Further and Higher Education, Research, Innovation and Science (DFHERIS) and a new Programme for Government.

Though the analysis upon which this report is based predates these two significant events, and though some of the cyclical data within it have since been superseded, the fundamental policy insights continue to be valid. The report responds to the important requirement for enhanced information, data evaluation and analysis in relation to the operation, performance and impact of the HE research system.

The report:

- Provides an insight into the ecosystem and complex interdependencies that underpin our national research system.
- Highlights the centrality of the health of our higher education system to the success of our research system and vice versa.
- Demonstrates the impacts of funding patterns and prioritisation on the Higher Education Research system.
- Offers a source of evidence for value-for-money arguments for increased investment in research. One of the main tenets for increased investment is recognising the higher education research system's role as a national strategic asset through knowledge creation, and diffusion, underpinning Ireland's long-term economic and social sustainability.
- Identifies some of the ways in which the performance of the HE Research system, as a whole, could be strengthened for enhanced performance and impact, contributing to broader national goals and objectives. This, in turn, could strengthen the value-for-money case for increased investment in HE Research referenced above.

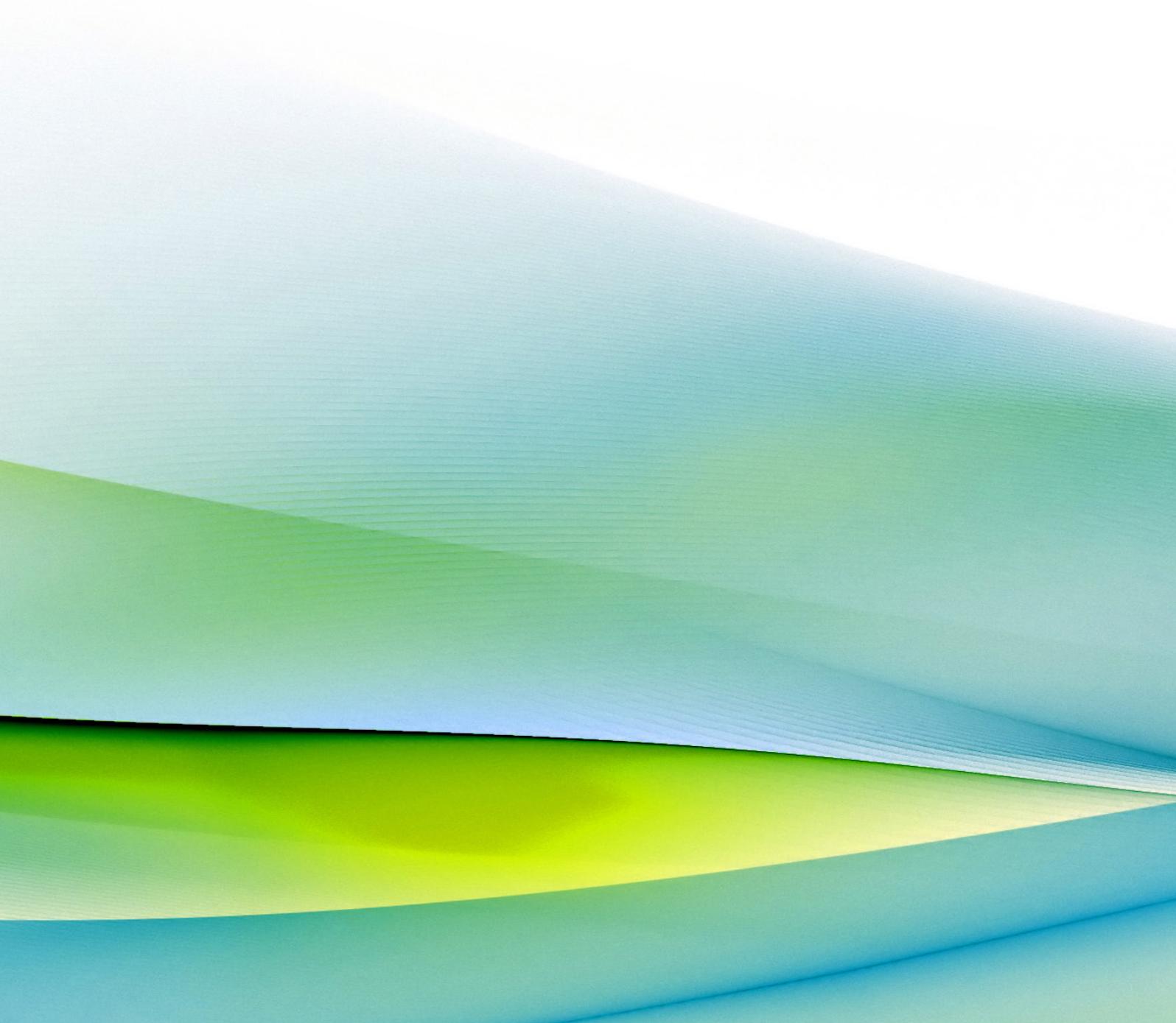
Higher Education Research Group

Addendum Spring 2021

The changes that have come about as a result of the pandemic have in many ways reinforced many of the key conclusions of this report. There is now stronger evidence of the central role of research in society and of the benefits and acceleration in the advancement of knowledge when researchers from many disciplines mobilise together to achieve a shared global mission. Trust in science and experts has underpinned the national effort against COVID-19. There continues to be a shared endeavour to work through the immediate challenges that the pandemic is creating and, in the medium term, to protect the quality and sustainability of the research and innovation system as an effective way of supporting wider economic and social recovery - an argument so clearly demonstrated by the evidence in this report.

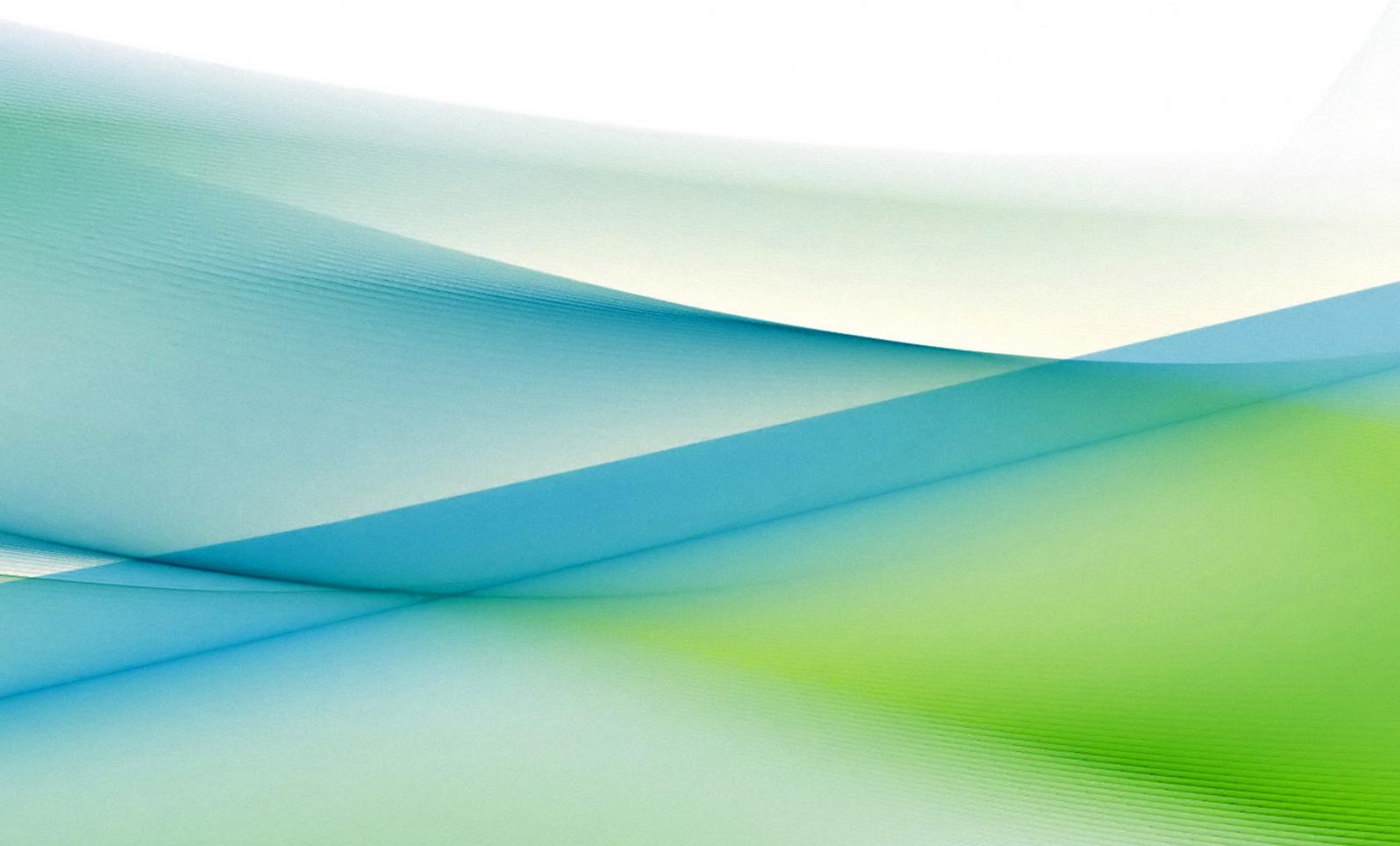
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Section 1

Executive Summary



Executive Summary

Impact and evidence

- Internationally and in Ireland, research has proven to be key to productivity, innovation and growth. Across Ireland, it has been central to the success and survival of many companies. Appropriate Exchequer investment in the public research system generates a multiplier effect: drawing in private sector investment and international funding.
- Building on its economic contribution, the value of Higher Education Research is increasingly recognised as being much wider, including, for example, for human capital development and public policy-making.
- With respect to the former, research is fundamental to the success of higher education. This relates not only to students at doctoral and masters by research levels, but also wider undergraduate formation.
- HE Research can be central to public policy-making. In order to embed and expand this form of impact, a more structured approach is required on the part of the research community and policy-makers.
- This Review process included a comprehensive evidence-gathering exercise which found system-level evidence for two of eight agreed impact categories: economic and new knowledge production. Ireland performs strongly in both of these areas.
- For the other six categories, there is an abundance of qualitative examples of positive impact.
- Development of a system-level perspective of the impact of research requires a systematic approach to both driving and monitoring impact.

Investment

- Ireland has held a long-standing ambition for Gross Expenditure on R&D (GERD) to reach 2.5% of GNP. However, it has struggled to achieve this and, it is considered that the Government Budget Allocations for R&D (GBARD) as a share of Total Government Expenditure may be a more appropriate metric.
- With regard to expenditure on R&D within higher education (HERD), inconsistencies in institutional inputs to national data collection processes (the “HERD Survey”) need to be addressed to provide a more accurate and internally consistent set of statistical findings.
- Investment in a broad-based foundational research capability across the HE system is the bedrock for the future pipeline of ideas, innovations and opportunities that translate into research value and impact. There is a strong interdependency that needs to be recognised between this core public investment and competitive sources of funding.
- Within competitive funding sources, discussions about the appropriate balance between basic and applied research have more recently extended into seeking to ensure that both directed and responsive research activity are appropriately incentivised and supported. Other interdependencies include those across research disciplines, public policy objectives and public and private sector investment in HE Research.
- Governance of the national research policy agenda which may arise, for example, in relation to the development of the successor strategy to Innovation 2020, will also have an important role to play in helping to secure a more optimal distribution of public funding for research that is consistent with national priorities and securing value-for-money. As part of this, further consideration could be given to the establishment of an advisory research council, a structure that appears to be effective

in several other countries.

External collaborations

- With respect to Irish HE Research’s ‘external’ collaborators, overall business expenditure on R&D (BERD) has grown strongly, reaching €2.8bn in 2017. This headline figure, however, masks the concentration of 75% of BERD in just 100 enterprises in Ireland. Nonetheless, HE Research engagement with enterprise, when defined in terms of collaborations and research commercialisation, is strong here.
- The growth achieved in research personnel in enterprise warrants deeper analysis. Increased researcher mobility into enterprise has the potential to be an important mechanism in widening the spread of R&D activity across firms and, by extension, helping to address productivity challenges.
- Citizen involvement in research is another critical, and growing, strand of external collaboration, and has three broad constituent elements: public awareness, civic engagement in the research process and citizen science.
- Irish HE Research’s international performance has traditionally been strong. With major global shifts, including Brexit and Open Research, international research relations need to be reformulated to reflect the changing research landscape and wider shifting geopolitics.
- These international relations can be broadly stratified in terms of the all-island dimension, Ireland-UK bilateral relations, those with the EU-27 and, fourthly, beyond Europe.

Clustering

- HE Research has an important part to play in key nationwide agendas such as Project Ireland 2040 and Future Jobs Ireland.
- HE clustering policy has evolved in the decade since the launch of the 2011 National Strategy for Higher Education. The latest evolution involves the establishment of innovation districts with research-intensive institutions at their heart.
- An important defining factor in putting such policy into practice in Ireland will be the particular research specialisations of the research performers involved, in keeping with the principles underpinning smart specialisation strategies.
- Differentiated implementation approaches will be shaped by the starting and evolving research intensity of the base: enterprise as well as academic.
- The establishment of Technological Universities is an important development in this context.

The researcher

- There has been a strong emphasis in national research strategies to date on increasing the numbers of researchers at all career stages, with particular attention paid to doctoral enrolments.
- With the benefit of the most up-to-date national statistics, it is timely to consider a sustainable researcher pipeline. As part of this, a deeper analysis is required of employer demand for researchers with a particular focus on doctoral graduates (and masters by research graduates), including whether, when employed by enterprise, they work as researchers or in other positions.
- This will inform individual as well as Government/ funder decisions. It will help researchers, especially those at the start of their careers, to make more informed choices about starting on or continuing in a researcher career path.

- Researcher career pathways may manifest themselves in several ways, for example, into enterprise, internationally and inter-institutionally. The Researcher Career Framework has an important role to play in supporting institutional best practice in researcher career development.
- The skills that researchers develop - whatever their domain expertise - are key to maximising their future employment prospects. Even within HE Research, the roles that researchers perform are wide-ranging and challenging. And the competences needed to perform research are ever evolving, the Open Research agenda being a prime example.
- Higher Education Institution (HEI) training, recognition and promotion processes should align with international best practice in both researcher competence and HE Research impact. Inter-institutional consistency also matters; inconsistency in the quality of researcher competence has potential implications for Ireland's international reputation in research.

A mission-oriented approach to research and innovation

- The adoption of a mission-oriented approach to research and innovation for Ireland encapsulates many of the themes and issues that have been surfaced during the Review exercise. It reflects the evolving international perspective on the role of research in national development: one where its economic function remains deeply valued yet, at the same time, its contribution to other dimensions of development, such as societal change, is now coming much more strongly to the fore.
- A mission-oriented approach can enable a balance between directed research activity on specified needs and researchers responding to the overarching mission, with creative exploratory research that can generate previously unimagined solutions and opportunities.
- It coalesces multiple disciplines around overarching strategic outcomes, both social and economic.
- The progression of a mission-based approach would generate a number of important considerations for the future development of HE Research including:
 - The core strategic objectives of publicly funded HE research (and their prioritisation),
 - Identification of missions for Ireland,
 - Alignment and oversight of approach to interdependent public investments in HE Research,
 - An appropriate mix within any mission of directed and responsive research activity,
 - And of research disciplines and interdisciplinary engagement.
- It has the potential to achieve greater and wider impacts, as manifested in the research response to COVID-19, with enterprise innovations, evidence-based policies and medical progress being seen in Ireland and elsewhere.

Section 2

Introduction

Introduction

2.1 Research in Higher Education

Research underpins higher education. It is intrinsic to, and indivisible from, its undergraduate formation, its relationship with enterprise, its regional role and its international reputation. It is the defining transformative step for Institutes of Technology in becoming Technological Universities. For all research-intensive institutions, research performance is integral to their success and reputation.

Within the realm of tertiary education, research is what fundamentally distinguishes higher education as a complementary rather than duplicative element of tertiary education provision. Taking a wider perspective, unlike other countries that have a layer of public research institutes, Irish higher education performs this critical function, i.e., it is Ireland's de facto public research system and consequently provides the bedrock of the national innovation system. The Department of Education and Skills (DES) invests in the region of €280m every year in research activity in higher education ("HE Research") through the Higher Education Authority (HEA) and the Irish Research Council (IRC), a manifestation of the importance of HE Research to its mission.

This Review examines the strategic priority of maximising the value and contribution of HE Research to the economy and wider society. The genesis for the Review lies in the [2019 Action Plan for Education](#), in which Action 61.1 requires the Department to produce a report that:-

- Assesses the degree of balance within the higher education research system in Ireland,
- Considers how that impacts on skills needs and future research capability, and
- Sets out a roadmap of measures, where appropriate, to develop and manage an optimal research ecosystem.

Its Terms of Reference (Appendix 2) articulates the purpose of the Review as follows:-

- *“Detail the current baseline Irish HE Research system,*
- *Relate it to the latest international perspectives on the role of research,*
- *Set out Government ambition for the contribution and impact of HE Research,*
- *Assess the available evidence of the research system's realisation of these ambitions to date.*

The review will also analyse key system interdependencies to examine how constituent elements of the HE Research system interact with and complement each other. It will seek to determine the strengths and weaknesses of the current HE research system. It will also seek to identify reforms that would enhance the research ecosystem, as well as system gaps or barriers that are resulting in a potentially suboptimal outcome for the country, the citizen and the researcher. The review is expected to inform the development of a strategic roadmap towards an optimal HE Research system for Ireland.”

The Review has been carried out in three broad phases:

- Project set-up (March - April 2019),
- Evidence-gathering (May – July 2019),
- Analysis and reporting (September 2019 – early 2020¹).

¹ The analysis in this report was undertaken early in 2020. As much as for all sectors of the society and the economy, the impact of Covid19 on the HE Research system is continuing to unfold. While there is a high degree of uncertainty, the assessment at this time is that the policy issues identified in this Review remain valid and should inform the response of the Irish higher education research system to the crisis.

On foot of the evidence-gathering and analysis, six strategic themes for the Review were identified which are introduced in Section 2.3 below and examined in the subsequent sections. Each theme concludes with emerging policy insights. These are intended to guide and inform the ongoing development of the policy agenda for HE Research in Ireland.

2.2 Development of Research Policy

Just over twenty years ago, Ireland took a decisive step in its pursuit of a knowledge economy: the Irish Council for Science, Technology & Innovation (ICSTI) published its landmark [Technology Foresight Ireland report](#). The exercise identified a critical barrier in Ireland’s evolution towards this vision: “*the need for a world-class research capability of sufficient scale in a number of strategic areas within our universities and colleges, research institutes and industry*”. The report was timed to coincide with the preparation of the 2000-2006 National Development Plan and it recommended major investment in the areas of ICT and biotechnology.

The consequent investment was announced in March 2000 with the creation of a £560m (€646m) Technology Foresight Fund for which Science Foundation Ireland (SFI) was established as a sub-Board of Forfás to administer (SFI was put on a statutory basis in 2003). In parallel, the Programme for Research in Third-Level Institutions (PRTLII) was established by DES in 1999 to support underpinning research-capability-building within, and across, all higher education institutions (HEIs). PRTLII comprised five cycles totaling €1.2bn investment in physical infrastructure, equipment and human resources. DES also set up a focused Technological Sector Research initiative to build applied research and enterprise development capability in the Institutes of Technology. And, at the same time, the Irish Research Councils for the Humanities and Social Sciences and for Science, Engineering and Technology were established (2000 and 2001 respectively).

In 2002, the Barcelona European Council set the objective of increasing overall expenditure on R&D as a percentage of GDP to 3% (colloquially known as the ‘Lisbon Agenda’). Ireland, through its 2004 R&D National Action Plan “Building Ireland’s Knowledge Economy”, concluded that a national target of 2.5% of GNP appropriately represented Ireland’s ambitions. This first phase of intentional development of Ireland’s research and innovation system thus focused on **building foundational research capability** and capacity.

The subsequent [Strategy for Science, Technology & Innovation](#) 2006-2013 (SSTI) continued this structured approach to the development of Ireland’s national research and innovation system. With an investment envelope of €8.2bn, **connecting the research capability** that had been built up to date was commenced in earnest with the launch of the Technology Transfer Strengthening Initiative and then the establishment of [Knowledge Transfer Ireland](#) (KTI). One of KTI’s immediate and continuing priorities was to improve the intellectual property (IP) environment in terms of consistency of IP agreements for collaborations and better clarity on collaborator expectations.

As the SSTI approached its midpoint, the Irish economy experienced the economic and financial downturn, which followed its banking crisis in 2008. In Q2 2010, unemployment stood at 14.6%. In these circumstances, the development of the national research and innovation system understandably changed focus to how best to generate economic returns from the research investments made to date, i.e. leveraging the then present research capability. The 2011 [National Research Prioritisation Exercise](#) (NRPE) encapsulated this policy shift. In parallel, the [National Strategy for Higher Education to 2030](#), published in the same year, took a wider view of the higher education system, looking across all of

its strategic objectives, including human capital development, equity of access, internationalisation, as well as research. Its reflections on, and recommendations for, the latter recognised the need for appropriate research prioritisation. The following year, the [Irish Research Council](#) was formed with the merging of the Irish Council for Science, Engineering & Technology and the Irish Council for Humanities and Social Sciences. The NRPE approach was carried through into [Innovation 2020](#), the present national research and innovation strategy that was launched in 2015 and, for which, a mid-term review was conducted in 2019.

2.3 Structure of this Report

The formulation of the successor strategy to Innovation 2020 will provide the opportunity to frame the next evolution of Ireland's national research and innovation system. It has been the responsibility and remit of DES, working with the HEA, to seek to ensure that the Irish HE Research system, working within the overall national RDI system, is performing effectively and is contributing appropriately to the delivery of Government's broader strategic priorities within the wider strategic context of Irish higher (and tertiary) education.

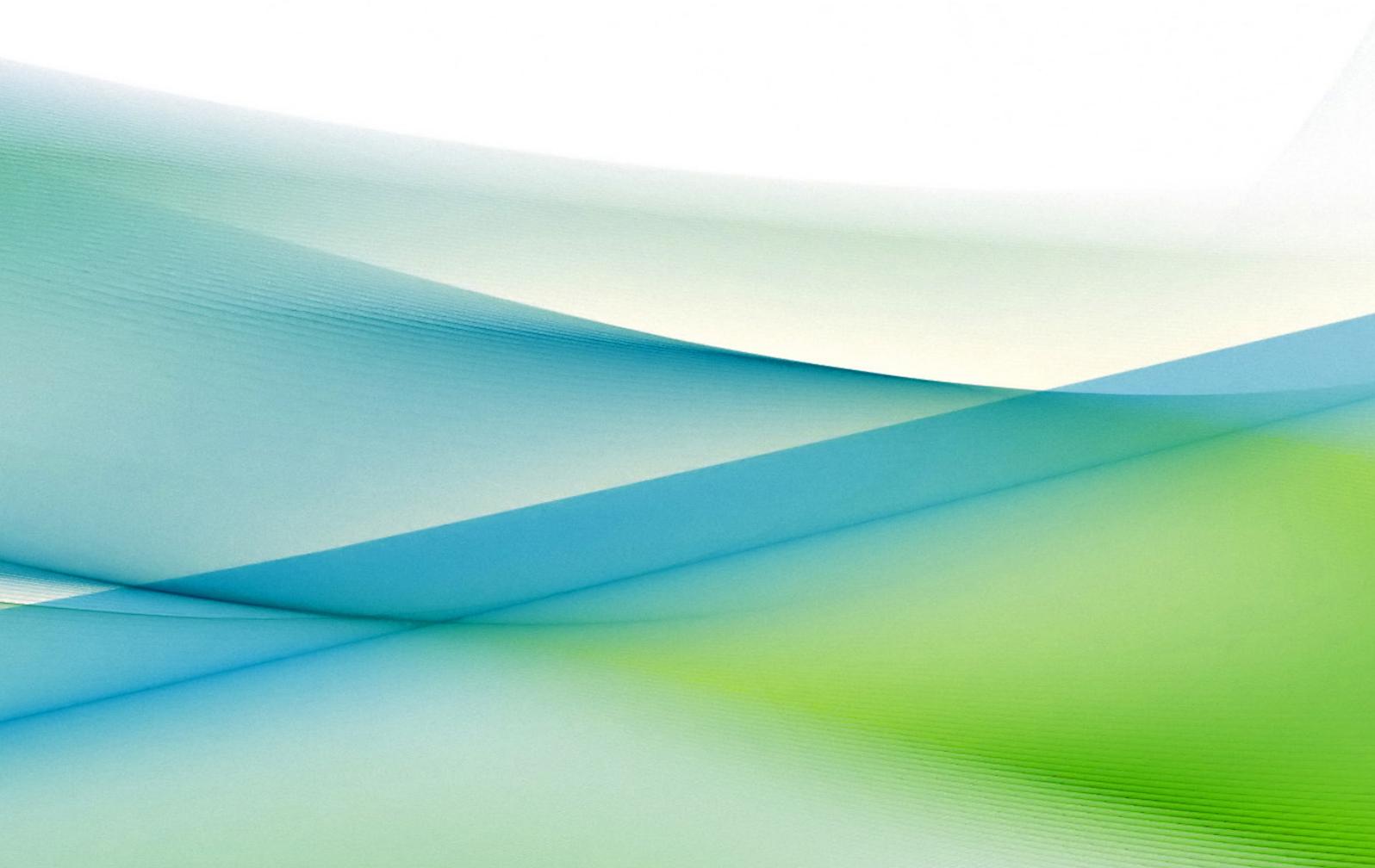
The purpose of this Action Plan for Education Review exercise has been to seek to take stock of the development of the Irish HE Research system two decades on from its effective inception and to identify key strategic themes and policy insights for the future strategic development of Irish HE Research.

This Report examines the following strategic themes:

- A. The impact of HE Research
- B. Public investment in HE Research
- D. HE Research and regional clusters and innovation districts
- E. The researcher
- F. A mission-oriented approach to research and innovation

Section 3

Theme A: The Impact of Higher Education Research



Theme A: The Impact of Higher Education Research

Research is increasingly recognised as having multiple forms of value. Its economic impact has been a central driver in the development of research and innovation systems around the world, including in Ireland. Building on this, its other forms of value are now gaining greater prominence. This can be seen, for example, in the evolution of the EU's Framework/ Horizon research funding programmes. The contribution of HE Research to a wider range of public policy objectives expands the potential for an effective and efficient return on the investment being made by the State.

The purpose of this theme is to:

- Identify the range of potential valuable impacts of HE Research,
- Assess, with the evidence available, the extent to which these are being realised in Ireland,
- Consider ways in which both these wider forms of impact can be grown, and how HE Research impact could be better monitored, thereby providing a more robust evidence base.

Building on its track record of economic impact and benefits, the value of HE Research is increasingly recognised through multiple forms of impact. An enduring issue is the measurement and quantification of these. In 2017, Campus Engage launched an impact framework with specific regard to civic society engagement in the research agenda and the concept of 'engaged research for societal impact'. For the purposes of this Review and its terms of reference, the HERG adopted a modified version of that framework such that it now includes specific focus on the impact of HE Research on human capital development, on public policy and on new knowledge production, as well as the other forms of impact worked up by Campus Engage. The eight impact categories agreed by the Group thus comprise:

- 3.1 Economic,
- 3.2 Human capital development,
- 3.3 Public policy,
- 3.4 New knowledge production,
- 3.5 Reputation and internationalisation,
- 3.6 Health and wellbeing,
- 3.7 Environment,
- 3.8 Social and cultural.

An extensive evidence-gathering exercise was undertaken in Q2 2019 as an integral element of this Review, the outputs of which are outlined below for each of the above impact categories. It is evident from this work that there are multiple positive impacts from HE Research activity, yet systematic information on them is incomplete and fragmented. Ultimately the outcome of this exercise was that robust system-level intelligence is available for two of the above categories: economic impact and new knowledge production, with case studies forming the predominant approach across the other six. The system-level evidence for those two areas points to a strong performance in both by the HE Research

system in Ireland. With regard to the other impact categories, there are very many examples through case studies of the contribution and value of the HE Research sector. However, while acknowledging the importance of qualitative evidence, a system-level perspective is essential to secure a systematic approach to both driving and monitoring impact.

3.1 Economic

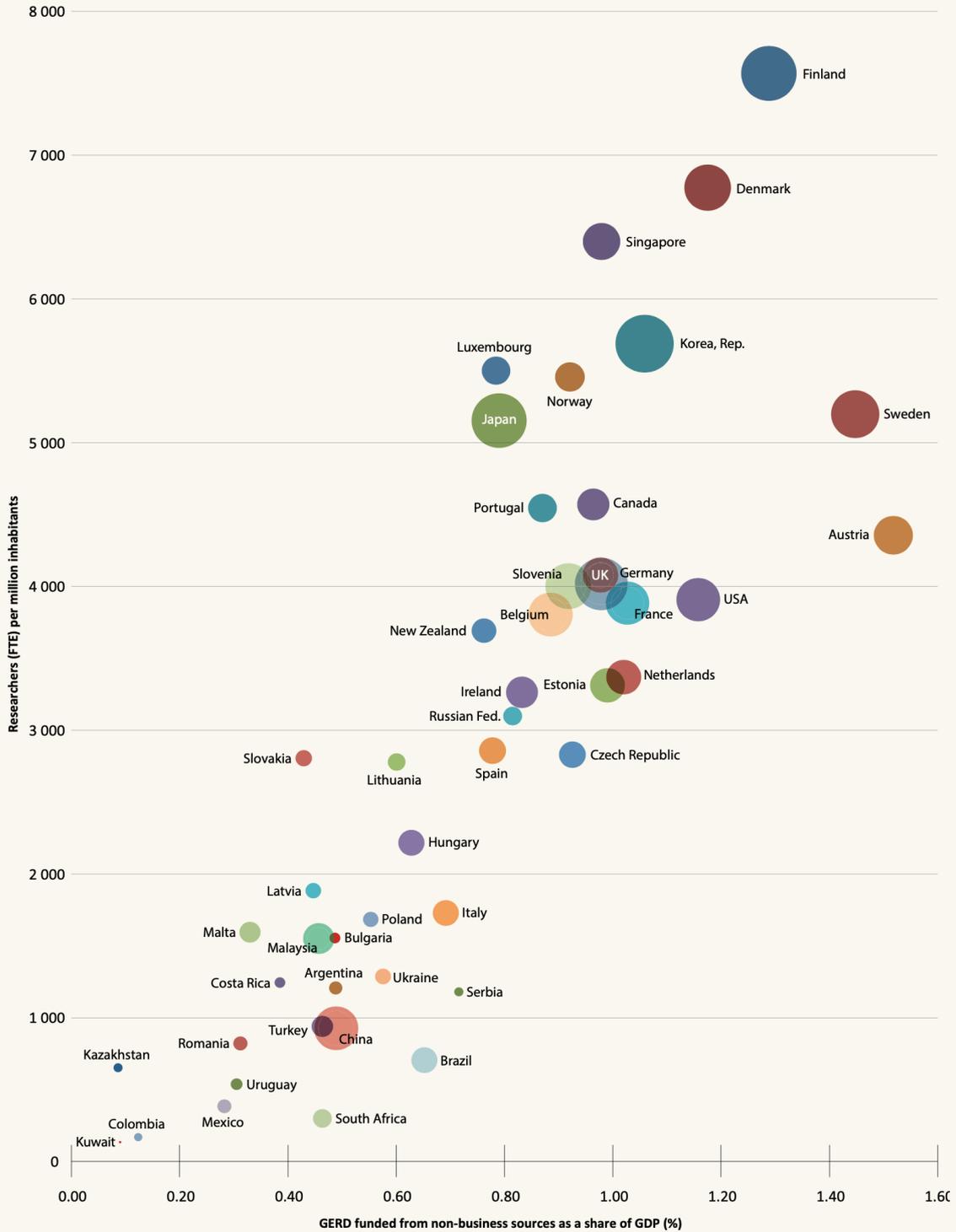
Internationally, research has been proven to be key to productivity, innovation and growth. Business investment in knowledge-based capital contributes 20% to 27% of average labour productivity growth, according to a [2013 OECD report](#). The European Commission reinforces this contribution in its [2017 report](#) citing several studies finding that:

- Two thirds of economic growth from 1995 to 2007 derives from research and innovation.
- Among all investment categories that drive labour productivity growth, including investment in tangible capital, research and innovation accounted for 15% of all productivity gains in the EU with large differences across Member States in the period between 2000 and 2013.
- An increase in 10% of R&D investment is associated with gains in productivity between 1.1% and 1.4% (i.e. an increase in R&D investment of 0.2% of GDP would result in a 1.1% GDP increase, i.e., a five-times bigger increase in absolute terms).

A 2016 [UNESCO Science report](#) examined, *inter alia*, the relationship between publicly and privately funded research activity and concluded (page 56) that -

“As [the graph: Figure 1.3] highlights, once countries are prepared to invest more in research personnel and in publicly funded research, the propensity of businesses to invest in R&D also increases (the size of the bubbles). Public and privately funded research have different aims, of course, but their contribution to national growth and welfare depends on how well they complement one another. This holds for countries of all income levels, but it is clear that the relationship becomes powerful above a certain threshold in researcher density and publicly funded R&D intensity. Whereas one can find a few countries with a relatively high intensity of business-funded R&D in the lower left-hand quadrant of the graphic, none in the upper right-hand quadrant have a low intensity of business R&D.”

Figure 1.3: Mutually reinforcing effect of strong government investment in R&D and researchers, 2010–2011
The size of the bubbles is proportionate to GERD funded by business as a share of GDP (%)



Source: UNESCO Institute for Statistics, August 2015

In Ireland, research activity has equally proven to be central to economic performance. The Department of Business, Enterprise and Innovation (DBEI) conducted several significant evaluations of research investment that attest to its role in a company’s success and in its survival. Its 2016 [Review of Economic and Enterprise Impacts from Public Investment in R&D in Ireland](#) found that:

- R&D activity in agency firms (with ten or more persons engaged) is a characteristic of firms that have been driving growth in sales, exports, and value-added from 2003 to 2014.
- R&D is an activity of firms that contributed most to employment between 2000 and 2014 in agency firms in the manufacturing and services sectors; and
- Employment in R&D roles has been more resilient than employment in other roles in the manufacturing sector between 2000 and 2014.

The 2017 DBEI [Review of Capital Expenditure on R, D & I \(2000-2016\)](#) similarly found that:

- Non-RDI-active firms were responsible for the greatest job losses during the recession, while innovation-active firms displayed greater resilience and growth in terms of rates of employment, exports and value-added.
- Pay levels in RDI-active firms were 10% ahead of the agency average and 66% higher than the economy in 2014.

And this continues today, as Irish-based companies work to diversify their markets and reduce their reliance on the UK in readiness for the post-Brexit world. As highlighted in the Enterprise Ireland 2019 End-Year Statement,

“Companies that invest in research and innovation generate 67% more in global sales than those who don’t”.

In addition, it has been established that investment in public research capability plays a major role in “crowding in” private sector investment. The 2016 DBEI Review referred to above cites the following impact evaluations of Enterprise Ireland programmes that all connect industry with HE Research:

State Funding Programme	Net Turnover Impact – experienced (per € invested in each programme)	Net Turnover Impact –projected (per € invested in each programme)
Applied Research Enhancement Centres (now the Technology Gateways)	€5.85	€12.31
Innovation Partnerships	€6.69	€26.35
Innovation Vouchers	€7.65	€27.76

The HERG Review exercise did not seek to revisit the assessment of economic returns on research (and, within that, public research) in light of the extensive work undertaken particularly by DBEI and its agencies in this regard. That said, two issues did emerge in the Review appearing to warrant future strategic consideration:

- The extent of research personnel employment in industry and its likelihood as a career destination for emerging researchers,
- The ongoing and longstanding challenge of R&D activity concentration within a small number of enterprises and the potential role of the HE Research system in expanding R&D activity more widely across the enterprise.

3.2 Human Capital Development

The impact of research on human capital development is potentially one of its most significant and important impacts. This dynamic, as noted in Section 2.1, is fundamental to the success of higher education, relating not only to students at doctoral and masters by research levels, but also to wider undergraduate formation. Its impact on the latter can manifest itself in several ways:

- Development of cutting-edge curricula based on latest developments in the field,
- Quality and currency of the educators, and
- Valuable experience that students can gain of research techniques and skills.

Because undergraduate formation and research are so implicitly connected through the academic staff who leverage their research expertise to develop new course curricula and to deliver these courses to students, it is difficult to separate out this form of impact. Like other impact categories, there are numerous case study examples of this integral connection between research and human capital development.

With particular regard to research students, the transferable skills that they acquire during the course of their studies are key to their future success. The evidence (also see section 5.1) suggests that many research graduates who gain employment in enterprise, do so in a wide range of roles well beyond their research domain expertise, thereby illustrating the value of the wider skills and competences that they develop while research students.

Overall, studies suggest that the more research-intensive/influenced a course is, the more sought-after the graduates will be. The 2019 [Indecon analysis](#) for the IUA calculated that the net premium for a PhD over an undergraduate degree in Ireland is €116,000 and €40,000 for a taught masters. The HEA's [Graduate Outcomes Survey](#) of the Class of 2018 finds that 75% of 2018 NFQ Level 8 graduates were working or due to start a job nine months after completing their studies, compared with 88% of postgraduate research graduates. The Survey also found that PhD and Masters graduates attract significant premia for these higher levels of qualification – approximately €7,400 a year for a PhD and roughly €1,700 a year for a Masters in comparison to an honours Bachelor degree (comparing like-for-like graduates).

3.3 Public Policy

The Review exercise highlighted many examples of researchers in higher education collaborating to deliver public policy impact. The COVID-19 crisis has been a remarkable illustration of how researchers

can connect effectively with policy-makers. The membership of the various expert groups under the umbrella of the National Public Health Emergency Team (NPHE) bears this out. Research experts from higher education are also playing an important role in supporting public policy through their contributions in the media.

At European level, there are structures that facilitate engagement between researchers and policymakers including the [Group of Chief Scientific Advisors](#) to the European Commission and Science Advice for Policy by European Academies ([SAPEA](#)), which are collectively referred to as the European Commission's [Scientific Advice Mechanism](#). It is important to differentiate at this juncture between structures that provide scientific advice (such as NPHE) and the advisory councils present in several other countries that advise on the strategic development of the national research and innovation system.

Here in Ireland, research funders provide some research and innovation supports for delivery of wider public policy objectives. For instance, the IRC manages the [COALESCE](#) programme and SFI runs its [Public Service Fellowship Programme](#), through which researchers can be seconded into Government Departments, agencies and the Oireachtas' Library and Research Service. The IRC is also supporting researchers to shadow Oireachtas members, and the RIA have too undertaken work in this area. These examples however, while interesting, highlight the distance to travel in order to achieve a strong commitment to delivering a transformational impact on public policy from research. A much more systematic approach by all parties to researcher-public policymaker engagement is needed, if we are to increase and embed this valuable form of HE Research impact.

It can potentially be addressed through stronger messaging from Government Departments to the higher education institutions about their research expertise needs. Other countries' practices may also be instructive in this regard, and there are some interesting [international examples](#) to consider. From the perspective of the supply of expertise (as opposed to demand for it), a more structured approach on the part of the HE Research system could help to drive engagement. Within this, the extent to which public policy engagement forms part of a researcher's progression criteria will naturally affect their level of engagement.

3.4 New Knowledge Production

While bibliometric analyses come with limitations, for example, databases providing varying degrees of coverage of different disciplines, it is helpful to reflect on Irish bibliometric performance with a view to considering how this could be enhanced in the future. A 2017 bibliometric report to the HEA compared research quality at national level, in terms of bibliometrics, between the 2011-2015 period and the preceding 2005-2009 period. It concluded that Ireland has generally maintained its research performance levels across the two periods. The report's analysis of the Top 50 fields ranked by Category Normalised Citation Impact (CNCI) found, *inter alia*, that 21 of the top 50 fields in the 2005-2009 list do not feature in the 2011-2015 list. The top five that came off the list were:

- Mathematical and Computational Biology,
- Mathematics – Statistics and Probability,
- Computer Science Theory and Methods,
- Transport Planning and Logistics Computer Science,
- Architecture.

In addition, Humanities was ranked 15th in the 2005-2009 list and does not feature in the 2011-2015 top 50 list. This decline in performance needs to be examined, particularly in the context of evolving discussions about the imperative for interdisciplinary research.

According to more recent analysis of the 2014-2018 period (undertaken by TCD in June 2019 for the purposes of this Review exercise):

- Ireland's research publications impact exceeds the global average for 2014-2018: Ireland's publicly funded research publications have an overall field weighted citation impact of 1.64. The global average citation impact is 1.
- All of Ireland's scholarly outputs regardless of subject area are performing at least at the global average in terms of field-weighted citation impact. Eighteen of the 27 subject areas are achieving high impact.
- Between 2014 and 2018, Ireland published more than 70,000 publications with an average field-weighted citation impact (FWCI) of 1.64 (significantly higher than the world average).
- In the period 2014 – 2018 Ireland collaborated with some 200 countries/regions, on more than 40,000 academic co-publications.
- Between 2014 and 2018, HEI-based researchers published 500 academic co-publications with corporate entities worldwide.
- 17.2% of Irish publications are amongst top 10% most cited worldwide (2014-2018).

The bibliometrics figures indicate that Ireland has, at a minimum, maintained its performance (noting that benchmarks with comparable countries would help in further understanding Irish performance in this regard). It should be noted that the research community has expressed concerns about Irish investment levels not keeping pace with that of leading research performers internationally. Either way, any impact of changes in research funding on performance can come with a delay, so continued monitoring is essential.

Newer forms of research assessment that work to improve how scholarly research is evaluated must also form part of any future work in this area, for example, the [Declaration on Research Assessment](#), to which the IRC, the RIA, SFI and the HRB are signatories, connecting too into the Open Research agenda.

3.5 Reputation and Internationalisation

The concern highlighted above is borne out by the fact that Ireland's country rankings have recently fluctuated in each of three significant international ranking systems as follows:-

- Global scientific ranking (GSI) (SFI Annual Report 2018: source InCites); ranking fallen marginally from 10th in 2016 to 11th in 2017, to 12th in 2018,
- [Global Innovation Index \(GII\) 2019](#): ranking fallen from 10th to the 12th most innovative economy in the world,
- [European Innovation Scoreboard 2019](#) (EIS): ranking fallen from 9th in 2018 to 10th place in 2019.

The GI illustrates that Ireland continues to perform above expectations for its level of economic development, effectively optimising its level of innovation inputs to a higher level of outputs. In the EIS 2019, employment impacts, human resources and attractive research systems are among the strongest innovation dimensions, while linkages are noted as weak.

In terms of attracting talent, a 2019 [OECD report](#) on benchmarking higher education system performance finds that Ireland demonstrates a relatively high inward and outward mobility of scientific authors, in third position behind Luxembourg and Switzerland. The same report notes that Ireland has a relatively small positive “*net flow*” of scientific authors. While this offers an indication of mobility, more information would be helpful, for example, in relation to the potential attraction of researchers as a result of Brexit, and the attraction of international students because of the research intensity of higher education institutions in Ireland.

With regard to international investment, the April 2020 interim report on Horizon 2020 performance notes funding secured by then of €911m, equating to 1.74% of the H2020 total budget. Ireland’s target is 1.56% so this represents evidence of strong leveraging of EU funds. It also represents an overall Irish success rate of 15.49%, comparing very favourably to the EU Member State average of 12.16%. The HE Research system has secured 56% of this funding and is also an active partner in many of the enterprise successes. While some examples of the latter were provided through this Review exercise, a more comprehensive understanding of this dynamic would be helpful.

3.6 Health and Wellbeing

The Review exercise gathered many positive case studies of the health and wellbeing impact of HE Research. The pandemic has generated many more high-profile instances of HE Research making a major difference in a range of ways, including:

- As well as their success in the research funders’ joint [rapid response funding call](#), researchers from nearly all disciplines have re-oriented their existing research work to contribute to tackling the crisis. As well as involving medical research fields such as immunology and diagnostics, it also includes public health research and wider research on wellbeing, behavioural science and the value of culture, together with a range of other disciplines.
- Because of their expertise, researchers have been seconded to join the frontline effort to tackle the pandemic in hospitals and other healthcare settings across the country.
- Skilled diagnostic laboratory staff have been mobilised to undertake laboratory processing of samples and to take swabs from patients at testing hubs.
- As noted under section 3.3, research experts form a major plank of the membership of the various expert groups and committees that have been set up and they are engaging extensively with the media to provide expert communication to the public.

While no system-level evidence for this impact category could be sourced, it is an area with potential for a future strategic/systematic approach by virtue of the establishment of the hospital groups, each with an academic partner and a chief academic officer.

3.7 Environment

Again, similar to other impact categories, system-level evidence could not be sourced for the purposes of this Review. Internationally, Irish institutions perform relatively strongly in the [THE Impact rankings](#) that assess their performance against the UN's Sustainable Development Goals which include:

- Clean water and sanitation,
- Affordable and clean energy,
- Sustainable cities and communities,
- Responsible production and consumption,
- Climate action,
- Life both below water and on land.

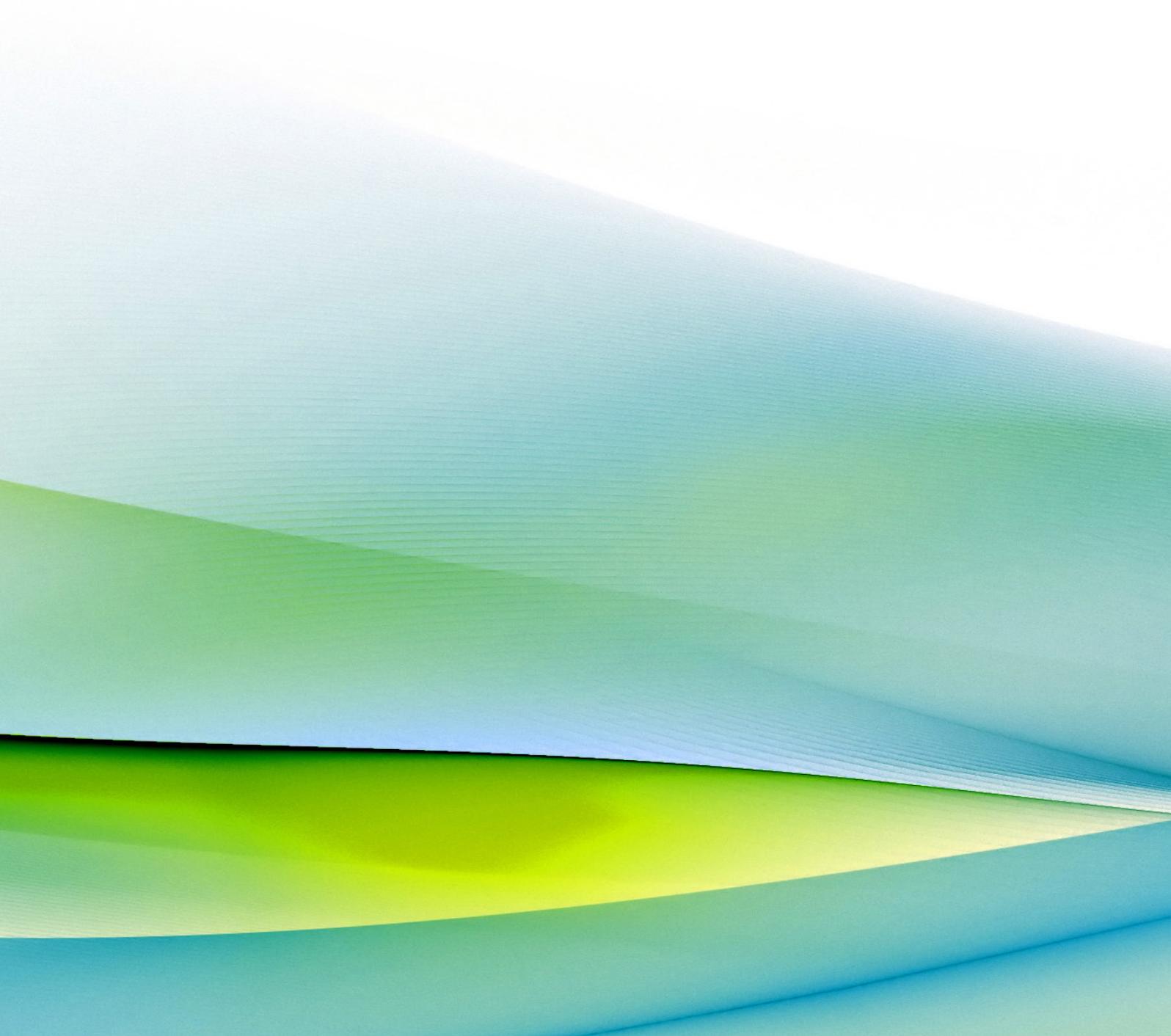
With a strong environmental dimension in the new Programme for Government, how the HE Research system delivers this form of impact will be an important element of its engagement with the public and the political system over the forthcoming years.

3.8 Social and Cultural

As is the case for the other impact categories, while the Review highlighted many excellent case studies in this area, system-level evidence was not available.

Emerging Policy Insights:

- There was strong availability of system-level evidence from the HEIs on two important areas of impact: economic benefits created, for example, through the commercialisation of research activity, and research quality as captured in bibliometrics. The availability of system-level evidence for these dimensions of impact very likely reflects their incentivisation in the system. There has been an emphasis nationally on knowledge transfer of HE Research through commercial innovation. Within academia, there is a longstanding emphasis on academic outcomes such as citations and co-authored publications. This review confirms that the HE Research system in Ireland is performing strongly in these two areas when compared to international benchmarks.
- For the other forms of impact investigated, there is a multiplicity of ‘case-study’ examples of how research is positively impacting our society and economy, especially in the spheres of health, environment and societal issues. However, structured and systematic reporting in relation to those other impacts has not yet been developed. There is a need for systematic data collection that supports the qualitative case studies in measuring the impact of research. The Review therefore confirms that, though the impacts of HE Research are often deeper and wider than conventionally understood, the systems do not currently exist for their consistent and reliable measurement.
- Highlighting this evidence gap - which is not unique to Ireland - does not underestimate the challenge of putting such systems in place. Nevertheless, addressing this requirement is very important for addressing a significant knowledge deficit that leads to an underestimation of the broader valuable impact of HE Research activities. In turn, this can impact adversely on the case for increased investment in a system that can yield substantial wider societal benefits. As long as a narrow set of research outputs are emphasised and as long as researchers continue to be primarily recognised in terms of historically limited academic metrics, a step-change in how HE Research delivers other forms of value will face challenges.
- An additional important insight arising from the Review is that a structured and systematic approach should be developed not only in relation to the measurement of the wider impact of research, but also in the actual delivery of this wider impact on the ground. To take one example, in the field of public policy, a more structured approach could significantly improve the alignment and interaction between public policy requirements for high-quality research arising from significant societal challenges and the available expertise in the field, especially the expertise in the higher education system. This could also broaden the policy audience for HE Research outputs helping more researchers, especially those at the earlier stages of their career, to connect with policy-makers. Of course, as highlighted above, for this change in approach to be effective, it also needs to be appropriately incentivised.



Section 4

Theme B: Investment in Irish Higher Education Research

Theme B: Public Investment in Irish Higher Education Research

Public investment in HE Research reflects the recognition that it has the potential to realise the range of impacts examined above. Such investment comes via a range of channels including Exchequer competitive funding, Exchequer core investment and EU public funding. The interplay between these influences the degree of balance in a research system in a number of forms, such as that between directed and responsive research activity, across research disciplines and across public policy objectives. In order to maximise the return on all public investments and value-for-money for the State, it is imperative that these investment interdependencies are recognised by all stakeholders.

This theme examines:

- How expenditure on HE Research is reported within the wider national RDI framework,
- The relationship between the indirect core investment in HE Research and the competitive public funding that leverages that underpinning funding,
- The range of system interdependencies that affects the returns on public investment in HE Research.

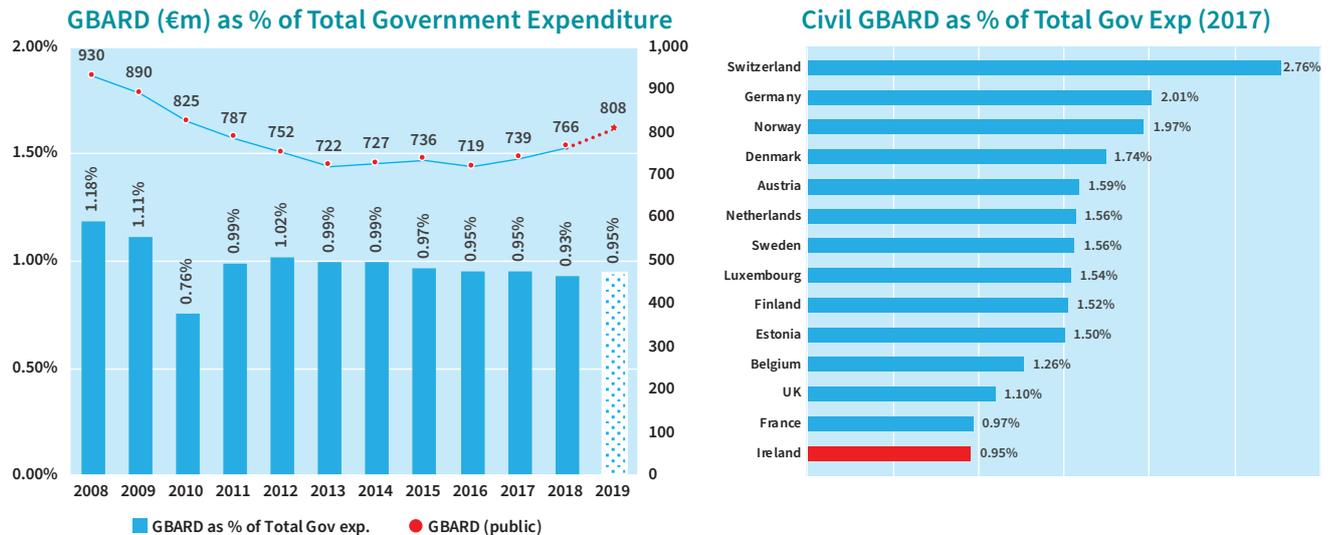
4.1 National Investment Levels

While Ireland has a long-standing ambition under, for example, the Lisbon Agenda and the 2004 R&D Action Plan, to achieve a 2.5% of GNP in respect of Gross Expenditure on Research and Development (GERD), it has consistently fallen short of this target. The current national strategy for research and innovation, Innovation 2020, recommitted to this target. According to the [2018-2019 R&D Budget](#) prepared by DBEI, the outturn for 2018 was 1.46% of GNP. It is important to bear in mind that very rapid economic growth and the unique composition of income measures for the Irish economy combine to create significant challenges in interpreting progress in any aggregate expressed as a proportion of measures such as GDP or GNP. GERD was 1.88% of GNI* in 2018 which in practice is a more realistic measure of the economy's income. In absolute terms, 2017 GERD was €3.7bn, a 42% increase in a decade. GERD can be broken down into Business Expenditure on Research and Development (BERD), Higher Education Expenditure on Research and Development (HERD) and GOVERD (R&D performed in-house by Government Departments and agencies). The latter is smaller in scale in Ireland compared with other countries, demonstrating the strategic emphasis placed on higher education institutions as the primary locus of public research capability in Ireland. In 2018, BERD was estimated at €2.8bn, an increase of 58% since 2011 and representing three quarters of total GERD.

Government Budget Allocation on Research and Development

In setting targets for research funding expressed as a proportion of aggregate income measures in the economy, Government Budget Allocation on R%D (GBARD) as a % of Total Government Expenditure may be a more appropriate target for the future. Such an approach would aim to elevate the relative financial priority within overall Government expenditure that is afforded to research. In essence, this would be a clear demonstration of research becoming a more valued component of Government activity as manifested in its spending decisions and choices between priorities. GBARD levels have been slowly

increasing since their 2016 low (€719m) but still compare unfavourably with leading research performers internationally as illustrated below. According to the [2018-19 R&D Budget](#) prepared by DBEI, GBARD was €766m in 2018, an increase of 3.6% in expenditure over the previous year, and it is estimated to be €808m in 2019. In overall terms, GBARD as a percentage of total general Government expenditure² has remained around 1% since 2011 standing at 0.93% in 2018 and estimated at 0.95% in 2019.



DBEI presentation 27 January 2020

The Survey on R&D Expenditure in the Higher Education Sector

The [HERD Survey](#) is the source of national statistics on research activity in higher education including, for example, research expenditure in different disciplines, the breakdown of expenditure across what is categorised as “basic” and “applied” research, and personnel distribution across disciplines. The Survey is compiled biannually by DBEI in accordance with the [OECD Frascati Manual](#) guidelines.

It became apparent during the course of this Review that there have been inconsistencies in the inputs provided by higher education institutions into the survey. One important example relates to the measurement of what is termed “basic” and “applied” research. As reflected in the Terms of Reference for this Review, the HE Research community has regularly highlighted the importance of, and potential imbalance between, these two research classifications. The 2016/17 HERD Survey found that 60% of research expenditure in Irish higher education was categorized as “basic” research, an increase of one-third from the 45% of higher expenditure research spending on basic research in 2014, and thus apparently significantly at odds with experience on the ground.

In light of the disparities in what was being reported in the statistics, DBEI initiated a full review of the survey methodology with the institutions. Thanks to this, better defined criteria - that work with available HEI data and that also comply with international reporting requirements - have been employed for the next iteration of the HERD Survey.

² DBEI 2018-2019 Budget, p8: estimate of €85,365m is taken from the Department of Finance Budget 2020 Economic and Fiscal Outlook.

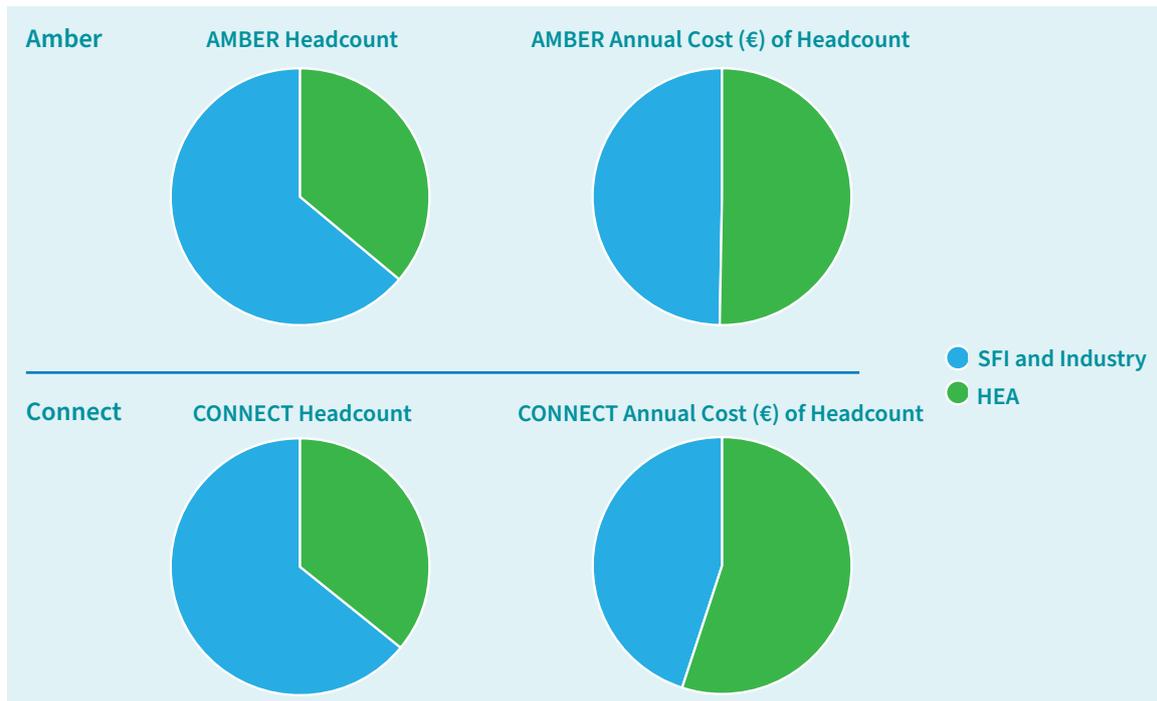
4.2 Core Investment in Foundational Research Capacity in Higher Education

The discussion in Section 3.1 above illustrates the ongoing importance of foundational research capability across higher education that can then be leveraged to secure broader and deeper impact from that research activity. In order to ensure that Ireland can aspire realistically to meet 'best-in-class' international benchmarks for research, it is imperative that it sustains its broad-based research capability as this is the primary source of the ideas, innovations and opportunities that translate into research value and impact.

The annual core grant allocation to the higher education institutions reflects this imperative for foundational investment in public research right across the higher education system. As noted at the outset of this report, research is integral to the higher education system's undergraduate formation, its relationship with enterprise, its regional role and its international reputation. The State through the Department and via the HEA's management and administration of this grant, invests in the region of €230m in higher education research annually.

Importantly, this is not by way of discretionary spending by the institutions; it is an estimate of the proportion of academic staff time that is spent on research activity. It funds the academic staff who – as well as their other activities - lead competitively funded HE Research activity, including the major research centres. These faculty have their salaries funded through the core grant, while the competitive funding secured then supports the postdoctoral and postgraduate researchers and research staff who they supervise. According to the HERD Survey, the share of expenditure on research that is accounted for by the core grant differs significantly across disciplines, with it making up roughly two thirds of research expenditure for the Humanities and Social Sciences, and less than one quarter in engineering and technology.

In light of this foundational role of the HEA core grant research allocation, a simple analysis was carried out by institutions as part of this Review to consider the interdependency between this funding and SFI-supported Research Centres. This exercise estimated the headcount of researchers, at a point in time, paid for by the SFI grant (including industry funding that is required for that grant) and compared that to the researchers that are paid for by the funding from the HEA (and who do not charge any salary against the Research Centres). The exercise found that the core grant supports broadly in the region of half of an SFI Centre's staffing costs (which typically account for about 70% of a Centre's total costs). This is illustrated in the case of two of the SFI centres for which Trinity is lead institution in the figure overleaf.



How the HEA grant allocation is utilised by each HEI is of course their individual preserve, and it forms part of its wider relationship with the HEA. The Higher Education System Performance Framework is a potentially key instrument in providing the opportunity to improve the cohesiveness of overall system investment and its alignment with national strategic objectives. A strengthening in the work undertaken by the HEA with the higher education institutions to deliver maximum research impact – very much in its broader and wider sense – has the potential to achieve stronger value-for-money from the significant resources invested by the State in HE Research. It also has the potential to better balance the full economic cost of research across those who commission it, for example, competitive research funders and industry, so that the core grant allocated to the institutions carries a reasonable share of these costs.

4.3 Competitive Research Funding

A significant catalyst for this Review was the increasing level of debate about possible imbalances in competitive public investment. On this basis, one of the key purposes of the Review has been to examine these issues using available evidence or data. The main areas within this Review objective include the balance:

- between basic and applied research funding,
- between different research disciplines,
- across public policy objectives,
- between competitive research funding in its entirety and the foundational investment in research through the core grant discussed in the section above.

From Basic and Applied Research ...

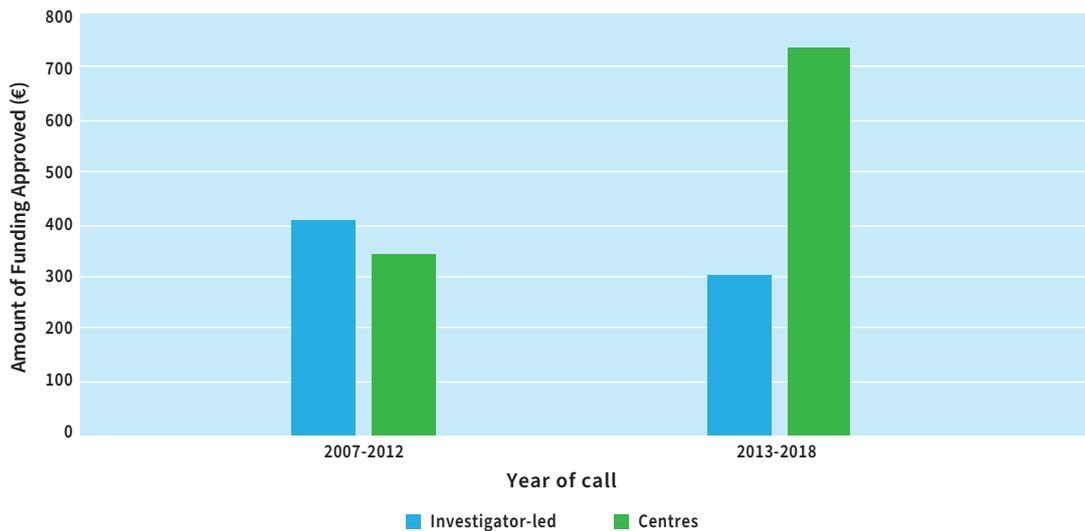
As discussed previously, this has been at the centre of many debates about balance in higher education research and perceived system imbalances. The fundamental issue relates to a concern that what is categorised as basic research is being underfunded in Ireland. The 2016/17 HERD Survey found that 60% of HE Research expenditure in 2016 was spent on basic research, an increase of one-third from the 45% share in 2014. However, in light of the data issues highlighted in Section 4.1 above, these results need to be treated with caution. It will be more accurate and appropriate to consider the statistical findings of the next Survey, with the benefit of the revised approach by the institutions in collaboration with DBEI.

... to Directed and Responsive Research

The HERG expert group's deliberations indicate that, in fact, the key dynamic here is the balance between directed ("top down") and responsive ('bottom-up') public research investment. Directed research funding, such as that allocated by way of large-scale research centres, sets out a clear specific direction for the funded research to pursue. This is a critical element of any national research and innovation system.

Responsive research activity is individual-led discovery research that enables new ground to be broken within and across research disciplines. Successful individual researchers are the seed of the subsequent scaling up of their success into large-scale activity and they are the genesis of many of Ireland's research spin-out companies. As well as providing a role model for early-stage researchers, they can inspire students and, indeed, the wider public to believe in the possibilities that research offers: as a career, as a source of solutions to global challenges, and as an important part of Ireland's reputation.

Funding Approved per call (Centres versus Investigator-led)



Source: Irish Universities Association

Internationally, Ireland performs particularly well in individual-led Horizon 2020 (H2020) funding programmes and this is a good proxy for the quality of individual researchers that are hosted in Ireland's institutions. As of April 2020, researchers based in Irish higher education institutions secured €277.3m from the two primary funding streams for individuals (i.e., Marie Skłodowska-Curie Actions (MSCA) and the European Research Council (ERC)). This represents over 30% of Ireland's €911.4m drawdown from H2020 at that time.

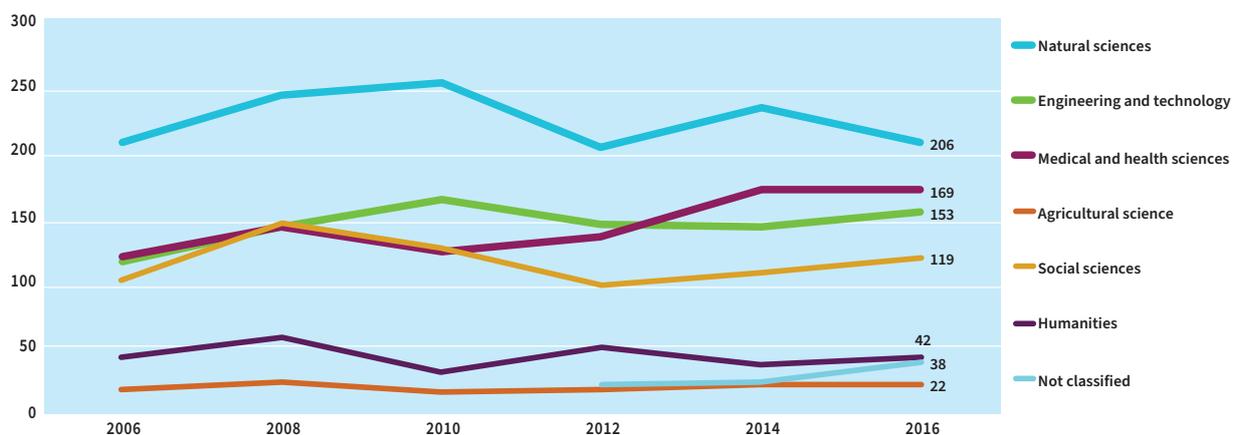
There has been [concern](#) expressed in the HE Research community about national support for individual researchers, and the balance here between support for directed and responsive research activity. It has been argued that the supports available do not sufficiently optimise Irish researcher potential to contribute to the national research and innovation system and to succeed internationally. In this regard, consideration is required of whether existing supports for individual researchers to undertake responsive research are being deployed optimally in all circumstances and if they are, in their totality, sufficient. The mission-oriented approach examined in Theme F may provide a framework within which to consider future activity in this domain.

Across Research Disciplines

One of the other dimensions of potential system imbalances also referred to above related to the distribution of resources between STEM and AHSS research. It is relevant to note here, that the debate about balance in disciplinary funding is often linked to the outcome of the 2011 National Research Prioritisation Exercise.

According to the HERD survey, and as illustrated in the following figure, STEM accounts for approximately three quarters of expenditure on HE Research and AHSS research accounts for the remainder. More information on international benchmarks would be helpful in understanding the appropriateness of the balance in research funding in Ireland between these two broad areas. In addition, in an increasingly interdisciplinary world, the approach to disciplinary activity itself (as posited in Section 8.2), as well as the monitoring of it needs to be reviewed.

HERD expenditure (€m) by Fields of Science 2006-2016



Across Public Policy Objectives

The HERD Survey 2016-2017 provided the following breakdown of sources of direct Government funding of higher education research:

	2016 (€m)	2017 (€m; est)
Department of Education and Skills	0.5	0.5
PRTL Current funding	1.7	1.1
PRTL Capital funding	1.8	1.4
Teagasc	4.4	4.8
EPA	6.4	6.8
Department of Agriculture and Food	10.3	10.5
Other HEA funding ³	16.1	14.1
Health Research Board	26.5	27.1
Irish Research Council	31.3	30.9
Other State Funding	29.9	38.8
Enterprise Ireland	58.4	59.7
Science Foundation Ireland	162.1	166.7
Total	349.4	362.4

Using the Enterprise Ireland and SFI funding as proxies for the direct Government funding that has economic development as its primary public policy objective (on the basis of them being DBEI agencies), direct Government funding primarily aimed at economic development accounted for 63.1% of total direct Government funding in 2016 and for 62.5% in 2017.

The shift discussed elsewhere in this report towards a much more explicit recognition of the wider relevance of HE Research and of its importance beyond supporting economic development, evidenced by the increased focus on a mission-oriented approach, also has important potential implications for the distribution of public investment resources. Further development of the governance of the national research policy agenda which may arise, for example, in relation to the development of the successor strategy to Innovation 2020, may also have an important role to play in helping to secure an optimal distribution of public funding for research consistent with national priorities and in securing value-for-money for the State. As part of this, consideration may be given to the establishment of an advisory research council, a mechanism present in many other countries.

Between Competitive Research Funding and Recurrent Investment

According to the HERD Survey, indirect Government funding from the HEA core grant for higher education institutions accounts for in the region of one third of expenditure on HE Research. As noted earlier, this is not by way of discretionary spending by the institutions; it is an estimate of the proportion of academic staff time that is spent on research activity. In addition, the analysis in the case of the SFI funded Research Centres discussed above estimated that, at a point in time, in the region of half of a Centre's total staffing costs are supported by public funding allocated through the HEA core grant.

For social sciences and humanities, approximately two thirds of HERD is constituted of indirect Government funding through the core grant. This may be attributable to a number of reasons including the lower cost of such research as well as the lack of alternative funding sources. In contrast,

³ Including for example, HEAnet and e-journals.

engineering & technology and natural sciences receive up to a quarter of their expenditure on R&D from the core funding.

As discussed previously, this highlights – both for research performers and research funders - the very significant interdependency between the research component of the core grant to higher education institutions and the competitive funding that is secured on foot of the foundational investment made in higher education by the State.

Understanding infrastructural investment deficits

The quality and capacity of research infrastructure continues to be highlighted consistently by research performers as a major issue to be addressed in order to enhance Ireland's potential to be a world leader in research and innovation. This was specifically raised in the [Innovation 2020 Mid-Term Review](#).

Previously, research infrastructure in higher education was primarily supported through the Programme for Research in Third Level Institutions (PRTLTI) managed by the HEA. Since its launch in 1998, there were five cycles of PRTLTI funding, total investment amounting to approximately €1.2bn (including investment from non-exchequer sources). The last investment round was run a decade ago.

As was the case in other instances, system-level evidence could not be sourced in time for this Review. The HEA's planned space survey of higher education institutions may generate better information on this subject.

In addition to physical infrastructure, e-infrastructure has become substantially more important with the exponential growth of data and the continued development of the Open Research agenda. The latter is set out in Ireland's [Framework for Transition to an Open Research Environment](#) published in July 2019. The Framework will be progressed through a National Action Plan as the main priority now of the National Open Research Forum (NORF). Framework principles relating to infrastructure are to be advanced within the context of the NORF National Access Plan.

4.4 Exchequer Funding and Other Sources of Investment

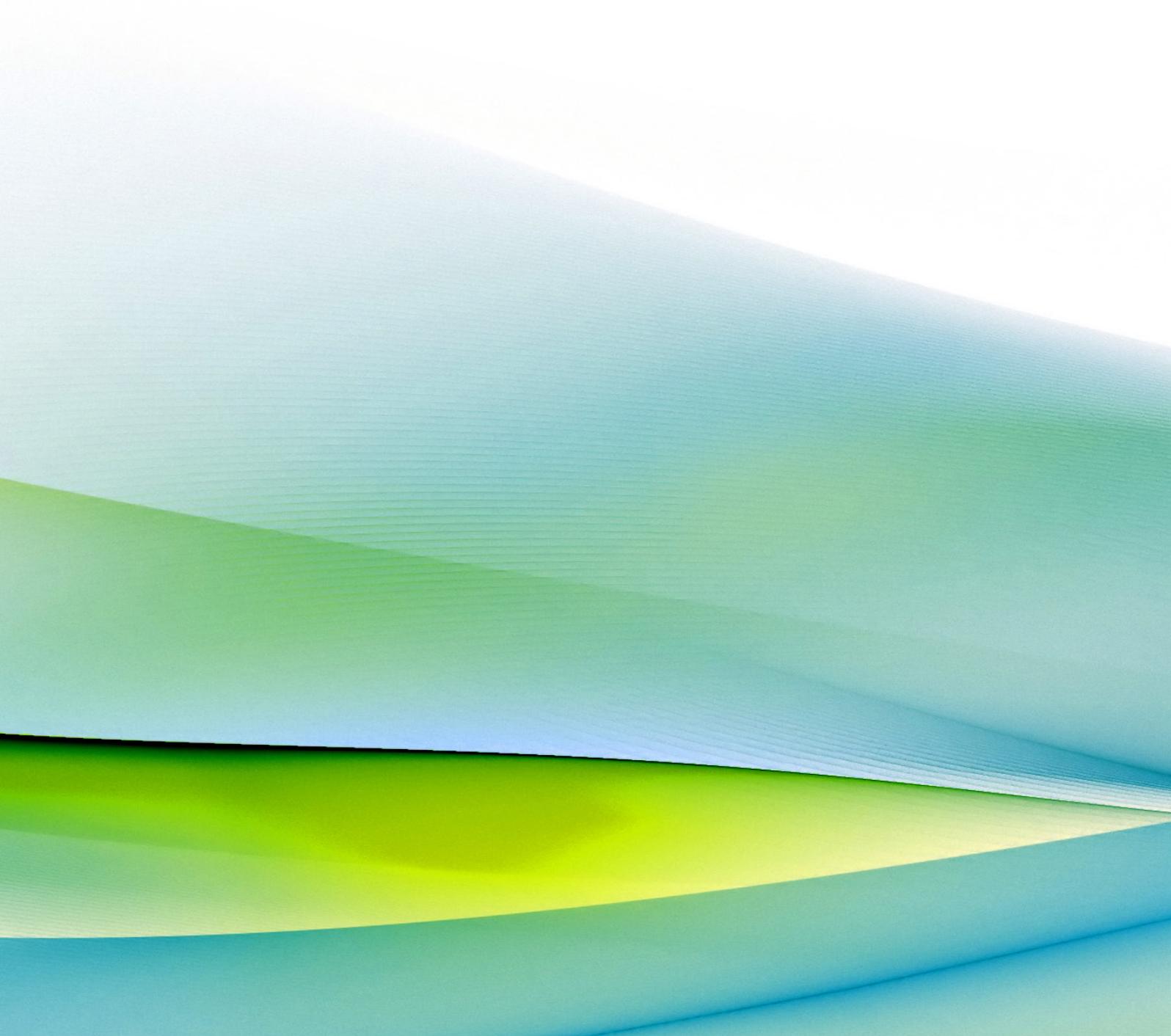
It is evident that there are clear and strong system interdependencies across the four axes of balance discussed in the previous sections. A fifth axis is that between Exchequer funding and other sources of investment (i.e. private sector and international EU funding) and with the multiplier effect of public investment in research articulated in Section 3.1. The strong growth in overall BERD (58% growth between 2011 and 2018) is therefore a welcome achievement. Nonetheless, it is important to consider benchmarks for a sustainable/appropriate level of BERD as a share of GERD for a country wishing to lead internationally in relation to RDI and how Ireland compares to these. Some concerns were expressed by the research community in the course of the Review that the growth in BERD may be having unintended consequences on other forms of research, including the balance between discovery and closer-to-market research being undertaken and this merits exploration.

Ireland's performance, including that of the higher education system has been strong in Horizon 2020 to date. As noted in Section 3.5 above, total funding for Ireland, as of April 2020 reached €911m, equating to 1.74% of the H2020 total budget. Ireland's target is 1.56% so this represents evidence of strong leveraging of EU funds. It also represents an overall Irish success rate of 15.49%, comparing very favourably to the EU Member State average of 12.16%. The HE Research system has secured 56% of this funding.

Emerging Policy Insights

- While Gross Expenditure on Research and Development (GERD) has increased significantly over the last decade, it has fallen well short of the longstanding 2.5% of GNP target (acknowledging the issues that arise in Ireland with targets set as national income-based ratios). The Review discusses how a more appropriate strategic objective may be Government Budget Allocation on Research and Development (GBARD) as a % of Total Government Expenditure. This measure would reflect the extent to which there is a prioritisation of expenditure on research and development by Government relative to other Government spending priorities. Using this yardstick, the Review demonstrates that though Ireland's overall performance is stronger than would be evident from the current GNP-based target, it still falls clearly short of those countries we would wish to emulate as research leaders.
- Over the last two decades, for various reasons, the distribution of competitive research funding in Ireland, as elsewhere, has been weighted towards the achievement of (often narrowly) quantified economic benefits and impacts, especially since the 2008 economic and financial crisis. This strategy merits reappraisal in light of the growing recognition, nationally and internationally, of the role of research in progressing broader goals (e.g., mission-based) and achieving wider national strategic objectives as set out in Project Ireland 2040 and Future Jobs Ireland.
- The research and innovation system is a collection of complex interdependencies between sectors, structures, infrastructure and people across a range of fields. This is recognised in the primary approach to balanced funding for HE Research through a broad-based, bottom-up core investment.
- Any selective strategy that emphasises a particular element of the system will impact, potentially both positively and negatively, on the other elements of the interdependent system. A balance needs to be struck between focusing on specific purposes and outputs, and maintaining the health of the system overall, so that it can continue to develop and provide for the required purposes and outputs of tomorrow. Too narrow or short-term a focus will impact negatively on the potential longer-term sustainable capacity of the system. In other words, in terms of national policy, while it is possible to prioritise from time to time, it is not possible to solely focus on these priorities given the high degree of interdependency between all elements of the HE Research system.
- In order to underpin the potential for HE Research to deliver impacts across a wide spectrum of economic and social dimensions, it is essential that its foundational capability continues to be broadly-based. Building on this, appropriately identified priorities can also be progressed. It is complex to achieve this in a manner consistent with safeguarding appropriate balance across various axes including for example:
 - what might now be described as directed and responsive research activities,
 - a range of national policy objectives,
 - different research discipline, and
 - funding of individual-led research and other structures, such as Research Centres.

- The Review has demonstrated that indirect core funding forms the bedrock of the HE Research system, providing foundational investment right across higher education. Other research funding sources (e.g., SFI, HRB, IRC) then leverage this foundational investment to support the achievement of a wide variety of more specific objectives. For example, the Review illustrates how the core grant supports somewhere in the region of half of the staffing costs of SFI funded Research Centres, and its resulting metrics and outputs. There is, therefore, a critical system interdependency between public investment in higher education from the core grant and other competitively allocated sources of investment provided by these other research funders, funding sourced from the EU as well as that provided by industry. This interdependency needs to receive greater attention and recognition from the various research funders and in decisions regarding the strategy for research and the allocation of research funding. Providing additional funding to the competitive research funders' budgets, necessitates additional core funding to the higher education institutions. Otherwise, HEI funding will be skewed towards its research activities to the detriment of its teaching and learning remit, while acknowledging the contribution of research activity to the development of Ireland's talent pipeline.
- At the same time, it is equally important to recognise that there is insufficient information available at system-level about how core grant funding is distributed, managed and delivers value-for-money to create a strong case for greater levels of investment in this stream. Additionally, as a consequence, there is a significant underestimation of its pivotal importance to other funding sources and to the delivery of the objectives and priorities to which these other competitive sources of funding are directed.
- An enhanced Higher Education System Performance Framework has the potential to provide the first step towards an improved understanding of the role, value and impact of core public funding allocated to HE Research. The current three-year Framework concludes at the end of 2020, which provides the opportunity for a substantive debate on how the Framework can be enhanced to link public funding in a more explicit, direct and measurable way to the performance of the higher education system as a whole and that of individual higher education institutions in relation to both sectoral and national strategic priorities.



Section 5

Theme C: External Research Collaboration and Higher Education

Theme C: External Research Collaboration and Higher Education

The extent to which, and how, Irish HE Research collaborates with external stakeholders is critical to its performance, its role in the national research and innovation system and its international success. This theme considers these collaborations in three broad strands:

- (i) With enterprise,
- (ii) With the citizen and civic society, and
- (iii) Internationally.

It looks at the varying developmental stages of these strands and considers particular elements of each that, if improved, could help to optimise the performance of the Irish HE Research system and its external national and international collaborations.

5.1 With Enterprise

In overall expenditure terms, according to the 2017/18 CSO BERD Survey, enterprises spent almost €2.8bn on R&D in 2017, an increase of 24% on 2015 and the largest biennial increase in the last ten years. However, this headline figure masks its high concentration within a small number of companies: the largest 100 enterprises in terms of R&D expenditure accounted for 75% of BERD. For these 100 enterprises, 82% of the spend can be attributed to foreign-owned firms.

The KTI Survey 2018⁴ notes almost 2,000 HE Research collaborations with industry – a 38% increase on the previous year and a strong indication of the role that HE Research can play in catalysing enterprise R&D activity. DBEI's June 2019 progress update on Innovation 2020 targets similarly finds collaborative projects well ahead of target. Research spin-out companies from higher education institutions are in the region of an annual outturn of 30, which compares favourably to relevant international benchmarks. In overall terms, therefore, HE Research collaboration levels with enterprise are strong.

Having regard to the level of industry financing of public research in Ireland, according to the 2016/17 HERD Survey 4.5% of total HERD in 2016 was financed by industry in Ireland, almost unchanged since 2014 (4.4%) and below the EU28 average of 6.5% and the OECD average of 5.8%. It is worth noting though that some of the countries with the highest R&D intensities, such as Sweden, Finland and Denmark, had an even lower level of R&D financed by industry than Ireland.

The Review exercise has considered the potential role for HE researchers in facilitating and enabling the wider and deeper development of enterprise R&D activity which would be expected to contribute significantly to strengthening the long-term sustainability and future prospects of such firms. In that context and with that outcome in mind, it is opportune to focus on the mechanisms that could be utilised to strengthen HE Research's engagement with enterprise, including through supporting researcher mobility into industry.

⁴ Note: while the KTI Survey covers slightly more RPOs than the HEIs, the vast majority are HEIs.

As documented in the CSO [BERD Survey 2017-18](#), research personnel employed in enterprise have been increasing. However, it is unlikely that the Innovation 2020 target of 40,000 will be met, with just over 27,000 R&D personnel in enterprise by the end of 2017. According to the survey, small enterprises accounted for 39% of all PhD-qualified researchers in enterprise; 41% were in large enterprises, with just one in five in medium-sized enterprises. Differences between the BERD results below and Census information on the number of PhD-holders employed outside higher education may indicate that research graduates are being employed in enterprise in non-research roles and this, in turn, may be an indication of the importance of their transferable skills to both their employment prospects and to companies across Ireland. Further analysis of researcher mobility into enterprise would help to ensure that any future policy actions in this space are appropriately targeted.

CSO BERD Survey 2017-18 Enterprise Sector Research Personnel (Headcount) 2007-2017

	2007	2009	2011	2013	2015	2017
PhD qualified researchers	1179	1639	1551	2181	2163	2195
Other researchers	7063	7321	9067	11569	12011	13410
Technicians	2949	3572	4479	5893	6942	7391
Support staff	2760	3241	3971	5142	5220	4324
All research and development staff	13950	15773	19068	24785	26336	27320

5.2 With the Citizen and With Civic Society

There are broadly three constituent elements to this strand: public awareness, civic engagement in the research process and citizen science. Over the last decade, HEIs have grown their public awareness activities in order to inform the public of the research activities that are underway and, more generally, to increase public awareness of research and its value to society. A KPI specifically for Education and Public Engagement (EPE) was introduced for SFI-supported Research Centres in 2017, while events such as European Researcher Night have become part of the annual calendar. Many researchers across the country engage with primary and secondary schools as part of their outreach activities. One (rare) positive impact of the COVID-19 crisis is that it has generated significant public interest in research.

Under the Higher Education [System Performance Framework 2018-2020](#), civic engagement is encompassed under System Objective#2: ‘Creating rich opportunities for national and international engagement which enhances the learning environment and delivers a strong bridge to enterprise and the wider community’. Civic society engagement with research is supported through the IRC’s [New Foundations](#) programme, through which the Council collaborates with The Wheel and Dóchas to support researchers working with community organisations or NGOs. In addition, the mission of [Campus Engage](#) is to advance civic engagement with higher education, including with research. It provides a host of resources, including policy briefings, guides and training, in support of this. The Health Research Board also is leading work to involve patients in its research funding activities through their [PPI](#) work.

Thirdly, citizen science is gaining increasing traction internationally manifested, for example, in the support provided for it under Horizon 2020 (under its Science with and for Society strand). The underlying objective of “citizen science” is to focus on moving the citizen up the ‘research activity chain’ advancing the main citizen involvement from one primarily of dissemination and outreach to

one where the citizen may, for example, help to collect scientific evidence. Some work is underway in building citizen science in Ireland, but it is at an early stage of development.

It may be useful - within the context of the Innovation 2020 successor strategy and the mission-oriented approach that will be considered in Theme F – to explore whether it is time for a system-wide push in this area. In order to understand its potential, further information from the institutions would be helpful on how they systematically support their researchers to engage in this, and about the extent to which it features in career progression processes.

5.3 Internationally

Under Horizon 2020 (as of April 2020), Ireland has secured €911.4m in EU funding and the HE Research system has secured 56% of this. Ireland's top five international research collaborators in it are Germany, the United Kingdom, Spain, France and Italy. The departure of the UK from the EU could mean, depending on the nature of any associate membership of Horizon Europe, not only the loss of a key project collaborator but also the loss of a like-minded partner in negotiations on the future direction of Horizon Europe and its constituent work programmes.

Ireland's post-Brexit research engagement therefore needs to be reformulated in terms of opportunities within the EU27, Ireland- UK, on an all-island basis and globally.

Deepening strategic engagement with other EU Member States is critical. HE Research in Ireland must build new EU alliances including with the EU13 (newer Member States) and position itself for a changed landscape of Member States against the backdrop of Horizon Europe. At EU level, as well as the planning for Horizon Europe (being undertaken within the wider context of the next Multiannual Financial Framework), there are other potentially significant developments. The first is the re-organisation of the European Commission portfolios in which research is now incorporated into the Innovation and Youth portfolio, bringing education, research and innovation under the one umbrella. Secondly, the Commission has launched the [European Universities Initiative](#) (EUI) with the aim of building 'European Universities' by 2024 that will bolster the European Education Area. While this initiative is situated within Erasmus+, it is now being connected into Horizon 2020 through support for successful EUI consortia to develop their research dimension.

Bilaterally, the UK is consistently one of Ireland's top five collaborators (whereas Ireland has traditionally featured somewhere around 17th place as a research collaborator for the UK). The strong connection and shared heritage between the two countries' academic cultures provide a very strong foundation for intensifying collaboration in particular for Ireland because of its smaller scale. The UK's departure from the EU, as well as having financial implications for Horizon Europe, may also have financial ramifications for INTERREG, an important issue for HE Research on the whole island of Ireland, and in particular for institutions located near the Border.

Finding ways to preserve Ireland's vital bilateral HE Research relationship with the UK outside the traditional European framework is therefore important. In support of this, the Irish Research Council has signed a trilateral Memorandum of Understanding with UK Research & Innovation and Science Foundation Ireland. The scale of interest in the Council's 2020 joint call with the UK's Economic and Social Research Council illustrates the continuing value of our bilateral relationship with the UK. The work of the [British-Irish Chamber of Commerce](#) and the [Royal Irish Academy](#) is also directed towards this purpose.

The all-island research agenda has understandably received renewed attention in light of Brexit. Activity within Horizon 2020 provides an approximate indication of engagement: there have been 83 collaborative North-South projects thus far. For H2020 participants in the State, approximately 8-9% of their Horizon 2020 projects include Northern Irish partners; the figure stands far higher at 35-45% for Northern Irish H2020 projects including Irish partners. [Universities Ireland](#) (Irish universities plus their Northern Irish counterparts) have convened to discuss shared issues in higher education research on the island.

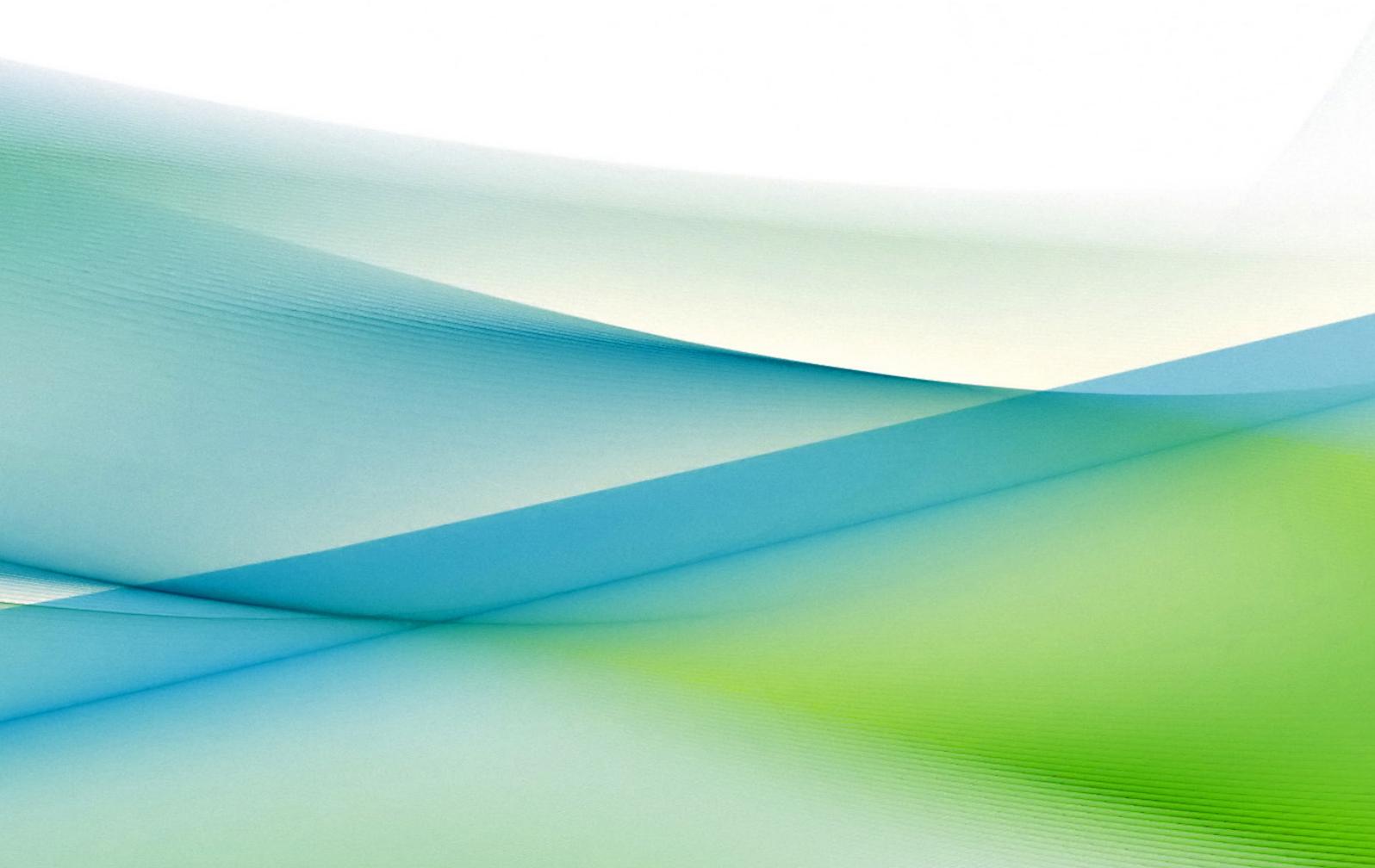
Beyond the EU, institutions and indeed research funders will need to explore possibilities for wider cooperation with international funders and private Foundations, for instance, in the US, Africa, India and China. The possibilities of leveraging existing global connections, for example through international education partnerships, IDA opportunity-spotting and Enterprise Ireland trade missions, may provide the basis to develop and strengthen these partnerships further.

Emerging Policy Insights

- Research is an integral pillar of the engagement between higher education institutions and industry. As noted previously, collaboration and commercialisation levels are strong overall, but these have not been matched by growth in researcher employment in enterprise, which is comparatively at low levels and the reasons for this require closer examination. There is potential for graduate HE researchers to boost research activity in firms, a national policy objective. Such a development could also, over time, ease the concentration of R&D capacity within industry from the current concentration in a relatively small number of firms and contribute to improving the, currently lagging, productivity levels of the indigenous sector. Further analysis of the determinants of the supply and demand balances for researchers in industry would also aid understanding of how recruitment into it could be promoted and potentially incentivised as necessary.
- The public's interest in research has grown significantly with the pandemic and the search for a vaccine. Civic engagement in the research process has already been seeded through a number of activities and it may now be opportune to look at how this can be systematically embedded and expanded.
- To date, the international context for Ireland's HE Research system has reflected a strong reliance on research collaborations with the UK. Its departure from the EU has created a significant risk to the level of international connectedness of the Irish HE Research system, in particular in the context of the EU funding of HE Research under Horizon Europe. A major effort will be required to re-orientate the system and to intensify research linkages with other EU Member States.
- At the same time, it will be vital to maintain those with the UK and in particular with Northern Ireland on an all-island basis. Some initiatives already in train may help to protect and bolster cooperation with Great Britain. All-island research activity could be catalysed to build on the range of existing connections that are illustrated in Horizon 2020 North-South collaborations to date.
- Other global developments also continue to shape and influence the HE Research system's international engagement potential. One of these is the Open Research agenda. Notwithstanding the challenge it creates for traditional research models, this is a very positive development. Though the potential impacts are yet to be fully clear, the scale and priorities of the EU's next Multiannual Financial Framework, will be a factor. A cohesive and more collaborative approach within the Irish HE Research community is the best strategy for yielding dividends when navigating the evolving global environment for HE Research.

Section 6

**Theme D: Higher Education Research, Innovation Districts
& Regional Clusters**



Theme D: Higher Education Research, Innovation Districts & Regional Clusters

Higher Education Research can play an important role in the realisation of nationwide agendas like sustainable regional development and tackling the productivity gap. Research-intensive institutions can anchor innovation districts, driving highly innovative activity across multiple proximate actors. HE Research can serve at the heart of clusters throughout the country that boost knowledge diffusion, with particular regard to indigenous enterprise development.

This theme considers:

- The role of HE Research in sustainable regional development and the national productivity agenda
- How HE clustering policy has evolved and
- How, in practice, it can manifest itself most effectively in light of the particular needs and strengths of its region.

6.1 Nationwide Challenges

HE Research can help to deliver key national strategies including Project Ireland 2040 (and the associated 2018-2027 National Development Plan) which aims to achieve sustainable and balanced regional development, a major Government objective. Ireland's productivity challenges are highlighted in Future Jobs Ireland, with research and innovation forming a key part of the planned response.

Sustainable Regional Development

Sustainable and balanced regional development is critical to Ireland's long-term economic, social and environmental performance. The challenge cascades into enterprise R&D activity: according to the BERD Survey 2017-2018:

- The Eastern & Midland region spent €1.8bn (67%), the South €582m (21%) and the North & West €327m (12%) in business expenditure on R&D.
- The Eastern and Midland region accounted for 60% of all R&D personnel in enterprise, compared with 24% in the South and 15% in the North and West.

Project Ireland 2040 and the associated 2018-2027 National Development Plan seek, *inter alia*, to address these imbalances, and contain four Funds with significant monies attached:

- €2bn Urban Regeneration and Regeneration Fund,
- €1bn Rural Development Fund,
- €500m Climate Action Fund,
- €500m Disruptive Technologies Innovation Fund.

The NDP's National Strategic Outcome #5 (“A strong economy supported by enterprise, innovation and skills”) is the most relevant to HE Research. This objective is to be achieved by:

- Supporting entrepreneurialism and building competitive clusters,
- Sustaining talent and boosting human capital in all regions,
- Digital and data innovation.

Enterprise Ireland's [Regional Technology Clustering Fund](#) is also relevant here.

The Productivity Gap

While overall productivity levels in Ireland are high, Ireland has experienced a longstanding challenge in boosting productivity in indigenous SMEs, whose levels are far behind those of foreign-owned ‘frontier firms’. The National Competitiveness Council's [2019 Productivity Statement](#) noted that:

- At enterprise-sector level in the 2000-2017 period, the annual average growth rate of labour productivity in the Foreign-owned Multinational Enterprise (MNE) dominated sector was 9.3%, compared with 2.3% in the Domestic and Other sector (which in turn was higher than the EU average of 1.3%).
- While there is clear evidence about the direct contribution made by a highly productive and concentrated group of MNEs to the Irish economy, there is less clarity about the productivity performance of an increasingly diverse domestic sector, where both high-performing and low-performing sectors and SMEs seem to co-exist.

Addressing this productivity gap forms a central objective of Future Jobs Ireland which targets an annual increase in multifactor productivity in the domestic sectors of the economy by 1% per year to 2025.

Unsurprisingly, this uneven spread of productivity performance flows through into enterprise R&D activity: while business expenditure on R&D (BERD) reached €2.8bn in 2017, this masks a massive concentration in a very small number of firms: the largest 100 enterprises in terms of R&D accounted for 75% of BERD and 78% of Irish-owned enterprises spent less than €500,000 on R&D in 2017. As research has the potential to be a key driver of productivity, improvement in the spread of R&D activity across enterprises would be expected to play a significant role in enhancing productivity growth in the indigenous sector.

HE Research's contribution to nationwide agendas

Project Ireland 2040 cites the expansion of higher education as a key enabler for our cities and regions and its National Strategic Outcome #5 (“A strong economy supported by enterprise, innovation and skills”) is very directly relevant to the role and contribution of HE Research. The four Funds referred to above have seen some HE participation, particularly in regard to the Disruptive Technologies Innovation Fund.

Research undertaken in higher education can contribute strongly across at least three of Future Jobs Ireland's five pillars, namely:

- Embracing innovation and technological change,
- Improving SME productivity,
- Enhancing skills and developing and attracting talent.

In particular as discussed under Section 5.1 above, the higher education sector can play an important role in expanding the development of R&D-active enterprises, for example, through Enterprise Ireland's Innovation Vouchers and the Technology Gateways and potentially through increased researcher mobility into industry.

There is potential to enhance HE Research's future contribution to these national agendas through collaboratively planned engagement with them and with the existing available funding opportunities.

6.2 From Regional Economic Clustering to Innovation Districts

In Principle

In Ireland, the National Strategy for Higher Education (2011) highlighted the potential for the creation of regionally based clusters of collaborating higher education institutions. Such clusters or networks were seen to be central to the creation of the necessary engagement between the higher education system and both indigenous firms and multi-national businesses, to create regional economic clusters or 'knowledge hubs'.

As discussed previously, Project Ireland 2040 and the 2018-2027 National Development Plan reiterated the pivotal role of higher education institutions in supporting balanced regional development by enabling collaboration between the sector and enterprise, in particular by strengthening applied research and innovation in strategic sectors of the regional and national economy.

The Innovation District (ID) concept is the latest evolution of clustering good practice, with particular regard to regional innovation systems. An ID has clear potential to be a focal point for delivering on the Project Ireland 2040 and Future Jobs Ireland objectives articulated above. While underpinned by the same principles as those that apply in the case of regional economic clusters, IDs as described in more detail below are anchored in the concept of a more compact physically and geographically focused approach to creating a dynamic and vibrant network of key actors engaged intensively in research, development and innovation.

International experience demonstrates that IDs are multi-faceted, and each ID is unique and atypical in its own terms, but several common characteristics can be identified including: -

- The presence of leading-edge anchor institutions often comprising research-intensive higher education institutions closely connected to clusters of innovative, technology intensive enterprises, which in turn prioritise their research activities.
- The presence of multiple actors – companies, entrepreneurs, skills workers, researchers and innovators – across disparate business sectors and institutions, possessing different knowledge and expertise that can be combined in creative and innovative ways to commercialise new ideas through co-invention and co-production, leading to new discoveries being brought to the market.
- High level of proximity, density and agglomeration, as the research suggests, shows that knowledge spillovers appear to be highly localised in some instances dissipating quickly with distance.
- Open innovation is considered essential to the success of IDs, requiring extensive and intensive collaboration and networking between participants in the ID. This is imperative to the seamless transfer of knowledge and the acceleration of innovation that has underpinned the strongest international examples of successful IDs.

- Functional and organisational boundaries between the different participants need to be quite porous for IDs to be effective.

In light of the factors above, IDs have therefore been described as diverse combinations of economic, physical, networking and institutional assets. They need to be underpinned by the existence and activation of strong pre-existing core competencies to build up the ID's competitive position.

In this vein, international research and experience emphasise the core role of research-intensive HEIs in securing the success of IDs. Their presence at the heart of an ID will serve to ensure that its activities and outcomes are defined by:

- A bedrock of internationally competitive cutting-edge research,
- The ability to grow, attract, develop and retain a pool of talented researchers,
- The establishment of knowledge-intensive hubs for attracting and building research-intensive companies, investment and catalysing innovation.

The ID concept therefore has the potential, in principle, to knit together in an integrated way all of the key actors required for success. In this context, the role of collaborating research-intensive higher education institutions at the heart of the ID is critical. This collaboration needs to be of a nature and extent going well beyond what has been achieved in the past.

In Practice

The way in which the ID concept can be most effectively implemented in Ireland would benefit from further analysis. It is important to recognise that such clusters or districts should not be uniform and homogenous. An important defining factor will be the particular research specialisations of the research performers involved, in keeping with the principles underpinning smart specialisation strategies. Differentiated implementation approaches adopted will be shaped by the starting and evolving research intensity of the base: enterprise as well as academic. It is also important to acknowledge that the primary public objectives involved in IDs/regional clusters will differ and therefore how they can be optimally developed will also differ. It is crucial that there is an explicit understanding of these necessary differences at the outset in order to achieve a clarity of purpose in terms of the public policy objectives and associated appropriate supports.

In a less research-intensive district or cluster, key policy objectives would be likely to prioritise the productivity agenda and knowledge diffusion with a particular focus on the SME sector. The imperative for more companies to become more research-intensive, thereby becoming more productive and, ultimately, more successful and resilient, lies at the heart of the Future Jobs Ireland agenda and strongly reflects international best practice and policy advice. HE Research can play a critical role in supporting indigenous firms to move up the R&D-activity chain and, as noted earlier, this is supported by several Enterprise Ireland initiatives such as the [Innovation Vouchers](#) and [Technology Gateway](#) programmes.

By way of another example, in a highly research-intensive district, the main focus will be expected, from the outset, to include research commercialisation through research spin-out companies and the attraction of FDI research operations. There is also a potential role for spillover activity to enhance the spread of productivity performance throughout the district.

The creation of Technological Universities (TUs) is a significant development in the context of clustering in Ireland. Arising from a recommendation of the National Strategy for Higher Education, the TU

legislation was passed. On 1 January 2019, [TU Dublin](#) came into being and others are at varying stages of formation. The [October 2019 report](#) of the Technological University Research Network (TURN) identifies the building of TU research capacity as one of its three priority investment pillars. This will include:

- Developing researcher human capital,
- Facilitating research activity and opportunities for existing academic staff,
- Addressing infrastructural deficits,
- Prioritising research strategies within TUs, and
- Exploiting fully the mutually supporting roles of teaching and research.

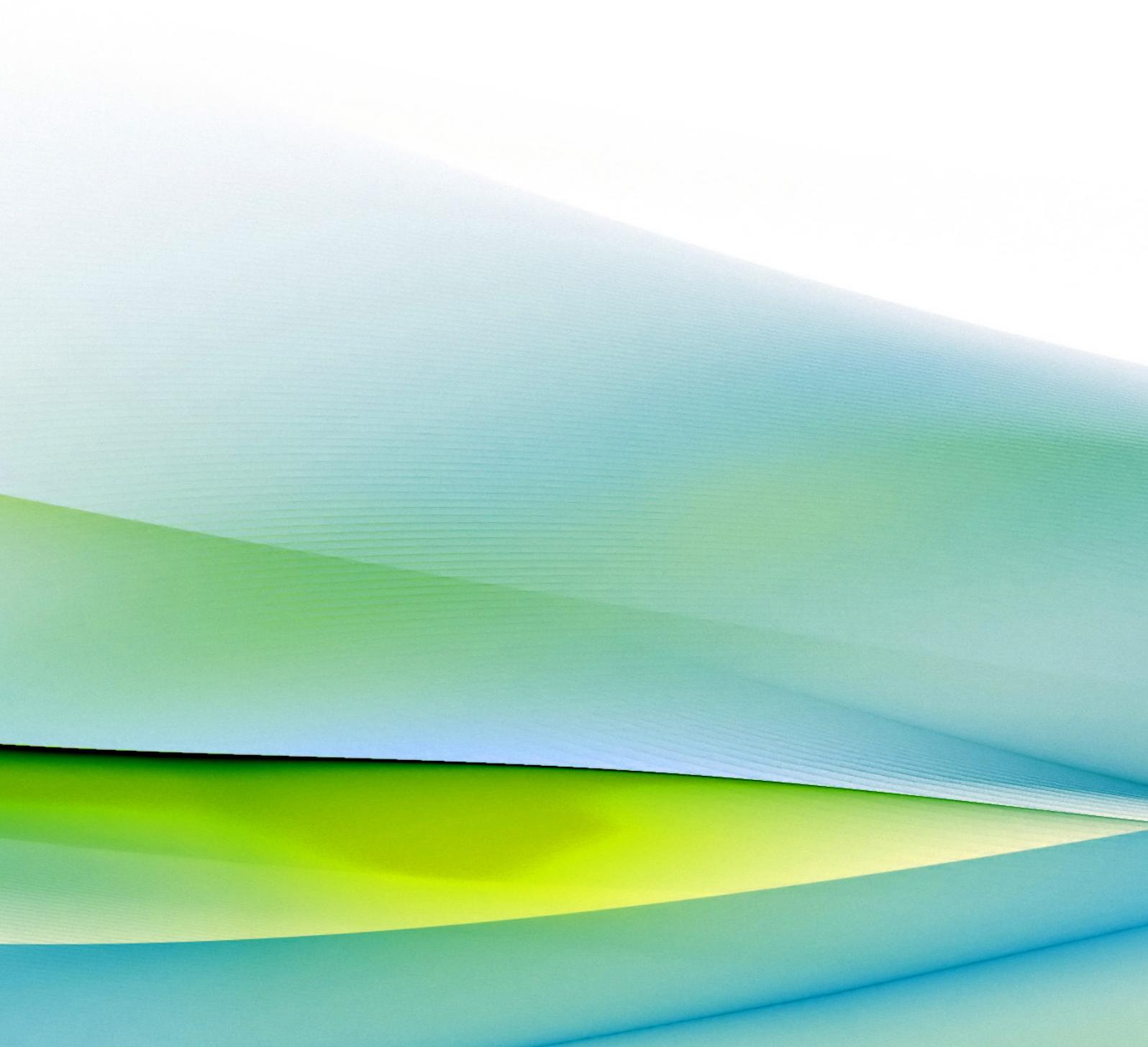
In the HERD Surveys (please see also Section 4.1), overall expenditure in HE Research has usually consistently broken down into 88% and 12% between the university and technological higher education sectors respectively. As set out in the TURN report, the establishment of TUs and their expected increased research intensity, will require support for research capacity growth and capability in order to enable them to achieve their mission.

Another potentially powerful development in this context is the proposed [Grand Canal Innovation District](#) initiative in Dublin for which an Advisory Group report was published by Government at the start of 2020. This seeks to mirror other locations such as Rotterdam and Boston by creating an innovative space (in this instance, the Grand Canal area in Dublin) in which knowledge generation and diffusion within it is planned to be concentrated and accelerated.

Also, while the further education sector is not traditionally considered within the context of a national innovation system, it can play a vital part in knowledge diffusion in regions. It has greater relevance and potential in this context than has been recognised in Ireland heretofore. Upskilling and reskilling is a central component of knowledge diffusion and an October 2019 European Commission [JRC report](#) highlights the role that FET can play in *“supporting diffusion of innovation, providing relevant skills for industrial development and overall supporting local/ regional innovation ecosystems”*.

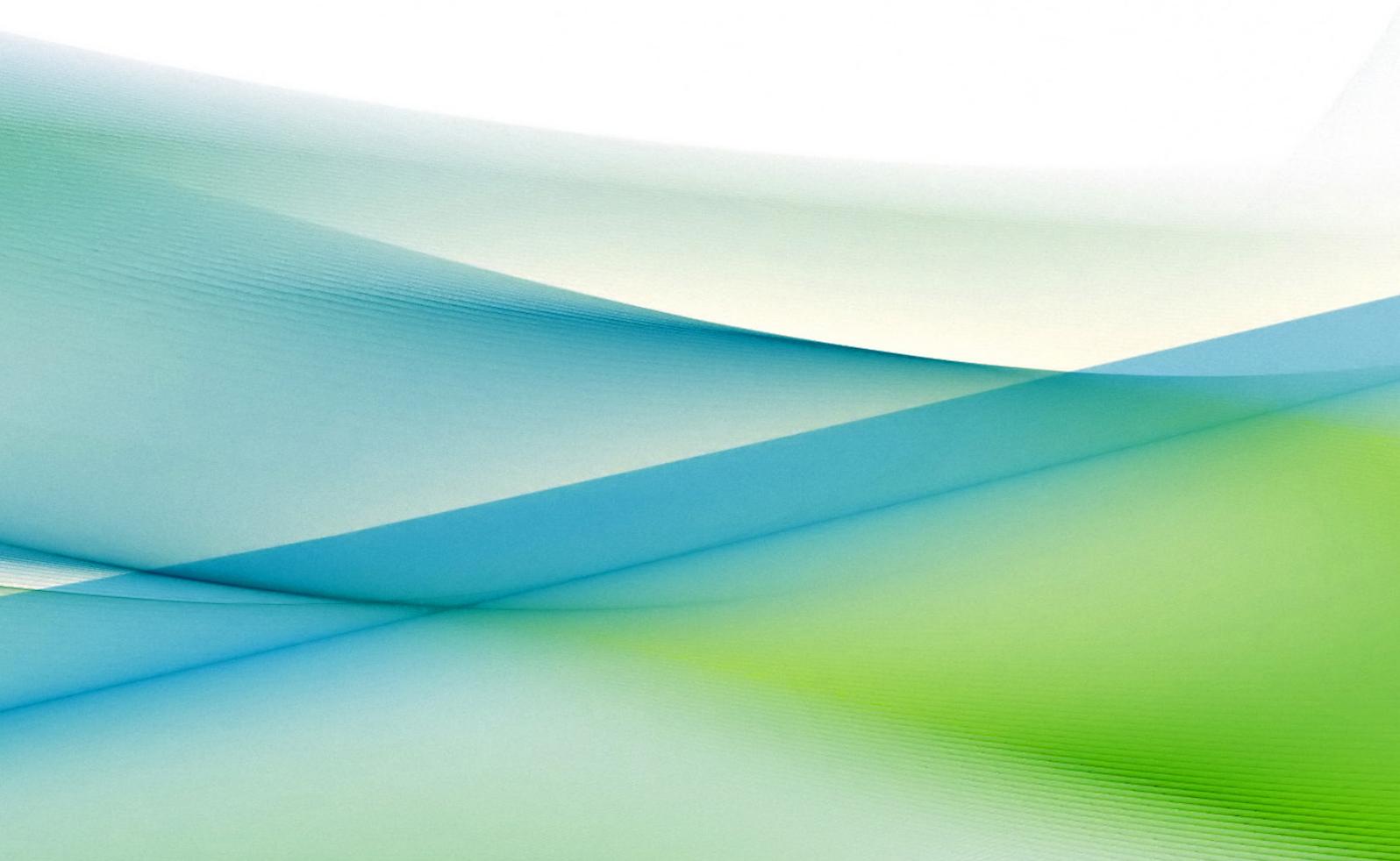
Emerging Policy Insights

- Pivoting back from the international to the regional perspective, Government priorities such as Project Ireland 2040 and Future Jobs Ireland emphasise the pivotal role that HE Research can play in achieving overarching strategic national objectives. These relate, for example, to securing balanced regional development and enhancing productivity levels within the indigenous sector. Individual higher education institutions are contributing to these objectives through, inter alia, their role in building regional economic clusters and there is scope to achieve a substantial amount more through a more sustained collaborative effort by higher education institutions particularly in regional cities. Over the last ten years, a core principle of higher education strategy has been to build strong clusters of higher education institutions, which in turn could function as engines of regional development and growth. This is particularly relevant for HE Research. A major recommitment to this objective is now essential to help underpin the next phase of regional development and growth.
- The anchor role of research-intensive higher education institutions in the development of innovation districts is firmly established by international experience and understandings of prerequisites for success. The higher education system, and in particular the emerging Technological University sector, must progressively build its research intensity in line with the recommendations of the TURN report to enhance the research intensity of the regional base, to ensure that the essential success factors of both knowledge generation and knowledge diffusion are put in place to underpin ‘sticky regions’. These are regions characterised by a virtuous circle of strong high productivity indigenous firms, with a research and innovation capacity rooted and sourced in HE Research.
- The resources of Project Ireland 2040 through the various funds established under the NDP have the potential to generate a significant impact in these areas. Approaching funding opportunities provided by these Funds in a more collaborative and planned way has the potential to enhance the flows of funding to higher education in general and HE Research specifically.



Section 7

Theme E: The Researcher



Theme E: The Researcher

Researchers lie at the heart of Ireland’s research performance. They make the new discoveries, undertake the research activity, draw on their expertise for the benefit of students and public policymaking, work with enterprise, and boost Ireland’s global reputation. A sustainable researcher pipeline with clear career pathways is an integral element of any successful research and innovation system. The requisite suite of researcher skills is evolving as international policy agendas such as Open Research and Research Integrity develop.

This theme considers:

- Researcher levels in Ireland,
- Career expectations and pathways,
- The skills with which researchers need to be equipped in order to succeed.

7.1 Researcher Levels

There has been a strong emphasis in national research strategies heretofore on increasing the numbers of researchers at all career stages, with particular attention paid to doctoral enrolments. This objective requires examination in terms of the demand for researchers at different career stages and the scope for early-stage researchers to progress within the research system in higher education.

The HERD Survey points to some interesting changes in the number of researchers at different career stages. Given the revised approach to the next Survey report as noted in Section 4.1, it is prudent to await that publication before examining in detail such changes. The different cohorts across researcher levels can then be examined with a view to ensuring an appropriate and sustainable pipeline.

In addition to considering the Survey plus latest international good practice, reference can be made back to the [Strategy for Science, Technology & Innovation 2006-2013](#) in which the balance across researcher cohorts, as set out in the table below, was recommended:

Science, Engineering and Technology		Humanities and Social Sciences	
Principal Investigator	1	Principal Investigator	1
Post Doc	3	Post Doc	2
Postgraduate	5	Postgraduate	3
Technician/ research manager/ assistant	1	Technician/ research manager/ assistant	-

With respect to technicians and support staff, in the higher education sector, they account for 13.5% of all research personnel, while in the enterprise sector, the corresponding ratio is 39% (ref DBEI Survey 2017-18, FTE). A further action is therefore to understand if the variation in these ratios represents sectoral norms or if either ratio is out of kilter with good practice.

In terms of researcher demand, it is estimated that, anecdotally, approximately 10% of doctoral

graduates will secure a career in academia in Ireland. Qualitatively, in terms of researchers moving into enterprise, there are anecdotes regarding over-qualification. In light of this and the variations between the CSO BERD Survey and Census data on PhD holders' employment, it would be desirable to have a deeper analysis of the characteristics of employer demand for researchers with a particular focus on doctoral (and masters by research) graduates, including whether, when employed by enterprise, they work as researchers or in other positions, as raised in Section 5.1.

7.2 Researcher Careers: expectations and pathways

Career Expectations

Improved data availability will not only help policymakers. It can also help researchers, especially those at the start of their careers, to make more informed decisions about starting on or continuing on a research career path. Clearer understanding of the extent of demand and researcher career opportunities would have a significant benefit in informing such decision-making. Higher education institutions' career offices can helpfully collaborate with their graduate studies offices to support, particularly doctoral students, in crystallising and managing their career expectations in an environment in which such a small proportion of researchers have a realistic prospect of progressing within the academic system. There are also opportunities for research funders to work together to ensure that there is parity of treatment across the system.

Researcher Pathways

Researcher pathways may manifest themselves in several ways, for example, into enterprise (both for-profit and not-for-profit), internationally and inter-institutionally. A clear signal emerging from the CSO BERD Survey findings is that many researchers who move into enterprise are taking up non-research roles, thereby underlining the importance of their transferable skills. As well as further analysis of employer demand for researchers, evidence on both international and inter-institutional HE researcher mobility may also help to inform strategic consideration of researcher mobility.

The Researcher Career Framework (the development of which is being led by the Irish Universities Association) as well as standardising terms and conditions, is intended as a tool for support institutional best practice in researcher career development. The Framework "recognises that, nationally and internationally, the majority of researchers trained by HEIs will ultimately continue their careers outside the HEI. Its purpose therefore is to prepare those entering the framework for a variety of careers in the public and private sector in research and non-research roles". In order to manage career expectations, including having regard to the current funding base for HE Research, it will be important to assess the application of this Framework in practice in the institutions and its realisation of this stated purpose.

7.3 Researcher Skills Development

The skills that researchers develop - whatever their domain expertise - are key to maximising their future employment prospects. Doctoral graduates develop competences, for example, in critical thinking, project management and communication. These transversal skills are at least as important, if not more so, to prospective employers than their research focus, especially given that, as discussed above, the vast majority of early-career researchers do not remain in academia and, as suggested by the BERD

Survey results, many of those who move into enterprise take up non-research roles.

Even within HE Research, the roles that researchers perform are wide-ranging and challenging. In addition to undertaking research, they are expected to engage with citizens, inspire students, collaborate with industry and collaborate internationally. Their capability and capacity to conduct excellent research in a global research environment remains vital while also evolving.

There is an evolving suite of researcher competences, including but not limited to open research, research integrity and intellectual property. The HEA's [Principles of Good Practice](#) in Higher Education Institutions in Ireland is relevant here and sets out seven key elements of good practice focused at institutional level:

- i. Excellence in research and academic freedom,
- ii. Research integrity and ethics,
- iii. Open Research,
- iv. Intellectual property and knowledge transfer,
- v. Researcher development,
- vi. Research project and programme management,
- vii. Dignity and respect.

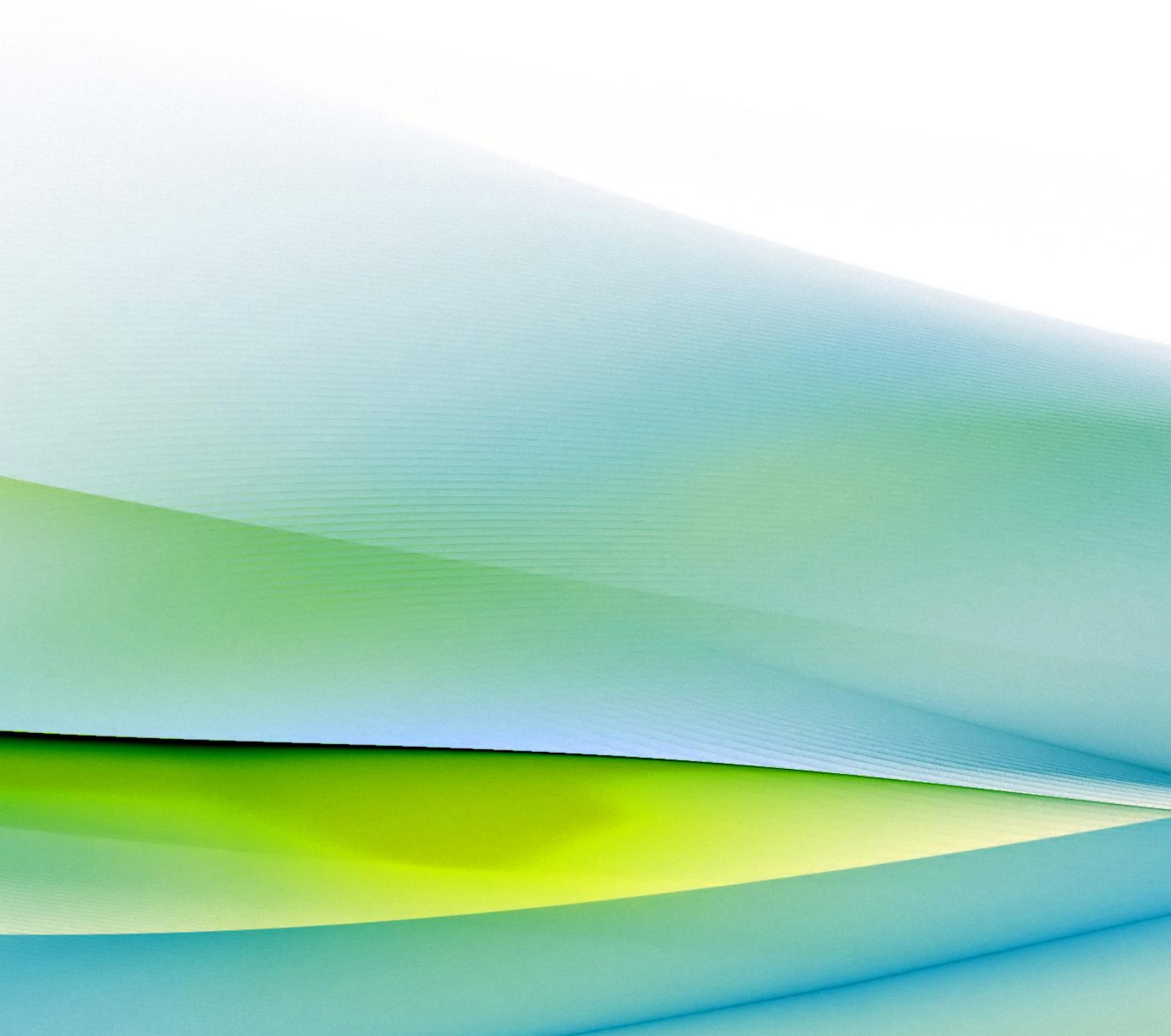
Within the higher education system, how researchers are rewarded by their institutions should reflect these competencies. As well as the evolving understanding of the value of HE Research that is articulated in Section 3 of this Review, improved assessment of scholarly research outputs has a critical role to play, for example through implementation of the [Declaration on Research Assessment](#) (DORA). Higher education institutions should review their recognition and promotion processes to ensure that they align with international best practice, in both researcher competence as well as HE Research impact.

There is varying information available on the levels of researcher training. It can depend on a number of factors, such as the host higher education institution and the (if any) competitive funding award with which the research is being supported. It is not clear if there is consistency across the HE Research sector as a whole. It would therefore be helpful for higher education institutions, as part of their implementation of the Researcher Career Framework, to review their researcher training to ensure that it consistently aligns with latest good practice, in both researcher competence, and higher education research impact.

Inter-institutional consistency also matters: inconsistency in the quality of researcher competence has potential implications for Ireland's international reputation in research. Implementation of initiatives such as the [National Framework for Doctoral Education](#) are important in this regard. Any development of a two-tier system will be detrimental to Ireland's attractiveness as a research partner internationally on account of any (real or perceived) variability in the standards of researcher competence and conduct. This consideration is also very relevant to enterprise as major employers of researchers.

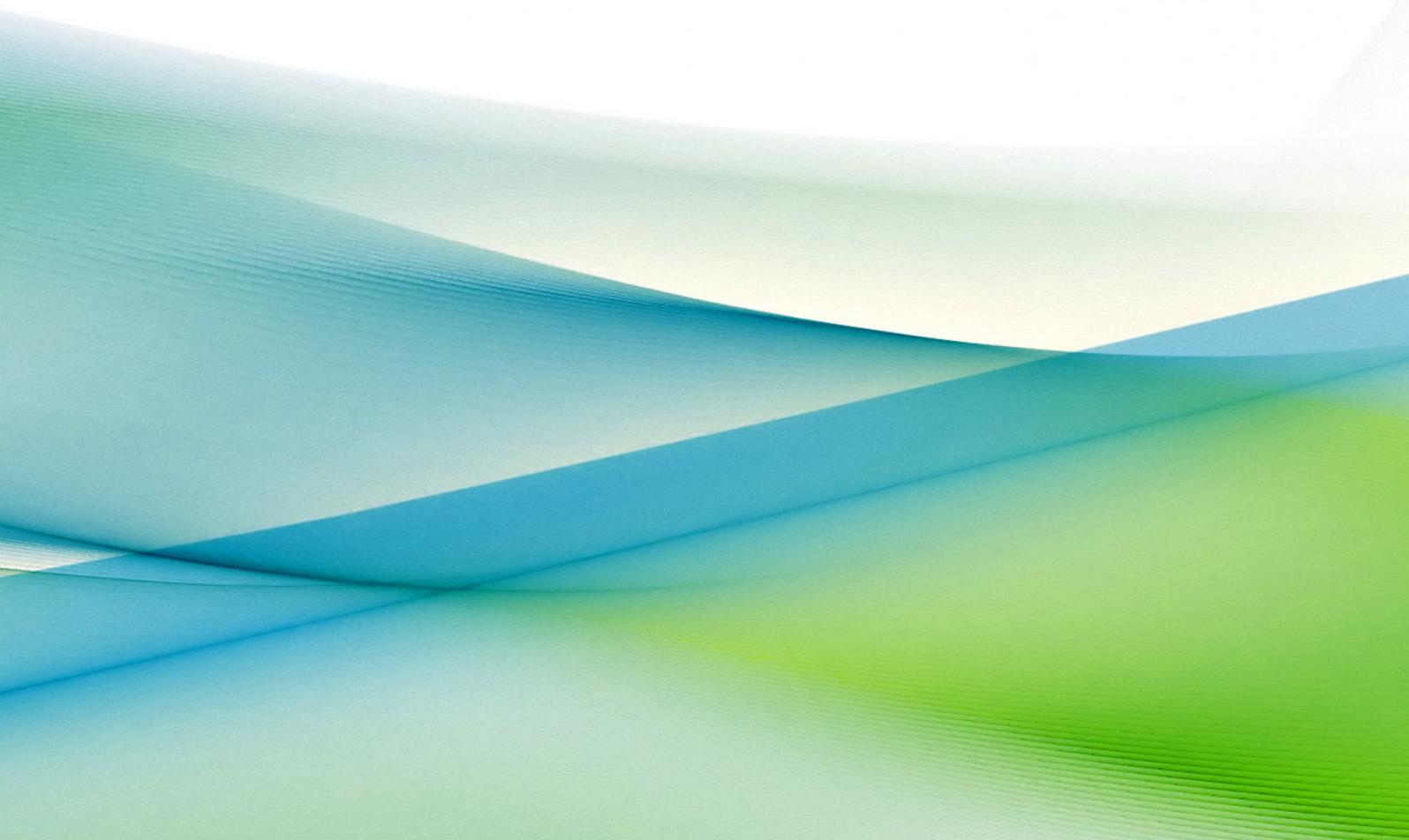
Emerging Policy Insights

- This Review has confirmed the imperative for focus on the research community, especially researchers at the early stages of their careers, as they comprise the talent pipeline for Ireland’s future capacity in research, development and innovation.
- National policy emphasis to date on researchers has taken a broad-based approach of growing researcher numbers overall, at each stage of career development. It is now appropriate to examine carefully whether the higher education system appropriately develops a sustainable research talent pipeline. It is also timely to encourage an expanded vision for researchers, to include not only their potential to remain in academia but also the scope for greater movement into industry, thereby contributing to the transformation of enterprise RDI capacity so essential to Ireland’s long-term economic performance and sustainability.
- This rethink should find focus in reshaping the way that early-career researchers are prepared for their careers. Clarity (and parity of esteem) on the full suite of possible career pathways and the support to pursue them can be improved. Such management of career expectations is ideally fostered as early as possible, i.e., in advance of committing to doctoral studies.
- Throughout their careers, whatever their individual trajectory and career aspirations, researchers will need to be equipped with the broad range of transversal skills which are essential to their effectiveness on all career paths. Researcher preparation, incentivisation and promotion processes must be designed to recognise and value these skillsets. Such process design is critical to ensuring that HE Research is, in all instances, creating broader societal benefits and potential beyond what might be traditionally prioritised within the academic domain.
- Resolving the gap identified earlier in Theme A in evidencing the broader impacts of HE Research, is accentuated by the nature of the incentive system for researchers in higher education. The institutions should examine how best they can structure and organise their research models and incentives to deliver these broader impacts, while recognising traditional parameters of monodisciplinary practices. This should include consideration of researcher reward and recognition processes. Research funders need to ensure that their efforts are complementary and are designed to optimise all opportunities for achieving greater cohesiveness of the research system, and the researcher pipeline, as an interconnected whole.



Section 8

Theme F: A Mission-Oriented Approach



Theme F: A Mission-Oriented Approach

Consideration of a mission-oriented approach to research and innovation in Ireland encapsulates many of the themes and issues that have been surfaced during the Review exercise and throughout the preceding themes. It also reflects emerging international policy and practice.

It offers an organising framework within which the core issues of impact and balance examined in this Review can be progressed in an aligned and comprehensive fashion. A mission-oriented approach can enable a balance between directed research activity on specified needs and researchers responding to the overarching mission with creative exploratory research. It coalesces multiple disciplines around an overarching strategic outcome. It therefore has the potential to achieve greater and wider impacts, a taste of which has been seen in the research response to the pandemic, with enterprise innovations, evidence-based policies and medical progress being seen in Ireland and elsewhere.

This theme considers:

- Relevant international developments,
- What missions may mean for research disciplines,
- Ireland's mission-readiness.

8.1 International Developments

International research and innovation policy development increasingly explores the pursuit of missions. Bloom, Van Reenen & Williams (July 2019), as part of their work on '[A Toolkit of Policies to Promote Innovation](#)', consider the idea of a mission-oriented approach. They recognise that, in their discussion paper, they "*have taken a pragmatic and marginal approach: given a policymaker's constraints, what is the best use of resources to stimulate growth through innovation? However, this approach may be too conservative given the scale of the current productivity problems*". They put forward two arguments for what they describe as mission-based moonshots:

- "Moonshots may be justified in and of themselves. Climate change falls into this category...;
- "Moonshots may be justified based on political economy considerations. In order to generate significant extra resources for research, a politically sustainable vision needs to be created".

This perspective is developed further in Van Reenen's June 2020 [proposal](#) for a Grand Innovation Fund in the United States and the pursuit of a mission-oriented approach. It sets out five principles to underpin this:

1. The agency deciding how to disperse funding needs to be politically independent and run by experts.
2. The agency must be prepared to allow many failures, which are inherent to experimentation, rather than assuming that the government is capable of selecting (exclusively) winning approaches.

3. Different coalitions in different geographical areas can collaborate on competitive bids for these funds.
4. A variety of incentives and rewards could be used.
5. There should be an explicit set of criteria to make sure the resources are allocated geographically in a way that is both cost effective and productive.

In the EU, the European Commission's proposal for Horizon Europe is based on the following premise: *“Research and innovation deliver on citizens' priorities, boost the Union's productivity and competitiveness, and are crucial for sustaining our socioeconomic model and values, and for enabling solutions that address challenges in a more systemic way”*.

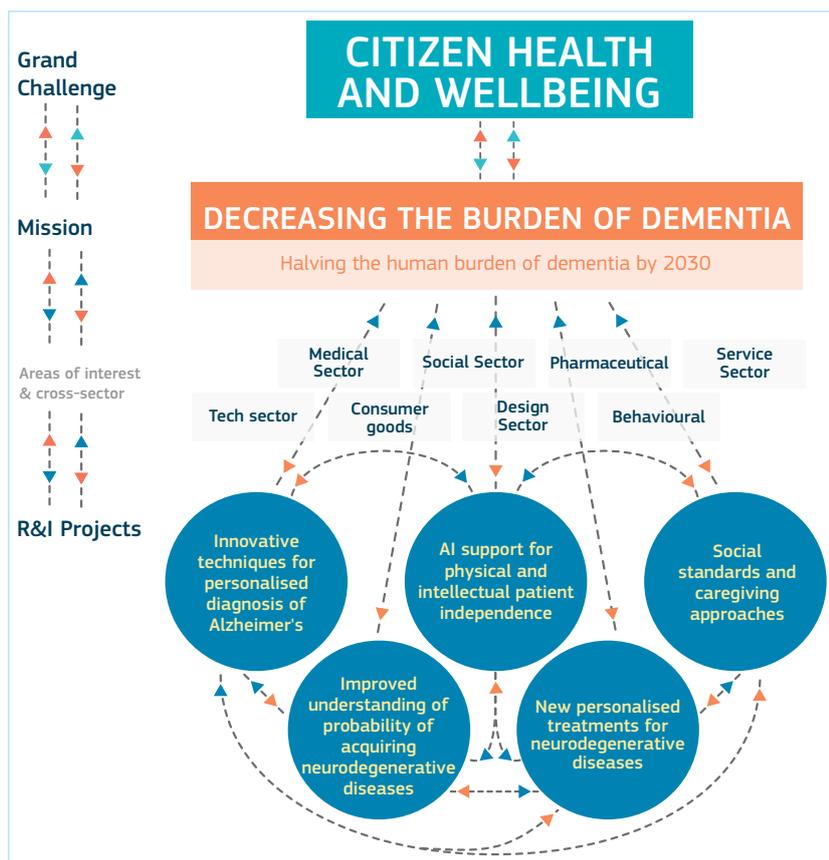
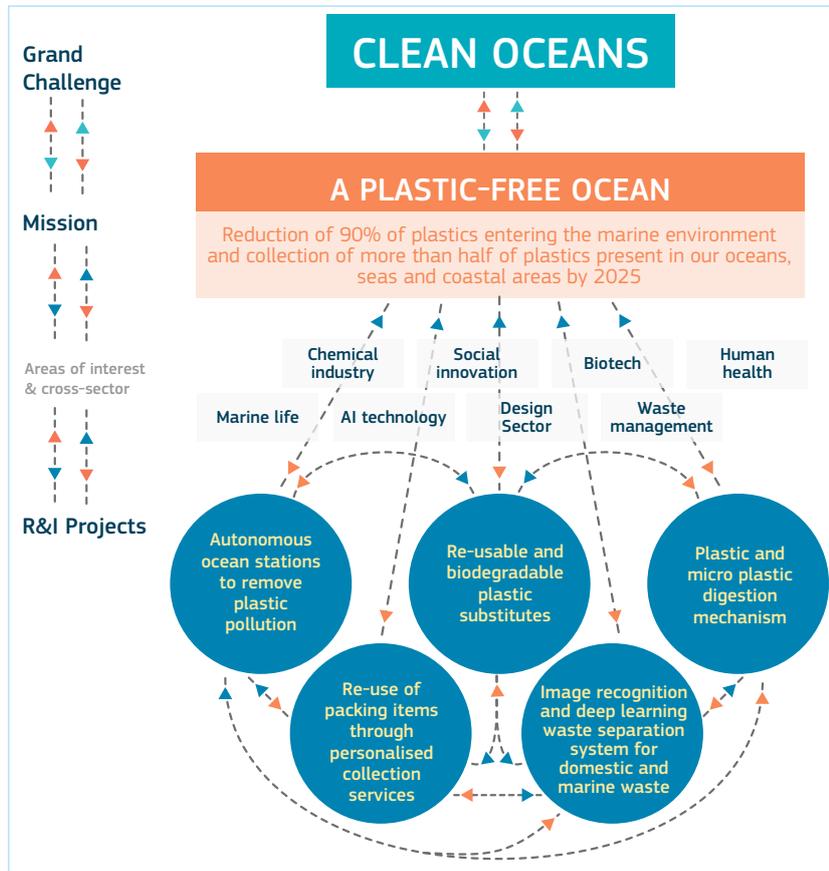
This language highlights the evolving international perspective on the role of research in national development: one where its economic function remains deeply valued yet, at the same time, its contribution to other dimensions of development, such as societal change, is now coming much more strongly to the fore. Horizon Europe sees the [introduction](#) of five Missions under Pillar Two (Global Challenges and European Industrial Competitiveness), currently comprising:

- Adapting to Climate Change, including societal transformation,
- Cancer,
- Climate-neutral and Smart Cities,
- Healthy oceans, seas, coastal and inland waters,
- Soil health and food.

In her 2018 [expert report](#) to the European Commission, Professor Mariana Mazzucato recommended the following criteria for selecting missions:

1. Bold, inspirational with wide societal relevance,
2. A clear direction, targeted, measurable and time-bound,
3. Ambitious but realistic research and innovation actions,
4. Cross-disciplinary, cross-sectoral and cross-actor innovation,
5. Multiple, bottom-up solutions.

Two mission examples from the 2018 Mazzucato report:



Developments at EU level reflect those globally and in individual countries. The UN’s Sustainable Development Goals provide a framework for global missions, while countries such as Denmark, the Netherlands and Norway are placing increasing focus on the societal role of their national research agendas. In a similar vein, in 2017, UKRI launched a £4.7bn Industrial Strategy Challenges Fund that focuses on four global trends (artificial intelligence and data; ageing society; clean growth; future of mobility) They [note](#) that they are currently “developing ambitious missions to tackle the Grand Challenges”.

8.2 Missions and Research Disciplines

Involvement of Many Research Disciplines

The illustrations above give some sense of the relevance of (nearly) all research disciplines to a mission. This is also borne out in the research community’s response to the pandemic where, what started naturally as a health and medical priority, has evolved into something far more encompassing, with research expertise from across the spectrum now engaged, for example, other ‘STEM’ disciplines such as ICT and engineering. The central importance of AHSS research is also crystallising and the [humanities](#) will help us to understand and learn from the historical context of this pandemic and others, as well as examining critical issues such as ethics, communication and philosophy.

The 2017 Lamy Report ([Lab-Fab-App](#)), from the high-level group to the European Commission on the design of Horizon Europe, notes that “Missions [...] will, by design, fully integrate social sciences and humanities (SSH). Where missions concern the big social questions of our time, for example, having rewarding work in an era of robotics, living and working well together in the culturally diverse cities or ensuring equal opportunities in or fair benefits from an innovative society, SSH researchers will initiate and lead them.” Pillar Two of Horizon Europe, in addition to Missions, contains six Clusters, one of which is ‘Culture, Creativity and Inclusive Society’. The AHSS have a natural leadership role to play here and a potentially powerful partnership role in the others.

Irish AHSS research performs strongly internationally: during this Review exercise, the IRC undertook an analysis of Ireland’s 2014-2018 performance in the European Research Council awards which found that the Irish success rate in STEM was 8.8%, while its AHSS success stood at 13.4%. Expenditure on AHSS research in Ireland predominantly comes through the HEA core funding to higher education institutions, and funding from the IRC. It has been, however, difficult to assess the impact of AHSS research investment, in large part because there are limited opportunities for large-scale competitive project funding for AHSS, and thus fewer resultant quantitative indicators of outputs and impact. As with other areas of research impact reviewed in Theme A, there are numerous case studies such as those showcased by the [Irish Humanities Alliance](#). Yet, in common with other impact areas, system-level evidence could not be sourced for the purposes of this Review.

An Increased Focus on Interdisciplinary Activity

As well as involving many disciplines, a movement towards missions brings far greater interdisciplinary research opportunities. Some public investment has been directed to this area in Ireland in recent years. Given that the intention of interdisciplinarity is the coalescence of multiple disciplines around a common agenda, it is essential that future public investment supports this progression by being neither fragmented nor duplicative. Secondly, the ‘friendliness’ of non-interdisciplinarity-explicit funding programmes is very important in supporting the development of a more generally interdisciplinarity-

driven research system. This will have implications, for example, for how research questions are framed and funding applications evaluated. The question also arises as to whether there may be a benefit in undertaking more “disruptive” investment to incentivise greater inter-disciplinary research.

In practice on the ground, interdisciplinary research activity is challenged by traditional monodisciplinary academic practices. A [2020 study](#) notes that “*career promotions, funding decisions and scientific publishing are based on peer-review procedures that tend to favour monodisciplinary research. [...] Interdisciplinary research takes more time than conventional research as well as special effort and commitment and [...] high communication and coordination costs*”. A researcher’s progression depends in large part on his/ her publications and citations track record, which typically come through monodisciplinary channels. This can disincentivise researchers from engaging in interdisciplinary research because not only may it not add to their promotion chances, it can therefore also detract from their available time to advance these. Statistical data collection processes can compound these challenges with a typically monodisciplinary research classification approach. Progression of Action 7.6 of Innovation 2020 for a research classification scheme for Ireland could potentially address some of these data collection issues.

It is, at the same time, important to acknowledge that – for both institutions and data collection - the “rules” of the research system are not set locally. The model of peer-reviewed publications is internationally-led and national data collection must also align with international frameworks, for example, Eurostat and the OECD. And it can never be forgotten that the potential for excellent interdisciplinary research will always be grounded in excellent disciplinary research.

8.3 Ireland’s Mission-Readiness

An increased emphasis on missions offers a new lens through which research investment and activity in Ireland could be focused. The approach does, of course, require further critical evaluation with key stakeholders in order to assess the appropriate overall research policy for a small country seeking to develop a “small open” research system (mirroring the kind of considerations that come into play for a small open economy like Ireland).

The progression of a mission-based approach would generate a number of important considerations for the future development of HE Research including:

- The core strategic objectives of publicly funded HE research (and their prioritisation),
- Identification of missions for Ireland,
- Alignment and oversight of approach to interdependent public investments in HE Research,
- An appropriate mix within any mission of directed and responsive research activity,
- And of research disciplines and interdisciplinary engagement,
- Realisation of greater forms of impact of HE Research.

The development of the core strategic objectives of publicly funded HE Research in Ireland can build on its evidenced contribution to economic success to over the last two decades. An evolving prioritisation of these strategic objectives is not a zero-sum game. The HE Research system will continue to be a key factor underpinning the economic commercialisation of research, innovation and economic growth. The Review highlighted that, in parallel to this, HE Research is expected to impact on a broader range of public policy objectives, including but not limited, to societal impacts.

In light of the international examples quoted above, the question arises as to what may be appropriate missions for Ireland, as well as an appropriate approach for identifying these and for overseeing their progress. In Ireland, the ten National Strategic Outcomes in Project Ireland 2040 are salient and highlight the scope for putting in place a clear framework for this purpose as follows:

1. Compact Growth
2. Enhanced Regional Accessibility
3. Strengthened Rural Economies and Communities
4. Sustainable Mobility
5. A Strong Economy Supported by Enterprise, Innovation and Skills
6. High Quality International Connectivity
7. Enhanced Amenity and Heritage
8. Transition to a Low-Carbon and Climate-Resilient Society
9. Sustainable Management of Water Waste and other Environmental Resources
10. Access to Quality Childcare, Education and Health Services

Another relevant approach is illustrated through the 2011 National Research Prioritisation Exercise. The fourteen areas established through the exercise have been used to steer competitive public research funding, with the driver being the creation of quantified economic returns. In 2018, the priorities were refreshed and refined into the following six research themes:-

- ICT,
- Health and wellbeing,
- Food,
- Energy, climate action and sustainability,
- Manufacturing and materials,
- Services and business processes.

Section 4.3 above outlines a range of investment interdependencies that would play out equally in a mission-framed scenario as they do now. In order to maximise the return on future public investment in HE Research, it is vital that these interdependencies are recognised and taken into account when (especially large-scale) investments are being made by research funders. The establishment of an advisory research council has the potential to bolster existing oversight arrangements.

The same section draws out the issue of directed and responsive research activity which appears to lie at the heart of many of the research community concerns about balance within the system. A mission-oriented approach can enable a balance between directed research activity on specified needs and researchers responding to the overarching mission with creative exploratory research that will generate previously unimagined solutions and opportunities. For both directed and responsive research, it can coalesce multiple disciplines around an overarching strategic outcome.

It therefore has the potential to achieve greater and wider impacts, as manifested in the research response to COVID-19 with enterprise innovations, evidence-based policies and medical progress being seen in Ireland and elsewhere. This broader vision of impact has been explored at the outset of this report in its opening Theme, in which the need for a stronger system-level evidence base for HE Research impact is highlighted. Achievement of this will be a critical step toward optimising the future HE Research system in Ireland.

Emerging Policy Insights

- Appreciation of the broader societal objectives of research is growing, as evidenced in international literature. It is also reflected in the shift at EU level in the direction of a mission-oriented approach, for example, in Horizon Europe and in the national plans of individual countries.
- It involves opening up to greater levels of interdisciplinary research and ensuring a more widely balanced system, building on existing strengths and on the deeper integration of AHSS research in national research and innovation systems. The power of interdisciplinarity is being borne out by the research community response to the pandemic where, what started naturally as a health and medical priority, has evolving into something far more encompassing. The central importance of AHSS research is also crystallising; drawing in for instance behavioural science, psychology, and economics.
- It is acknowledged that academic research performance, particularly in monodisciplinary areas, is among the most traditionally important determinants of career progression and success in academia. This wholly legitimate objective of researchers in higher education to produce excellent research should increasingly reside within an overall framework which continues to motivate such research, while also generating more widely identified public value.
- An increased emphasis on missions offers a new lens through which research activity and investment in Ireland could be focused. Evolution of this perspective on publicly funded HE Research in Ireland can build on its evidenced contribution to economic success to over the last two decades. In order to ensure the alignment between activity, investment and this expanding appreciation, research performers and research funders need to collaborate on the driving objectives and to reflect on their prioritisation.
- The question then arises as to what appropriate missions may be for Ireland, as well as the means by which to identify these and to oversee their progress. Effective oversight would involve sustained commitment, support and co-operation among a diversity of stakeholders. An advisory research council or similar could be a key enabler in achieving this level of balance.
- A mission-oriented approach can enable a balance between directed research activity on specified needs and researchers responding to the overarching mission with creative exploratory research. The critical investment interdependencies previously highlighted would play out equally in a mission scenario as they do now. They therefore need to be paid far greater attention in the interests of protecting the overall future sustainability and strength of the Irish HE Research system.

Appendix 1: Higher Education Research Group (HERG) Membership

(June 2020)

		Organisation	Position
Professor	Greg Hughes	Dublin City University	Vice-President for Research and Innovation
Professor	Ray O'Neill	Maynooth University	Vice-President for Research and Innovation
Professor	Linda Doyle	Trinity College Dublin	Dean of Research
Dr	John Donovan	TU Dublin	Head of Research
Dr	Niall Smith	Cork Institute of Technology	Head of Research
Dr	Lisa Keating	Irish Universities Association	Director of Research and Innovation
Dr	Jennifer Brennan	Technological Higher Education Association	Director of Research, Development and Innovation
	Sinead Riordan	Royal Irish Academy	Head of Policy and International Relations
	Peter Brown	Irish Research Council	Director
Dr	Eavan O'Brien	Irish Research Council	Assistant Director
	Tim Conlon	Higher Education Authority	Head of Policy and Strategic Planning
	Niall Kelly	Higher Education Authority	Policy Analyst
	Tim Cullinane	Department of Education and Skills (*up to July 2020)	
	William Beausang (Chair)	Department of Education and Skills (*Up to July 2020)	Assistant Secretary-General
	Nicki O'Connor (Secretariat)	Higher Education Authority	Senior Policy Advisor

* Establishment of new Department of Further and Higher Education, Research, Innovation and Science.

Appendix 2: Review Terms of Reference

1. Background

- 1.1 Research is a core part, and purpose, of the Irish higher education system. It advances human capital development within our higher education institutions (HEIs) through its contribution to curriculum development, teaching quality and students' exposure to the world of research.
- 1.2 Higher education research is a recognised central element of Ireland's national research and innovation ecosystem, all the more so in this country as the primary locus of public research activity. It underpins the innovative performance of enterprise in Ireland, both indigenous and foreign-owned, and contributes to the delivery of a range of key Government strategies including Project Ireland 2040, the National Skills Strategy and Future Jobs Ireland. It nurtures the pipeline of talented researchers and highly-skilled graduates that are key to Ireland's present and future performance.
- 1.3 Irish higher education research operates in a global context. It enriches Ireland's international reputation through its success in securing international research funding and its contribution to knowledge creation. Its engagement on global societal challenges not only has international benefits: it is fundamental to the response to key societal issues for Ireland such as climate action, healthcare and cultural progress.
- 1.4 These vital roles are recognised in relevant national strategies, including the National Strategy for Higher Education to 2030 and Innovation 2020. They are also manifested in the scale of public investment in higher education research⁵.

2. Department of Education and Skills Statement of Strategy 2019-2021 / Action Plan for Education 2019

- 2.1 One of the key Strategic Actions under Goal 4 of the Department of Education and Skills' Strategy Statement 2019-2021 is to maintain and improve standards of research and innovation in our HEIs, develop individual and collaborative talent, and ensure that there is tangible and positive impact upon society and the economy.
- 2.2 In furtherance of this, Action 61.1 of the Action Plan for Education 2019 requires the Department to produce a report which assesses the degree of balance within the higher education research system in Ireland, considers how that impacts on skills needs and future research capability, and sets out a roadmap of measures, where appropriate, to develop and manage an optimal research ecosystem.

3. Purpose of the Review

The overarching purpose of this high-level review is to:-

- Detail the current baseline Irish HE research system,
- Relate it to the latest international perspectives on the role of research,
- Set out Government ambition for the contribution and impact of HE research,

⁵ With reference to the Department of Business, Enterprise and Innovation's Survey of Research in the Higher Education Sector 2014-2015, roughly €5.7bn in public funding was invested in higher education research in the decade from 2006 to 2015.

- Assess the available evidence of the research system's realisation of these ambitions to date.

The review will also analyse key system interdependencies to examine how constituent elements of the HE research system interact with, and complement each other.

It will seek to determine the strengths and weaknesses of the current HE research system. It will also seek to identify reforms that would enhance the research ecosystem, as well as system gaps or barriers that are resulting in a potentially suboptimal outcome for the country, the citizen and the researcher.

The review is expected to inform the development of a strategic roadmap towards an optimal HE research system for Ireland.

3.1 The 'Ask' of Research Internationally

The review will look at the most up-to-date available international perspectives on the impact that research can have on a country's development, including but not limited to:

- Economic development, innovation, productivity and sustainable regional development,
- Societal challenges, including but not limited to health, environmental, cultural,
- Human capital and skills advancement,
- Reputational.

It will also explore the emphasis that other countries place on research as a means towards delivery of their national objectives, and whether or how this has evolved. And it will consider what part HE research plays in all of this internationally, both in principle and in practice.

3.2 The Irish Government's Ambitions for HE Research

Against this backdrop, the totality of the Irish Government's 'ask' of HE research will be set out, with a view to understanding better the extent to which HE research is recognised as a factor in Ireland's development to date and in the future. This will incorporate, for instance, Project Ireland 2040, enterprise development strategies, the National Skills Strategy and the sector's own ambitions for the Irish HE research system (as well naturally as the National Strategy for Higher Education and Innovation 2020).

3.3 Current Baseline Scale of the Irish HE Research System

With available system evidence, the baseline (~input) scale of the Irish HE research system will be detailed having regard to:

- Levels of expenditure on HE research, its spread across disciplines, basic-applied, and other relevant available data;
- Numbers of people working in HE research and again their spread as per available data;
- Capital investment: facilities, equipment, investment trends.

3.4 Its Impact

Utilising available evidence, the impact that the Irish HE research system has made to date will be reviewed. This element of the review will be informed by the framework developed by Campus Engage and the forms of impact that it sets out:

- Economic,
- Environmental,
- Health and wellbeing,
- Policy and/ or product development,
- Professional and personal services,
- Social and cultural,
- Internationalisation,
- Capacity-building,
- As well as new knowledge production.

3.5 Key System Interdependencies

A critical component of this review will be to examine how various elements of the Irish HE research system interact with each other when this is effective as well as circumstances in which sub-optimal outcomes are achieved. It will analyse key system dynamics and how they function together to generate impact and to support system sustainability. These may include:

- Interdependencies between basic and applied research,
- The spread of activity across research disciplines and how they (need to) work with each other in an increasingly mission-/ challenge-focused research environment,
- Reliance of international funding success upon national supports,
- Contribution of core funding, e.g., core-funded staff, to competitive funding success,
- Research led by individuals as compared with that led by centres,
- Capital investment and current investment.

This is intended to provide a picture of the interplay between what are sometimes viewed as distinct parts of the system (for example in terms of STEM and AHSS, or national research performance and international success) and how they, in fact, influence each other's impact.

A key element of this section will be to seek to elucidate how the HE research system functions as an essential and critical element of Ireland's current and future model of economic and social development. Having identified what works well, reforms will be considered to ensure that this diverse yet interconnected system is fit for future purpose.

3.6 Towards an Optimal HE Research Ecosystem for Ireland

This report on the significance of the Irish HE research system and its realisation of associated ambitions, contextualised by the system's baseline inputs, is crucial to developing an appropriate roadmap towards its optimisation. Building on this, a deeper understanding of system interdependencies will help ensure that future public investment is targeted such that it has maximum reach and positive effect.

4. Conduct of the Review

- 4.1 The Higher Education and Research Group (HERG) will serve as advisory group for this review. The HERG is chaired by the Department of Education and Skills and composed of representatives of the higher education institutions, their representative bodies (the Irish Universities Association and Technological Higher Education Association), the Irish Research Council, the Royal Irish Academy and the Higher Education Authority.
- 4.2 The Higher Education Authority will provide the secretariat for the review with support from other HERG members as appropriate.
- 4.3 Consultation with a broad range of stakeholders will be undertaken as part of the review.
- 4.4 The review will be completed by Q3 2019. Its foundational analysis may point to a future requirement for deeper examination of identified issues as well as evidence gaps that will need to be addressed.

