Strategy for Science, Technology & Innovation 2015-2020

Submission to the Consultation Process March 2015

Department of Education and Skills

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

Higher Education Authority

HEA | HIGHER EDUCATION AUTHORITY
AN tÚDARÁS um ARD-OIDEACHAS

Contents

Critical SSTI 2015-2020 Priorities

The Department of Education and Skills and the Higher Education Authority strongly welcome the formulation of a successor Strategy to the Strategy for Science, Technology and Innovation 2006-2013. Building on the preliminary views given in January 2015, we recommend that the structuring of the new national Strategy emerge only when the vision, baseline analysis and consequent key strategic areas and issues for the 2015-2020 period are developed and agreed. Pre-determination of 'pillars' can constrain the Strategy's formulation and therefore diminish its success. Nevertheless, this set of inputs is provided in accordance with the consultation paper's pillars: while this naturally limits the submission's fluidity, it is hoped that this approach will be most helpful to the IDC secretariat in its management of submission material received. For clarity of reading and in summary, the critical national strategic priorities in the development of SSTI 2015-2020 are identified as follows:

1. ***People are the lifeblood of this Strategy. In order to maximise the Stategy's impact on employment as well as on other national priorities and global societal challenges, Ireland's next generation of researchers and innovators require – and deserve – the best possible start from our higher education system. Full implementation of, and investment in, the National Strategy for Higher Education is essential to Ireland's success in research and innovation. This will manifest itself in strong institutions that are adequately resourced to educate those ~200,000 students enrolled across the country such that these students are empowered to secure jobs and create companies, as well as shape and contribute to their society.***
2. ***The totality of Ireland's public investment in research is out of step with our ambitions, our potential and other countries with which we compete. The extent to which researchers are supported systematically from early-stage onward to build their research performance will dictate Ireland's success in initiatives like the EU's Horizon2020. This starts with doctoral education where the recent decline in enrolments must be addressed. A graduated and cohesive suite of supports across starter, mid-career and advanced will maximise the future delivery of research impact. It will be enabled by increased investment by the Irish Research Council in research that is awarded competitively on the basis of excellence and not limited to pre-defined NRPE areas.***
3. ***Enhancing and maintaining our research infrastructure is fundamental to ensuring that Ireland's research and innovation ecosystem is internationally competitive and attractive. As seen elsewhere, successful infrastructural investments require an appropriate combination of physical and human capital to maximise their returns.***
4. ***Enterprise R&D capacity is a fundamental factor in this Strategy. Ireland needs more companies undertaking more research here if we are to realise our ambitions as a knowledge-intensive country. Successful industry-academic collaborations depend on the strength of both partners and the progress made under the last SSTI can be***

leveraged in this Strategy to increase industry-academic collaborations which will generate even greater economic and societal impact.

Overarching Feedback

The formulation of a successor strategy to the Strategy for Science, Technology and Innovation 2006-2013 is strongly welcomed by the Department of Education and Skills (DES) and the Higher Education Authority (HEA). It will form an integral part of Ireland's suite of national growth strategies, for example, the Action Plan for Jobs and the National Strategy for Higher Education, all of which place people at their core. It provides a clear opportunity to develop a new whole-of-Government strategy for research and innovation. This can build on the progress made to date in developing Ireland's research and innovation system, as well as addressing identified challenges. The formulation of a new Strategy is also timely as Ireland moves into a new phase of economic growth and societal development. It gives us the chance to advance fresh strategic ideas that will distinguish Ireland globally through its ability to make research work to maximum effect for a country.

Such returns will manifest themselves primarily in the form of skilled people capable of gaining and creating jobs, as well as innovative companies that will succeed internationally and provide employment, and that will leverage a vibrant public research base here to do so. This research base will have a strong global reputation, not only for the funding that it secures, but also on foot of its contribution to international research excellence, its attractiveness to foreign-owned firms across the world, and its catalytic role in the national innovation ecosystem.

Partner engagement

DES and the HEA also welcome the opening of the consultation process**.** Given the importance – both national and international – of its effect on Ireland's reputation as a country that thrives on and values new ideas and bright people, the Strategy's success will rely on taking a whole-of-Government approach to its development. Engagement of the research and innovation performers themselves will be pivotal to its formulation and its implementation. This is consistent with the recognition in the UK Strategy "Our Plan for Growth: science and innovation" (December 2014) that such a plan "*is for government, for business, and for the education system. It can only deliver if it is owned and supported by the science and innovation communities in academia and business, and by all those who work alongside them*". Performer engagement will lend strength to the Strategy through both the credibility of experience on which any such exercise should be based, as well as inclusive engagement in the agreed vision, goals and plans.

Continuing relevance of DES-HEA preliminary views

The 'preliminary views' provided by DES and the HEA in January 2015 stand, in terms of both the Strategy's development and its key ingredients for success. In order to develop the best possible Strategy for Ireland, a clear vision is required. Its defining characteristics plus a

robust baseline analysis will help to identify the key strategic issues and goals. The structure of the Strategy can only then naturally flow from this.

Maximising the opportunity

The formulation of SSTI 2015-2020 is a significant opportunity and it is incumbent on us to realise its maximum potential for Ireland. If we want our researchers to think big, then we must be prepared to do the same. In defining the scope of this Strategy, the December 2014 background paper identified "*an opportunity to set these [existing] policies in context and to be more comprehensive in the articulation of STI strategy at national level*". In our view, the opportunity is much bigger than this. The totality of Ireland's public investment in research is out of step with our ambitions, our potential and other countries with which we compete. The time is right for us to build on our research track record and on the high level of interdepartmental activity to outline an ambitious vision for the advancement of human and knowledge capital within a national innovation ecosystem for Ireland.

Re-defining research impact

Making research work to maximum effect for Ireland will manifest itself in many ways and the range of mutually beneficial linkages between enterprise and higher education must be maximised. The impact of public investment in research needs to be defined comprehensively, in particular reflecting its contribution to talent development and the variety of routes through which knowledge gets transferred and diffused throughout the ecosystem. The work that is currently being undertaken by Knowledge Transfer Ireland in this regard is welcomed.

… and innovation

Equally, innovation is much broader than technological innovation. And, just as technological innovation can take place in services companies, non-technological innovation is an essential element of all successful firms' performance. Nor is innovation solely an economic issue: it is at least as relevant to other sectors such as health and environment as well society more generally. This wider view of innovation is a growing feature of global dialogue, for instance on Responsible Research and Innovation, and in the recognised critical nexus between education, research, innovation and the citizen.

Systems approach to research and innovation

The Strategy's spectrum of elements will be optimised through the intra- and inter-linkages between the various actors, primarily enterprise and the higher education base. In order to achieve this, one must view Ireland's research and innovation system as exactly that: a system. Over the last two decades, the Government has consciously pursued this approach in order to underpin longer-term economic growth. National policies during this period

have been instrumental in the capacity-building of the Irish higher education research base, e.g. through PRTLI and SFI investments, and the building of connections by funders and the HEIs themselves with the enterprise base in Ireland, for instance through the Technology Centres. An important recent focus has been on the drive for enhanced impact and economic returns such as that now being encouraged by Knowledge Transfer Ireland and the Higher Education System Performance Framework 2014-16.

A critical function of this new Strategy will be the further improvement of linkages between the research and innovation performers within the Irish system (as well of course as the system's international connectivity) and its structure must empower rather than inhibit this potential. International thinking over recent years has re-emphasised the systems approach because of its potential to address global challenges such as ageing societies and climate change. It is a whole-of-Government approach because these issues are systemic in nature. Whole systems, rather than fragments of them, must transition if the challenges are to be successfully addressed. It also includes actors outside Government because of their recognised centrality to the innovation process.

The vision

Therefore, in articulating the vision of where we want this Strategy to bring Ireland's research and innovation ecosystem we must be comprehensive and ambitious. Our vision needs to reflect the needs and aspirations of the full ecosystem, for example:

By 2020, Ireland will be recognised globally as a place that makes research work to maximum effect for a country and its citizens. Our future resilience will manifest itself in the form of:

- *Talented educated people working in, and creating, innovative organisations that are responding to economic and societal challenges;*
- *An internationally competitive and connected research system in which ideas and people thrive, maximising the impact of Ireland's full research potential and underpinning the talent development of our future;*
- *A healthy vibrant society in which we advance the opportunities and needs of the full spectrum of our population: from the quarter of us who are under 16 to those in need of the best possible care and cures;*
- *Prosperity shared right across the country that sustains and leverages our natural resources and distinctive heritage.*

Global challenges will provide the foundation

The Strategy's development is an opportunity for Ireland to be at the forefront of international practice in the advancement of its national research and innovation system. Global societal challenges require policy actions right across technological, economic and societal domains, as well as national borders. They are being used more and more as the foundation for international research and innovation strategies, as illustrated in the Horizon2020 Societal Challenges. Their scale and global relevance will set the scene for

Ireland's future success in international markets – creating the very demand that innovative companies in Ireland will strive to meet - and for our research activities. Consequently, they should logically be positioned as such in the new Strategy, reflecting Ireland's ambitions for global research relevance and impact.

Success throughout will depend on people

As emphasised in our preliminary views, the successful realisation of all aspects of this Strategy will depend on people and the human capital dimension must therefore be a unifying thread right throughout the Strategy. The first progress report (June 2014) on Research Prioritisation notes that "*human capital is the single most important enabler for the NRPE*". Ireland's research and innovation can only be as good as the people that it can educate, train, attract and retain. It will be people who conduct the research, work in companies to drive innovative performance and create new innovative companies. Ireland has the most youthful population in the EU with one quarter of the population aged 16 and under. This is the reservoir of talent that has the capacity to transform Ireland's national economic and societal development into the future. A sustainable supply of future skilled researchers and innovators requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge.

"*Our people are the cornerstone of our success – known for their innovativeness and flexibility. Competition for talent is global – and talent is mobile. Ireland will be that place which nurtures talent to meet the needs of an advanced economy, developing its own people and attracting talent from around the world*." -Department of Jobs, Enterprise and Innovation, July 2014

Pillar 1: Investment in STI and Key Goals/ Targets

Future growth depends on innovation; future innovation depends on people

Innovation is widely accepted as key to economic growth and, as noted in the consultation paper, Ireland has performed well to date in delivering returns on RD&I investments. Innovation also goes hand in hand with societal development and tackling identified global challenges like climate change. The scale and global relevance of such challenges will set the scene for Ireland's future success in international markets – creating the very demand that innovative companies in Ireland will strive to meet - and for our research activities. Consequently, they should logically be positioned as such in the new Strategy, reflecting Ireland's ambitions for global research relevance and impact.

In order to maximise the role that innovation can play in Ireland's economy and society, it must be defined more broadly than technological innovation. And, just as technological innovation can take place in services companies, non-technological innovation is an essential element of all successful firms' performance. Nor is innovation solely an economic issue: it is at least as relevant to other sectors such as health and environment as well society more generally. This wider view of innovation is a growing feature of global dialogue, for instance on Responsible Research and Innovation, and in the recognised critical nexus between education, research, innovation and the citizen.

The OECD recognises that people are the lifeblood of innovative processes and outcomes. Closer to home, the 2015 Action Plan for Jobs recognises that "*key to innovation are people*" and the IDA's 2015-19 Winning strategy advises that "*The availability of talent will be the key differentiator for locations to win FDI in the future*".

Ireland's pipeline of researchers and innovators

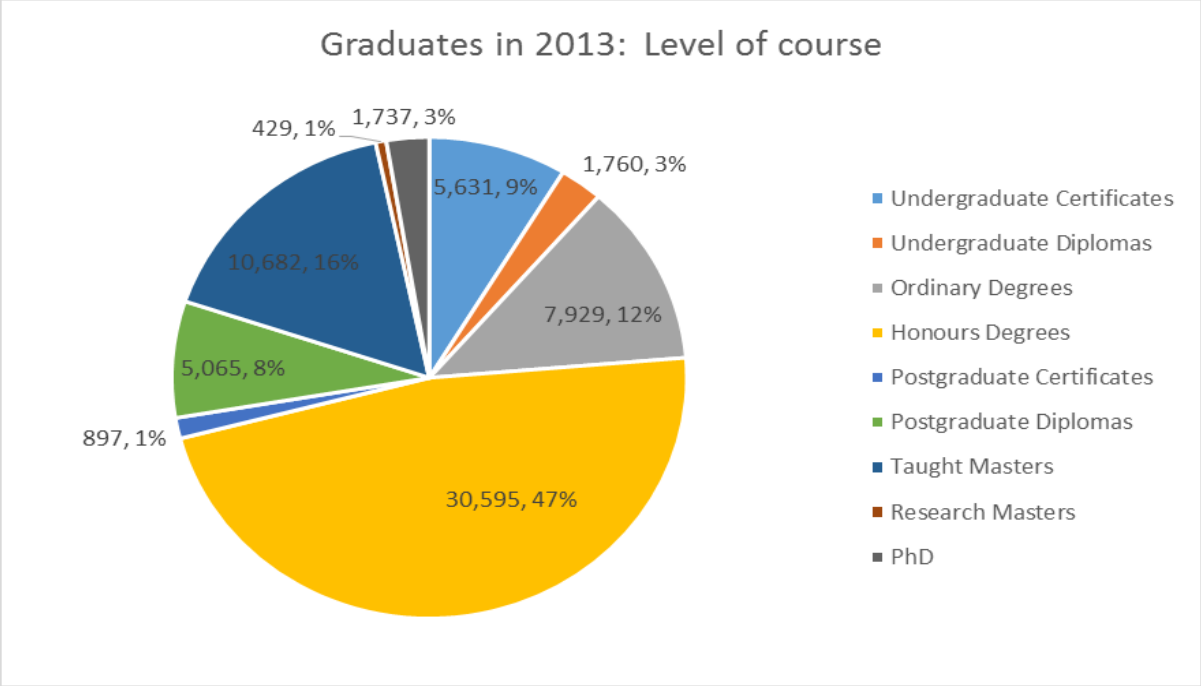
It is thus clear that job creation is inextricably connected to the employability of our people. Jobs will only be successfully created when people gain employment; and people can only gain employment if they are employable. In order therefore to deliver jobs through innovation, Ireland must have all of the following ingredients:

- Successful innovative companies that can offer jobs;
- Graduates and researchers with the right skills to take up employment in these companies;
- Entrepreneurial individuals that can create innovative companies, i.e. acting as job 'shapers' as well as jobseekers.

Ireland's graduates form an integral part of this mix. They are highly employable as demonstrated by the fact that, in 2012 when the national average unemployment rate was approximately 14%, that of university graduates came in around half that at 7%. The Expert Group on Future Funding for Higher Education, being chaired by Peter Cassells, notes that graduates' "*share of employment in Ireland is currently 13 percentage points higher than the*

EU-15 average", appropriately reflecting the progress made by Ireland with respect to the educational attainment of its citizens and the knowledge intensity of its economy. The Cassells Group also highlights the projections that "*48% of the job openings in the Irish economy to 2025 will be for graduates*".

Over the six-year period to 2014, the higher education system delivered 25,000 extra student places. At present, it produces approximately 65,000 graduates annually.

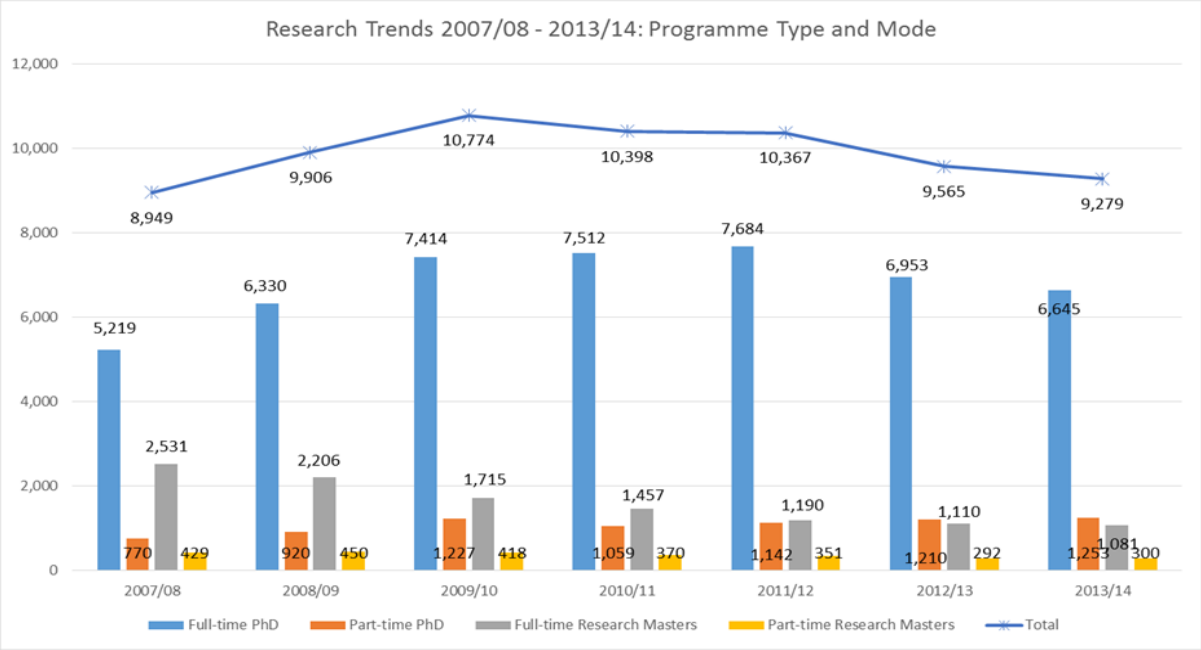


Substantial and steady increases in the demand for higher education will be experienced in the 2015-2020 period and beyond. Based on demographic drivers and labour market requirements for higher skills, it is predicted that the number of new entrants to higher education will increase by 29% between 2013 and 2028.

Looking specifically at doctoral education, the objective under SSTI 2006-2013 of doubling Ireland's PhD output has been successfully delivered by the higher education providers. Acting on the National Strategy for Higher Education to 2030, the HEA and Quality and Qualifications Ireland (QQI) in partnership with the institutions are now launching the National Framework for Doctoral Education, the purpose of which is to:

- Facilitate consistent excellence in the quality of postgraduate education and training;
- Enable and encourage higher education institutions to work more closely in the delivery of an improved learner experience and outcome;
- Maximise the employability of doctoral graduates across a broad range of employment sectors by ensuring that the acquisition of discipline-specific knowledge is complemented by the development of transferable skills;
- Underpin the international standing of the Irish doctoral award.

However, PhD enrolments are decreasing in recent years as a result of several factors such as reduced funding and less staff available for research supervision. While the number of graduates does not flow through automatically from the number of enrolments, the trend is concerning, especially when, for example, that the Action Plan for Jobs 2015 is calling for an increase in the number of researchers going into enterprise.



At such a time when Ireland is both at the forefront of international good practice in doctoral provision and there is a shared objective to increase the number of researchers going into enterprise, it is imperative that we re-align our PhD targets to match our national ambitions as a research-intensive nation (while understanding that, given the duration of a doctorate, the trajectory for bringing doctoral levels back on track travels beyond the lifetime of this Strategy). The availability of researcher skills is critical to attracting globally mobile R&D investment and to developing an innovative indigenous sector. Information currently available notes that Ireland's graduates compare reasonably favourably internationally, however the more recent enrolment trends above point to a future decline from this peak.

In a similar vein at the other end of the education spectrum, a sustainable supply of future talented skilled researchers and innovators requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge. The Strategy needs to recognise the role of education at primary, post-primary as well as higher level, in Ireland's research and innovation performance.

Investment in the higher education system

Reduced funding – as is being experienced across the public sector – is therefore squeezing the higher education sector at exactly the same time as it is facing huge pressure to deliver on the scale of demand for higher education. In the six-year period to 2014, core funding per student fell by 15%. The proportion of recurrent State funding for institutions' core activities has fallen from 78% in 2008 to an estimated 64% in 2016. This compares with an OECD average of 68%. A large proportion of this decrease has come through staffing and, while a share of staffing reductions may be natural and timely, the loss of 2,000 staff members and the linked deterioration in staff-student ratios from 1:15 to 1:19.5 - at a time when the OECD norm is 1:16 – manifests itself on the ground in less space for research supervision, less one-to-one engagement and less time to accommodate diverse learning styles.

The core funding provided by the HEA to the institutions delivers the national platform support for all education and research activity in Ireland's higher education institutions. As part of this:

- It pays for the salaries of the academics who are therefore in a position to apply for competitive funding from international programmes such as Horizon2020 and from national agencies such as SFI.
- The core grant also covers the supervision of Masters and PhD students, i.e. Ireland's pipeline of researchers.
- It empowers each institution to support the highly interconnected education-research nexus as befits its particular strategic environment and operational priorities.

The environment and priorities for each higher education institution echo many of the shared policy goals of the members of the Inter-Departmental Committee. Allied to their role in research, the institutions educate the ~200,000 students enrolled across higher education. They have responded strongly to the upskilling imperative exacerbated by the economic crisis, for instance achieving a 50% increase in graduate output from high-level ICT courses between 2008 and 2013. The institutions contribute to Ireland's balanced regional development through their direct and indirect impact on local economies. For example, in an impact review of Enterprise Ireland's campus incubation programme, it was estimated that 91% of the new companies then hosted in the higher education campus centres were planning to remain in their respective regions upon leaving the incubator. Given that the 2015 Action Plan for Jobs predicts that "*the next wave of jobs will be driven by small Irish companies*", this institutional 'stickiness' with its region will form an important element of the regional enterprise strategies that are currently being prepared. The hollowing out of higher education core funding is thus highly damaging, and contradictory to, Ireland's research and innovation aspirations as well as its wider economic and societal ambitions.

Accountability of the higher education system

The National Strategy for Higher Education to 2030 (approved by Government in 2011) articulates a vision that resonates very strongly with the ambition of the current SSTI 2015-2020 process:

"In the decades ahead, higher education will play a central role in making Ireland a country recognised for innovation, competitive enterprise and continuing academic excellence, and an attractive place to live and work with a high quality of life, cultural vibrancy and inclusive social structures. At its heart, however, it will still be about people and ideas: higher education institutions will have a strong engagement with individual students, communities, society and enterprise, will give students a sense of Irish place and identity, and will equip them with the skills to play a strong part on the world stage; they will be the source of new ideas through excellent research.

"The nature of the learning community and the modes of teaching and learning will also change significantly over the coming years. These changes will be supported through innovative approaches to research-led teaching and learning, programme design, student assessment and a quality assurance system – all of which will reflect a new emphasis on nurturing creative and innovative minds. Irish higher education will have a strong international presence, attracting overseas students and academics, and across all disciplines it will engage in high-quality research that will distinguish Ireland internationally".

On foot of the National Strategy for Higher Education, the coherence of the higher education system and its alignment with national policy objectives is provided for in the Higher Education System Performance Framework 2014-16 which has the following aims:

- To hold the system accountable for performance for the delivery of national priorities and monitor performance of the system as a whole;
- To articulate all the expectations on the system of different areas of government/agencies across the various dimensions of higher education activity;
- To increase the visibility of performance of the system to Government and the wider public;
- To contribute to system and policy development by highlighting structural and other deficits including data capacity;
- To allow HEIs to identify their strategic niche and mission and agree a performance compact aligned with funding with the Higher Education Authority.

The Framework identifies seven key objectives for the system over the 2014-16 period:

1. To meet Ireland's human capital needs across the spectrum of skills by engaged institutions through a diverse mix of provision across the system and through both core funding and specifically targeted initiatives;
2. To promote access for disadvantaged groups and to put in place coherent pathways from second level education, from further education and other non-traditional entry routes;
3. To promote excellence in teaching and learning to underpin a high quality student experience;

4. To maintain an open and excellent public research system focused on the Government's priority areas and the achievement of other societal objectives and to maximise research collaborations and knowledge exchange between and among public and private sector research actors;
5. To ensure that Ireland's higher education institutions will be globally competitive and internationally oriented, and Ireland will be a world-class centre of international education;
6. To reform practices and restructure the system for quality and diversity;
7. To increase accountability of autonomous institutions for public funding and against national priorities.

Based on these, each higher education institution has entered into a mission-based performance compact with the HEA (http://www.hea.ie/en/policy/national-strategy/higher-education-system-performance-2014-16). These are reviewed through a Strategic Dialogue process with the institutions. The first System Performance Progress Report (July 2014), while fully recognising the potential still to be realised and issues to be addressed, recognises the progress that has been made. It provides a solid basis for advancing and implementing national research objectives through the funding of higher education. It gives greater clarity of purpose and visibility of performance across all Government priorities, including – yet not limited to - research, knowledge exchange and innovation.

Impact of higher education

The scale of recent reductions in higher education expenditure on R&D (HERD) primarily reflects the salary cuts that have taken place during this period. The reduction of higher education core funding - allied with the increasing student demand - logically constrains the resources that are available to institutions to invest in research. It is within this context that the fall in HERD needs to be considered. It should not be interpreted as a direct reduction in, or any de-prioritisation of, research activity during this period. Indeed, the success of the Irish higher education system in these years bears testament to the commitment and performance of Irish higher education in research.

Despite such reducing resourcing and increasing demands, the efficiency and effectiveness of the institutions in delivering returns on research investment is clear. The consultation paper advises that (p10) "*in 2013, SFI had linkages with 72% of IDA Ireland job announcements …".* In fact, this should state that the higher education institutions, with the support of SFI, had linkages with 72% of IDA job announcements in 2013. It is the institutions that (with the assistance of funding such as that from SFI) run research centres, undertake the research projects and collaborations with industry, and provide the magnet of attraction for FDI.

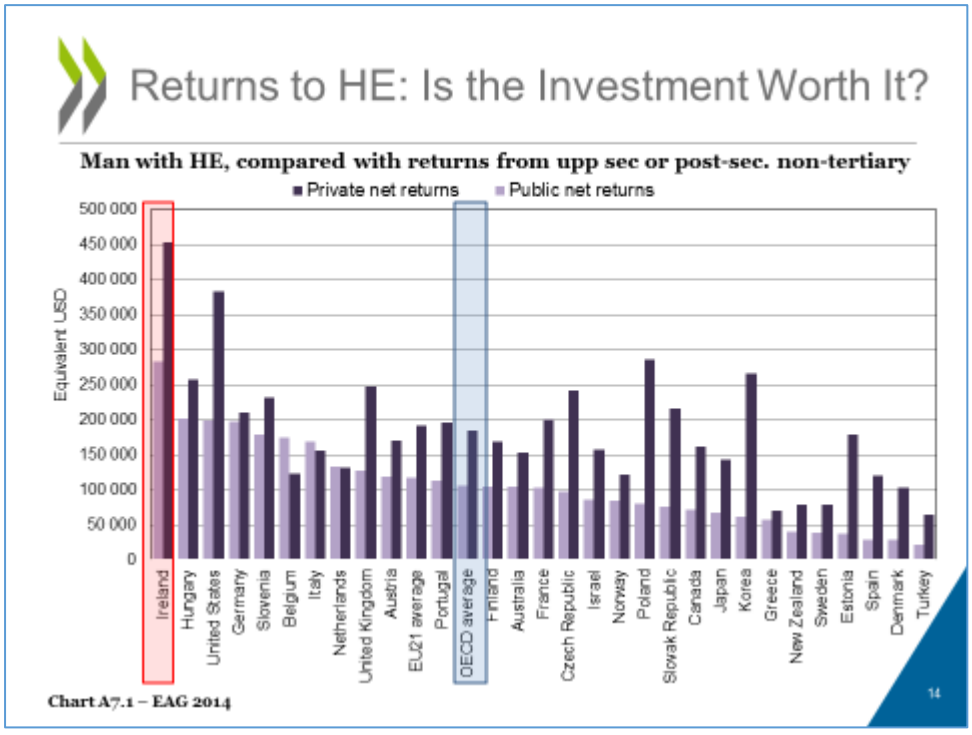
Similarly on p12, the results of TTSI and Technology Centre initiatives, while critically supported by the funding of Enterprise Ireland, are in fact delivered by the higher education institutions. The seven-fold increase in annual LOA agreements and the 450% increase in spin-offs were generated by the institutions. The impact of the Technology Centres is

delivered on the ground at the institutions. This incorrect attribution of results needs to be rectified throughout the consultation paper and any subsequent material produced.

Again on page 12, the Forfás evaluation of enterprise support programmes highlights the impact of higher education on research and innovation in Ireland and this should be reflected appropriately in the SSTI deliberations:

- Increased academic-industry linkages;
- An increase in the research relevance of the research conducted in research groups;
- Increased mobility of research staff to industry and enhanced in-firm capabilities.

And more widely, work undertaken by the OECD demonstrates significant public and private returns from higher education:



OECD Presentation, IUA Symposium 29 September 2014.

Maximising future impact

We fully support the call in the consultation document for "*an upward trajectory [of public investment in R&D] between 2015 and 2020*". An internationally competitive research environment requires sustained investment. The consolidation of research activities in recent years, as recommended in the National Research Prioritisation Exercise and the National Strategy for Higher Education, aims to drive focus and improve value-for-money. However, declining investment trends is a critical issue that must be addressed in the 2015–2020 period. The totality of Ireland's public investment in research is out of step with our ambitions, our potential and other countries with which we compete.

It will be essential not only to agree more ambitious targets for investment but also for more ambitious targets for impact. This is consistent with our overarching comments

concerning a more comprehensive definition of research impact. Making research work to maximum effect for Ireland will manifest itself in a range of ways. The returns will include primarily skilled people capable of gaining and creating jobs, as well as innovative companies that will succeed internationally and provide employment, and that will leverage a vibrant research base here to do so. The impact of public investment in research needs to be defined comprehensively, in particular reflecting its contribution to talent development and the variety of routes through which knowledge gets transferred and diffused throughout the ecosystem. The work that is currently being undertaken by Knowledge Transfer Ireland in this regard is welcomed.

Equally, innovation is much broader than technological innovation. And, just as technological innovation can take place in services companies, non-technological innovation is an essential element of all successful firms' performance. Nor is innovation solely an economic issue: it is at least as relevant to other sectors such as health and environment as well society more generally.

Pillar 1: Key Messages and Recommendations:

- ***The totality of Ireland's public investment in research is out of step with our ambitions, our potential and other countries with which we compete. An internationally competitive research environment requires sustained investment. The consolidation of research activities in recent years, as recommended in the National Research Prioritisation Exercise and the National Strategy for Higher Education, aims to drive focus and improve value-for-money. However, declining investment trends is a critical issue that must be addressed in the 2015–2020 period.***
- ***Future growth depends on innovation; future innovation depends on people. Higher education graduates form an integral part of Ireland's future pipeline of researchers and innovators.***
- ***New entrants to higher education are predicted to increase by 29% between 2013 and 2028.***
- ***Such student increases, allied with sharply reduced core funding and staffing levels, are constraining institutional capacity to invest in research.***
- ***Despite this, the institutions are delivering strong and increasing returns on public research investment. Their role in the results cited must be recognised.***
- ***The National Strategy for Higher Education and its implementation through the Higher Education System Performance Framework 2014-16 are driving system coherence and progress against a range of Government policy objectives.***
- ***Within this Framework, each institution's use of its core funding reflects its own particular strategic environment and operational priorities.***
- ***People are the lifeblood of this Strategy. In order to maximise its impact on employment as well as on other national priorities, Ireland's next generation of researchers and innovators require – and deserve- the best possible start from our higher education system. This translates into strong institutions that are adequately and stably resourced to educate those ~200,000 students enrolled across the country such that these students are empowered to secure jobs and create companies, as well as shaping and contributing to Irish society.***
- ***The extent to which researchers are supported systematically from early-stage onward to build their research performance will dictate Ireland's success in initiatives like the EU's Horizon2020. This starts with doctoral education where the recent decline in enrolments must be addressed. A graduated and cohesive suite of supports across starter, mid-career and advanced will maximise the future delivery of research impact. It will be enabled by increased investment by the Irish Research Council in research that is awarded competitively on the basis of excellence and not limited to pre-defined NRPE areas.***
- ***Enhancing and maintaining our research infrastructure is fundamental to ensuring that Ireland's research and innovation ecosystem is internationally competitive and attractive. As seen elsewhere, successful infrastructural investments require an appropriate combination of physical and human capital to maximise their returns.***

Pillar 2: Prioritised Approach to Public Research Funding

NRPE 2013-17

There are clearly commonalities between the overarching objectives of the National Strategy for Higher Education and the National Research Prioritisation Exercise. The first progress report on Research Prioritisation noted that "*human capital is the single most important enabler of the NRPE*". The National Strategy for Higher Education states that:

"*To meet Ireland's social and economic objectives, Ireland's higher education institutions need to continue to break new ground in research of the highest standards across the spectrum of disciplines and activity. The recent transformation of Ireland's research landscape must now be built upon by further refining our concentration of resources and investment to build on developed strengths. We must continue to identify key selected domains in which Ireland can make a real impact on the international stage and on which investment priorities should be focused, while sustaining research excellence across a broad range of disciplines. The choice of priorities will be informed by the potential for national, economic and social returns and will remain under review to ensure continuing responsiveness to global developments".*

Research prioritisation is one important facet of an overall strategy. However, to state that it is Ireland's "*primary STI policy goal*" (p17 of the consultation paper) risks losing sight of the context only within which it can succeed. In order to be able to prioritise research funding, we must have a strong base from which we can make such choices. The weight of emphasis on the Priority Areas and the consequent lack of focus on platform research and 'non-priority research' are leading to a dangerous imbalance in the system.

A review of Research Prioritisation is thus very timely. DES and the HEA welcome the independent panel assessment of the current NRPE. In summary, the views shared with the panel highlighted:

- The shared ground between the NRPE and the National Strategy for Higher Education;
- Slippage from the original intention of the NRPE to foster priority areas and to also support platform technologies, as well as 'research for knowledge' and 'research for policy'. The lack of detail in the NRPE with respect to the platform technologies, 'research for knowledge' and 'research for policy' has resulted in a lack of focus on them and their importance;
- The impact of this is an unbalanced research system that is being dangerously hollowed out;
- Significant concerns therefore that the system is not adequately 'future-proofed';
- The imperative thus to re-contextualise and re-balance Research Prioritisation as an important element within Ireland's overall Strategy and within wider national policies.

We look forward to the report of the independent panel.

The planned 2017 impact review of Research Prioritisation is also welcomed. It is recommended that the review examines closely the process and mechanisms of prioritisation and how it can best be structured. It is also recommended that consideration be given to the very successful Innovation Showcase 2014 and its approach to grouping overarching research areas.

With respect to current governance, the consultation paper notes the PAG structure. In recent years, a plethora of governance/ 'oversight' groups in the STI space have been set up in a somewhat reactive fashion. In order to successfully implement SSTI 2015-2020 (within which Research Prioritisation is one element), simplified yet comprehensive governance structures representing the whole of Government and engaging the critical research and innovation performers outside Government must be developed.

With reference to the Smart Specialisation process and in light of the importance attaching to it, it would be beneficial to include the regional dimension of research and innovation in the Strategy. For instance, the HEA is working with the higher education institutions to promote regional development through the establishment of HEI regional clusters. These will work to provide a cohesive offering in terms of both the education and research needs of the people and enterprises within a particular region. This approach is consistent with the EU's smart specialisation plans and the Strategy should therefore reflect this national development. It also needs to factor in approved Government policy on the creation of Technological Universities and their future national function to "*operate at the highest academic level in an environment that is specifically focused on technology and its application*", as well as recognising the diversity within the existing higher education system.

The Strategy also provides an opportunity to review how best Ireland can develop its foresighting/-horizon-scanning capability to support future research prioritisation and Ireland's research and innovation system more widely. The higher education institutions have the potential to play a strong positive role in this regard. The Strategy's timeframe obviously goes beyond that of the current Priority Areas and the 2017 review could very helpfully, in considering the processes supporting prioritisation, examine how global intelligence on economic and societal trends can best be accessed and used.

Re-balancing the base for successful delivery of future priorities

The concept of 'research for knowledge' used in the NRPE can be somewhat misleading. Research, by definition, is the creation of new knowledge; if research is not producing knowledge, it is simply not research. Fundamental research, by its very definition, poses fundamental questions. It opens new fields and creates previously unforeseen opportunities. It is complex and challenging and, as such, it is essential to the formation of high calibre researchers with the ability to manage complexity and to spot new opportunities. Closer-to-market research is equally invaluable through its role in translating identified opportunities into tangible solutions that have economic value and societal impact. A strong functioning innovation ecosystem will show distinctive strengths in

research from fundamental to applied, with well-developed diffusion pathways. The consultation document does not adequately reflect the vital importance of basic research.

Support for excellent research across all fields is also pivotal. The growing interdisciplinary nature of research and the role of humanities in societal challenges as illustrated, for instance, in Horizon 2020, mean that support for such areas must be protected and enhanced if Ireland is to succeed in the global arena. Current trends indicate a concerning fall in research investments in certain fields of study. This stems from a 'perfect storm' of:

- Competitive funding being focused on specific near-term commercial areas, and
- Core funding available for research being constrained by the massive upward student demand for educational resources.

If left unchecked, this may lead to a situation where new research priorities are identified but the relevant capacity in Ireland is no longer present. We must sustain an excellent and vibrant base so that, as priorities evolve in the future, we are best placed to deliver on them. To get Ireland's research base back on the best track for maximum impact, consideration needs to be given to the optimal portfolio of "priority" and other research activities and related funding instruments. This should involve a clear understanding of the developmental trajectories of the research performers themselves, be they companies, institutions or individual researchers, and the appropriate policy interventions that will enable them to optimise their performance. Success in initiatives like Horizon 2020 will only be maximised if researchers are being supported systematically from early-stage and onwards to improve their – and with that, Ireland's – research impact. A graduated and cohesive suite of supports across starter, mid-career and advanced will help maximise the future delivery of research returns. It will be enabled by increased investment by the Irish Research Council in research that is awarded competitively on the basis on excellence and not limited to pre-defined NRPE areas.

The strength of the Irish research base is also an important factor in the quality and relevance of teaching in our higher education system. It exposes our ~200,000 students to leading research techniques and practices that they can then use in later employment, many for which will be in industry. It ensures that they are learning from staff with an understanding of, and access to, the most up-to-date knowledge in the field. And it is this calibre of education that will prove pivotal to Ireland's future economic success, as highlighted for example in the 2015 Action Plan for Jobs:

"Ireland's competitive advantage in international markets, as well as the competitiveness of our regions, will increasingly be driven by the availability of world-class skills at all levels".

Pillar 2: Key Messages and Recommendations:

- ***In order to be able to prioritise research funding, we must have a strong base from which we can make such choices.***
- ***Research Prioritisation is an important element within the context of Ireland's overall Strategy and of wider national priorities.***
- ***A strong functioning innovation ecosystem will show distinctive strengths in research from fundamental to applied, with well-developed diffusion pathways. The consultation document does not adequately reflect the vital importance of basic research.***
- ***Support for excellent research across all fields is also pivotal. The growing interdisciplinary nature of research and the role of humanities in societal challenges mean that support for such areas must be enhanced if Ireland is to succeed in the global arena.***
- ***To get Ireland's research base back on track, consideration needs to be given to the optimal portfolio of "priority" and other research activities and related funding instruments. This should involve a clear understanding of the developmental trajectories of the research performers themselves, be they companies, institutions or individual researchers, and the appropriate policy interventions that will enable them to optimise their performance. A graduated and cohesive suite of researcher supports across starter, mid-career and advanced will help maximise the delivery of research returns. It will be enabled by increased investment by the Irish Research Council in research that is awarded competitively on the basis of excellence and not limited to pre-defined NRPE areas.***
- ***The strength of the Irish research base is also an important factor in the quality and relevance of teaching in our higher education system. It exposes our ~200,000 students to leading research techniques and practices that they can then use in later employment, many for which will be in industry.***
- ***In order to successfully implement SSTI 2015-2020 (within which Research Prioritisation is one element), simplified yet comprehensive governance structures representing the whole of Government and engaging the critical research and innovation performers outside Government must be developed.***

Pillar 3: Enterprise-level R&D and Innovation Performance

Enterprise R&D

The information provided in the consultation paper sets out several critical issues for progression under the Strategy. The fact that 300 firms accounted for nearly 70% of enterprise R&D expenditure in 2012 and that 13% of foreign-owned firms accounted for 88% of foreign-owned firms' spend in the same year points to a highly uneven enterprise base with respect to R&D activity.

This Strategy's contribution to the delivery of jobs across the country will depend on how it can support more firms throughout Ireland to become more R&D-active and more innovative. The consultation paper notes differences between the indigenous and foreign-owned sectors. It is important that RD&I is examined through the lens of company scale (as much as ownership) and its implications – both positive and negative – for R&D and innovation. A firm's R&D activity will naturally form part of its wider developmental trajectory and is appropriately viewed in that context. The entrepreneurial opportunities generated through research and innovation should also receive attention and advancement, for example research spin-offs and the beneficial linkages between campus incubation clients and their host institution's R&D expertise.

Collaborative linkages between enterprise and higher education

With reference to the comment on p23 regarding "*low levels of formal collaboration between firms and higher education institutions*", DES and the HEA fully recognise that there is further potential to improve higher education-enterprise collaborations in Ireland. That said, the progress in recent years must be taken into account when reflecting on the present Irish 'research landscape':

- Between 2005 and 2012, the average number of licences, option or assignment agreements (LOAs) executed each year by higher education institutions with companies was up seven-fold to 85 and the number of spin-out companies created each year was averaging 22: an increase of nearly 450%.
- In the European Knowledge Transfer Report 2013, Ireland was ranked first in Europe based on a composite indicator of knowledge transfer activities.
- The Forfás evaluation of enterprise support programmes (referred to under Pillar 1 of the consultation paper) draws attention to the strengthening industry-academic collaborative dynamic in Ireland in the form of, for example:
  - Increased academic-industry linkages;
  - An increase in the research relevance of the research conducted in research groups;
  - Increased mobility of research staff to industry and enhanced in-firm capabilities.
- The higher education institutions are central to a number of the progress updates on Innovation in Services and Business Processes (p24) and the Strategy needs to recognise this. The Innovation Value Institute Technology Centre is hosted by Maynooth University. The newer Financial Services Governance, Risk and Compliance Technology Centre is hosted by University College Cork in partnership with NUI Galway and

University College Dublin. TSSG – the Telecommunications Software and Systems Group – is Waterford Institute of Technology's internationally recognised centre of excellence for ICT research and innovation.

The Higher Education System Performance Framework 2014-16 and attendant institutional compacts all include indicators around enterprise engagement. Institutional progress is discussed through the Strategic Dialogue process. As well as activity at individual level, the institutions are being encouraged to form regional clusters that can, among other policy objectives, provide a cohesive offering to enterprises in their respective regions.

The consultation paper poses the question as to how to incentivise R&D-active firms to scale their research efforts. Given that people form the central plank of research endeavours, the opportunity offered by increasing researcher mobility between higher education and enterprise merits consideration under the Strategy.

A cross-cutting and comprehensive perspective on innovation

The consultant recommendation on p23 for "*better focussing of RD&I activities around public and societal challenges"* is strongly endorsed. As noted in our overarching feedback, global societal challenges such as food security and renewable energy require policy actions right across technological, economic and societal domains, as well as national borders. They are being used more and more as the foundation for international research and innovation strategies, as illustrated in the Horizon2020 Societal Challenges. Their scale and global relevance will set the scene for Ireland's future success in international markets – creating the very demand that innovative companies in Ireland will strive to meet - and for our research activities. Consequently, they should logically be positioned as such in the new Strategy, reflecting Ireland's ambitions for global research relevance and impact.

The related importance being attached to innovation as a cross-cutting and broadly based issue is also welcomed and the work of the ISBP Advisory Group can help to align Ireland with international best practice in this space. Again, as noted in our overarching feedback, innovation is much broader than technological innovation. And, just as technological innovation can take place in services companies, non-technological innovation is an essential element of all successful firms' performance. Nor is innovation solely an economic issue: it is at least as relevant to other sectors such as health and environment as well society more generally. This wider view of innovation is a growing feature of global dialogue, for instance on Responsible Research and Innovation, and in the recognised critical nexus between education, research, innovation and the citizen.

The role of the citizen in innovation processes

Citizens are increasingly recognised as an important partner in the innovation process. They are also core to the global societal challenges we face. To quote Nature magazine (January 2015),

"If you want science to deliver for society, through commerce, government or philanthropy, you need to support a capacity to understand that society that is as deep as your capacity to understand the science. And your policy statements need to show that you believe in that necessity."

Ireland's new Strategy must set out clearly how it will optimise civic engagement in research and innovation. It needs to outline how it will enhance public outreach in communicating the importance of research and innovation to people's lives. The provision of education reaching back to primary and post-primary levels, given the criticality of the skills pipeline, is also clearly relevant in this regard and is an important element of strategies in other countries.

Pillar 3: Key Messages and Recommendations:

- ***This Strategy's contribution to the delivery of jobs across the country will depend on how it can support more firms throughout Ireland to become R&D-active and more innovative.***
- ***Successful industry-academic collaborations depend on the strength of both partners and the progress made under the last SSTI can be leveraged in this Strategy to deliver greater (in both quantity and quality) industry-academic collaborations that will generate even greater economic and societal impact.***
- ***The entrepreneurial possibilities generated through research and innovation should be explored, for example, research spin-offs.***
- ***The scale of societal challenges and their global relevance will set the scene for Ireland's future success in international markets – creating the very demand that our innovative companies will strive to meet – and for our research activities.***
- ***The development of a cross-cutting and comprehensive perspective on innovation will be welcomed.***
- ***Citizens are increasingly recognised as an important partner in the innovation process and Ireland's SSTI 2015-2020 must set out clearly how it will optimise civic engagement in research and innovation. It also needs to outline how it will enhance public outreach in communicating the importance of research and innovation to people's lives.***

Pillar 4: International Collaboration and Engagement

Importance of international collaboration

Throughout the focussed development of Ireland's research and innovation ecosystem over the last two decades, the international dimension has consistently been a priority. This is not only in relation to the funding secured, but also with respect to Ireland's reputation as a location for, and one connected to, international excellence. Such connectivity provides Irish researchers (both in enterprise and higher education) with invaluable access to expertise. This access will in turn translate into economic impact through application of advanced thinking and direct opportunities for Irish companies to sell products and services abroad (for example, ESA). Ireland's research performance and its contribution to global knowledge will also underpin its international reputation. Our international research excellence will be key to our attractiveness for mobile talent, company operations and capital.

European Research Area

Within this context, the Irish higher education sector is fully committed to international research success, as is evidenced by its track record in EU funding programmes. Under the Seventh Framework Programme, it won 62% of the total national €600m take. As well as accounting for nearly two thirds of Ireland's drawdown, this figure represents a 174% increase on higher education's performance in the Sixth Framework Programme.

The Irish actions cited under the five ERA priorities should be revised to include:

More effective national research systems	The National Strategy for Higher Education, through the Higher Education System Performance Framework 2014-16, has an explicit system-level objective to "*maintain an open and excellent public research system focused on the Government's priority areas and the achievement of other societal objectives and to maximise research collaborations and knowledge exchange between and among public and private sector research actors".* Progress on this is outlined in the first System Performance report and individual institutional progress is reviewed through the Strategic Dialogue process.
Optimal transnational co-operation and competition	- Higher education institutions, as evidenced above in their Framework Programme success, are aligning themselves with global challenges. They are actively engaged in a variety of transnational cooperative initiatives, for instance, Science Europe (www.scienceeurope.org). - Through the Department of Education and Skills and with the Irish Research Council (IRC) as the representative body, Ireland is a full member of two pan-European (ESFRI) research infrastructures. These are DARIAH (Digital Research Infrastructure for the Arts and Humanities) and the ESS (European Social Survey).

	- The IRC also manages the €18m HERA (Humanities in the European Research Area) pan-European collaboration between humanities research funders.
An open labour market for researchers	At the start of this month (March 2015), the European Commission awarded six Irish higher education institutions the "HR Excellence in Research Award" for their implementation of the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.
Gender equality and gender mainstreaming in research	In February 2015, the Athena SWAN Charter was formally launched in Ireland. Established in the U.K. in 2005 and managed by the Equality Challenge Unit (ECU), the Athena SWAN initiative aims to effect cultural and systemic change in higher education institutions to support gender equality and the progression of women in science, technology, engineering, medicine and mathematics (STEMM) disciplines. This is one of a range of gender equality initiatives through which the Irish higher education community is committing to unlocking the full reservoir of talent that underpins our academic and scientific excellence.
Optimal circulation, access to and transfer of scientific knowledge	In light of the significant public investment in research and in the interests of excellent science, DES, the HEA and the IRC are committed to open access to research findings, facilities, outputs and datasets in a manner that is consistent with the National IP Protocol.

H2020: higher education participation and progress

Given the importance of Horizon 2020 for Ireland for all the reasons outlined above, DES has convened a dedicated working group to coordinate and optimise the higher education sector's approach to H2020. Chaired by DES, it comprises the HEA, the IRC, the Irish Universities Association, Institutes of Technology Ireland and Dublin Institute of Technology. The level of H2020 activity naturally varies across institutions and their engagement needs to be viewed in the context of their individual starting points. The institutions are planning for H2020 success by aligning their respective identified research strengths with H2020 project opportunities. This is consistent with wider national policy developments such as the Higher Education System Performance Framework 2014-16 and the National Research Prioritisation Exercise. They recognise H2020 as a strong opportunity both to build their capability in particular research fields and to enhance their international reputation and connectedness at the cutting edges of research. Another strong theme running through the institutions' plans is their intention to utilise H2020 monies as one of the tools towards sustainability. H2020 participation provides a potential funding stream that should complement – rather than replace – Irish support for research and innovation.

In order to implement their respective H2020 strategies, there is a wide range of initiatives underway across the sector with critical objectives such as:

- Improving awareness and understanding of H2020;
- Supporting more, better and bigger applications.

Ultimately of course, the outcome of greater awareness of, and applications to, H2020 will manifest itself in project funding success. While the higher education institutions will work to drive up the quality and quantity of their applications, the European-wide success rates will dictate the level of consequent funding secured. As of December 2014, the H2020 National Office reported that Ireland had secured over €45m so far and that higher education institutions had succeeded in winning 66% of this. Even with tougher competition (an oversubscription rate 8 times the available budget compared with an average of 5.5x under FP7) and high selectivity, the National Office reports that the Irish applicant success rate was 16% compared with a Member State average of 14.5%.

H2020 key performance factors

With the benefit of the institutional experience on the ground, the DES H2020 Working Group has identified a range of performance factors that will influence Ireland's success over the lifetime of H2020:

- *Researcher capacity*

The statement on p27 that "*Ireland is participating in the current Framework Programme in a far stronger position than ever before*" is inconsistent with detailed perspectives received from participants themselves (in the form of the higher education institutions) during 2014 as H2020 was getting off the ground. The essence of the issue and the solution lies in people who will - as always - be at the heart of our success. It is the individual researchers, with support from their institutions and the National Office, who will forge contacts, submit applications and, ultimately, secure the projects. However, many of the most experienced and successful Irish researchers have limited spare capacity to prepare and develop project applications because they are already working on either FP7 projects, domestic ones, or often a mix of both. Earlier-stage researchers may not be in a sufficiently secure position to do so: lacking the security of a robust researcher careers framework to commit to the H2020 application process.

- *Enterprise R&D activity, partnership and leadership*

The desire to involve more companies of all sizes in collaborative research and to generate innovations from this – leading it is hoped to job creation – has long been a key national industrial policy objective. Progress towards this goal, while improving, still has a distance to travel. In the immediate context, enterprise R&D capacity is a prerequisite for much of HE's involvement in H2020. The greater applied character of H2020 reflects the European imperative to increase enterprise R&D activity and to maximise economic returns on public research investment. At a practical level, it translates into the need for more firms in Ireland, both large and smaller, foreign-owned and indigenous, to participate. Higher

education institutions are a critical vehicle to enable this yet many are reporting difficulties in finding companies with the ability and appetite to engage. Furthermore, industrial leadership is an important feature of the EU's research agenda-setting process. Any influence that industry in Ireland can therefore bring to bear on this will have knock-on positive effects for Irish participation. Greater connectivity between EI and IDA with the institutions is also essential in this context.

- *Research support office capacity*

The resources of any institutional research support office are finite and are spread across a wide range of operational activities. Consequently, the prioritisation of pursuing H2020 monies infers a de-prioritisation of non-H2020 activities. This presents an obvious challenge to institutional involvement in the spectrum of important national initiatives, for instance, Technology Centres, Innovation Vouchers. It is also a hurdle to H2020 participation itself as such other activities usually act as stepping stones for researchers (especially the early-stage ones that will be essential to Ireland's performance) toward H2020 project success.

- *Institute of Technology sectoral capacity*

Institutes of Technology, by and large, lack the support office capacity to allocate resources to H2020. While most IoTs are less research-active than other institutions – in keeping with the intended diversity of the national system – the increased focus of H2020 on applied research and innovation plus its greater orientation towards industry (and particularly SME) engagement suggests a natural opportunity for the IoT sector to win more H2020 funding: if appropriately supported to do so.

- *The growing focus on interdisciplinarity and the continuing importance of AHSS*

The continuing shift towards more interdisciplinary research projects requires a fundamental change within - and beyond - higher education institutions. As well as convergence between various technologies, it entails far greater engagement of the Arts, Humanities and Social Sciences (AHSS) in what have traditionally been scientific/ technological projects, for instance, to address the Societal Challenges. Moreover, the growing interdisciplinary nature of research, and the increasingly recognised importance of non-technological ideas and innovations, point to the importance of support for the AHSS.

- *Domestic investment required to participate in larger-scale initiatives*

This issue has couple of critical components. Firstly, several of the larger-scale H2020 funding streams are predicated on national agency co-financing so Irish entities can only apply if the relevant Dept/ agency commits the necessary financing. Secondly, the EU is keen to use H2020 monies to leverage national infrastructural investments. The relative lack of public research capital investment here in recent years will therefore affect Ireland's chances of EU funding success, as well as diminishing the national landscape.

- *Maintaining momentum and motivation*

Finally, as noted above, people are ultimately what will make the difference. To succeed throughout the lifetime of H2020, Irish higher education institutions must 'play the long

game' and need to be empowered by the system to do so. It will be imperative for Ireland to encourage its researchers to either try again or to try for the first time having seen peers fail. A strategic long-term approach to H2020 is essential and must be seen as a component of Ireland's wider research and innovation policy framework. Nearer-term, the H2020 National Office's analysis of the early results and their realistic reflection in national planning will greatly help the positioning and advancement of H2020 in Ireland.

H2020: key enablers for success

Flowing from these identified performance factors, the DES H2020 Working Group proposes a number of enablers for Ireland's international research success:

- *Make the most of Ireland's particular industrial structure:*

The combination of relatively high SME H2020 participation plus the scale of the MNC presence in Ireland suggests an opportunity to secure greater levels of H2020 success through the engagement and leadership of industry here. We look forward to:

- An update on the DJEI strategy and its priority initiatives for enterprise H2020 engagement;
- Improved architecture for connectivity between higher education and enterprise: better identification of, and access to, suitable industry partners for H2020 projects;
- Clearer understanding of IDA client companies' ability and appetite to engage.

- *Better research capacity to enable more H2020 project success:*

- Greater flexibility in workload allocation;
- Derogation of European Research Council awardees for specified high-potential posts;
- National support for 'near misses' at H2020 level;
- Maximisation of applicant conversion rates;
- Greater support for project coordination (on the basis that, of the 86 successful Irish participations of 'scale' in FP7, Irish applicants acted as project coordinators in 67 of them).

- *Institutes of Technology:*

The Institutes have strong potential to grow their international R&D participation because of their shared interests with H2020 in applied research and in SME collaborations. An existing mechanism for building capability such the Technology Transfer Strengthening Initiative II could be explored for its potential to support the growth of IoT H2020 capabilities.

- *Interdisciplinarity & AHSS:*

It is understood that, in the 2016-17 H2020 Work Programme, AHSS will be integrated earlier and deeper across H2020 pillars. Ireland could pilot 'AHSS coordination champions' to work closely with small number of participants: creating role models.

- *Leverage Irish engagement with international research initiatives:*

Ireland's recent success in the European Institute of Technology's KICs could be leveraged to generate wider Irish traction with KIC opportunities.

- *Build on relationships with international partner countries:*

This is partly because several countries, including the BRICs and Mexico, no longer automatically eligible for funding. One of the recommendations for the 2016-17 Work Programme is the provision of "*direct funding of third country partners, in particular from the BRIC-M countries, in carefully selected cases where specific themes and topics are considered to be of strong EU (and mutual) benefit"*. Ireland is nurturing its relationships with countries like the BRICs and Mexico in several ways, for example, Enterprise Ireland regularly conducts international trade and education missions to them. SFI implements a range of 'international' initiatives such as the International Strategic Cooperation Award Programme. Given such channels of engagement with many of these countries, it could be worth exploring whether some of them can be leveraged to drive collaborative H2020 activity.

Strategic Research Proposals Group

Out of more than 18,000 projects funded between 2007 and 2012, 27 had a European Commission (EC) budget contribution of ≥€20m. Such projects are typically large-scale infrastructure or demonstrator-type projects. The FP7 areas in which these projects were funded comprise Transport (9 projects), Research Infrastructures (4), Space (4), Energy (3), Health (2), Security (2), ICT (1), Metrology (1) and one project that covers multiple FP7 programmes.

The coordinating countries are Germany (15 projects), France (4), Spain (3), United Kingdom (3), Switzerland (1) and the Netherlands (1). The average EC budget contribution secured by a project coordinator varies from €1.5m (22% of total EC contribution) to €61m (67% of total EC contribution); in percentage terms (of the EC contribution) the coordinator's share varies from 3% to 82%. Most coordinators are large private companies, for example, Airbus, Telefonica, Rolls Royce. The average number of project partners is 44 (excluding two outliers).

Ireland is involved in 14 of the above 27 ≥€20m projects and, in two of them, there is more than one Irish partner. It is not a coordinator in any of them. Apart from one, Irish drawdown in these projects has been less than €1m. The percentage of total EC contribution retained by Irish partners varies from 0.2% to 3.8%.

The DES H2020 Working Group thus recommends that Ireland be open-ended in identifying where and how Ireland can 'punch above its weight', i.e. be particularly successful, in H2020, for example:

- Being part of a large successful project (*note*: this does not automatically translate into significant Irish drawdown);
- Securing a relatively large share of individual projects: this can occur, for example, when Ireland acts as project coordinator;

- The combined results of successful projects in certain thematic areas, for example's Ireland's €120m ICT success in FP7;
- Success in particular calls that offer the greatest levels of funding per project, for example, ERC grants.

In undertaking its own work in this manner, the Working Group has arrived at the key enablers for success proposed above.

The DES Group has recommended to the Strategic Research Proposals Group that, when considering the submission of 'proposals of scale' by Ireland, robust due diligence is carried out to ensure maximum chances of success. Critical questions include:

- To what extent 'do opportunities of scale' exist in H2020 that Ireland can participate in?
- Based on our FP7 experience, how confident are we that a big project win of this type will translate into a significant financial drawdown for Ireland?
- If such opportunities are identified, how does a potential Irish proposal align with them? Is it (/ are they) in an area of European significance?
- Does a suggested Irish proposal have an existing track record (will be sought by the Commission), i.e. that it's not purely being pulled together for the sake of the bid?
- Given the central position of industrial leadership in successful scale projects, how does industry in Ireland feature in any suggested proposal?
- In recognition of the increasing centrality internationally of societal objectives in public research investment, how well does any Irish proposal encompass and espouse such societal aims?
- What is Ireland's 'value proposition'?
- What pre-submission consortium-building by partners within Ireland (both academic and industrial, as well as interdisciplinary) can strengthen the proposal?
- What pre-submission consortium-building with potential project partners in other countries, for example, other smaller countries like Austria, can strengthen the proposal?
- How can such a large-scale research proposal be built and 'championed'?

Pillar 4: Key Messages and Recommendations:

- ***International research collaboration is important not only for the funding that it secures, but also with respect to Ireland's reputation as a location for, and one connected to, global research excellence.***
- ***Within this context, the Irish higher education sector is fully committed to international research success, as is evidenced by its track record in EU funding programmes.***
- ***Institutions are planning for H2020 success by aligning their respective identified research strengths with H2020 project opportunities. They are also striving to utilise H2020 monies as one of the tools towards sustainability.***
- ***The DES H2020 Working Group has identified a range of performance factors that will influence Ireland's success over the lifetime of H2020. These include:***
  - ***Researcher capacity,***
  - ***Enterprise R&D activity, partnership and leadership***
  - ***Research support office capacity***
  - ***Institute of Technology sectoral capacity***
  - ***Growing focus on interdisciplinarity and continuing importance of AHSS***
  - ***Domestic investment required to participate in larger-scale initiatives***
  - ***Maintaining momentum and motivation.***
- ***Flowing from these, the DES H2020 Working Group proposes the following enablers for Ireland's international research excellence:***
  - ***Make the most of Ireland's particular industrial structure;***
  - ***Better research capacity to enable more H2020 project success;***
  - ***Improve Institute of Technology H2020 capabilities;***
  - ***Promote interdisciplinary role models;***
  - ***Leverage Irish engagement with international research initiatives;***
  - ***Build on relationships with international partner countries.***
- ***With respect to the work of the Strategic Research Proposals Group, Ireland should be open-ended in identifying where and how it can 'punch above its weight', i.e. be particularly successful in H2020. When considering the submission of 'proposals of scale' by Ireland, robust due diligence must be carried out in order to ensure maximum chances of success.***

Pillar 5: Organisational/ Institutional Arrangements to Enhance Research Excellence and Deliver Jobs

Organisations

Importantly, as per our preliminary views, it is the research and innovation performers themselves who will deliver this Strategy. In this section, the consultation paper provides information on activities of the DJEI agencies. Within this context, it needs to also include information on the relevant activities that come under the DES umbrella which are grounded in the National Strategy for Higher Education to 2030 which was approved by Government in 2011.

Higher Education Authority

The HEA provides core funding to the higher education institutions. This delivers the national platform support for all education and research activity in Ireland's higher education institutions. As part of this::

- It pays for the salaries of the academics who are therefore in a position to apply for competitive funding from international programmes such as Horizon2020 and from national agencies such as SFI.
- The core grant also covers the supervision of Masters and PhD students, i.e. Ireland's pipeline of researchers.
- Thirdly, it empowers each institution to support the highly interconnected education-research nexus as befits its particular strategic environment and operational priorities.

The HEA fosters and oversees the strategic development of the higher education sector through the implementation of the Higher Education System Performance Framework 2014-16. The Framework identifies seven key objectives for the system over this period, including:

1. To meet Ireland's human capital needs across the spectrum of skills by engaged institutions through a diverse mix of provision across the system and through both core funding and specifically targeted initiatives;
2. To promote access for disadvantaged groups and to put in place coherent pathways from second level education, from further education and other non-traditional entry routes;
3. To promote excellence in teaching and learning to underpin a high quality student experience;
4. To maintain an open and excellent public research system focused on the Government's priority areas and the achievement of other societal objectives and to maximise research collaborations and knowledge exchange between and among public and private sector research actors;
5. To ensure that Ireland's higher education institutions will be globally competitive and internationally oriented, and Ireland will be a world-class centre of international education;
6. To reform practices and restructure the system for quality and diversity;

7. To increase accountability of autonomous institutions for public funding and against national priorities.

Based on these, the HEA has entered a mission-based performance compact with each higher education institution (http://www.hea.ie/en/policy/national-strategy/higher-education-system-performance-2014-16). These are reviewed through a Strategic Dialogue process with the institutions. The first System Performance Progress Report (July 2014), while fully recognising the potential still to be realised and issues to be addressed, recognises the progress that is being made . It provides a solid basis for advancing and implementing national research objectives through the funding of higher education. It gives greater clarity of purpose and visibility of performance across all Government priorities, including – yet not limited to - research, knowledge exchange and innovation.

The HEA also manages Springboard on behalf of DES. This initiative is designed to help reskill people who lost their jobs as a result of the recession in areas where there are job opportunities in Ireland. These include ICT, high-level manufacturing and international financial services. Since its launch in 2011, over 21,000 people have participated in a Springboard course and 98% of participants surveyed would recommend it to others who wish to re-skill for employment.

Irish Research Council

The Irish Research Council (IRC) fosters the vibrancy of Ireland's research community through competitive funding for excellent research that addresses societal needs across, and between, all disciplines. Building on the HEA's core grant support for Masters and PhD student supervision, it provides critical funding for Ireland's early-stage researchers, helping them to build their research performance and to deliver maximum impact, societally as well as economically. It is mandated to:

- Fund excellent independent exploratory research within, and between, all disciplines. In doing so, enhance Ireland's international reputation as a centre for research and learning.
- Particularly support the education and skills development of excellent individual early-stage researchers and cultivate independent researchers and thinkers, whilst offering a range of opportunities which support diverse career paths.
- Enrich the pool of knowledge and expertise available and accessible for addressing Ireland's current and future needs, whether societal, cultural or economic by supporting excellent research and researchers.
- Provide policy advice on graduate education and research, with particular attention to the arts, humanities and social sciences.

The role of the education system in education

P34 of the consultation paper notes the work of SFI with respect STEM education. The role of the actual education system in education needs to be highlighted in the Strategy. As

noted in our Pillar 1 feedback, a sustainable supply of future talented skilled researchers and innovators requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge.

A critical early ingredient in maximising employment in Ireland is how well people are educated before they enter the labour market for the first time. Talent development starts a long time before people start looking for jobs. Because of its key role in a person's development, as well as its contribution to mitigating social inequalities and promoting better student outcomes, pre-primary education has become a policy priority in many countries. Results from the OECD's Programme for International Student Assessment (PISA) show that, in most countries, pupils who have attended pre-primary education programmes tend to perform better at age 15 than those who have not (OECD, Education at a Glance 2014: Highlights).

In 2013/14, there were 536,000 students enrolled in primary schools. Initiatives particularly relevant to the SSTI include the development of primary mathematics that will be accompanied by dedicated continuing professional development. During the same period, there were 333,000 students at second level as well as 34,000 undertaking PLC courses. A number of curricular enhancements are salient in this context, including the introduction of new specifications for mathematics ("Project Maths") and preparations to improve the Leaving Certificate Biology, Chemistry and Physics courses, with skills such as problem-solving and enquiry-based learning being prioritised. Work on other subjects, particularly in technology and engineering areas, will be commenced on a phased basis in the future. The new Junior Cycle Student Awards also emphasise skills development including creativity, working with others and communication.

PRTLI

Since its launch by the HEA in 1998, the Programme for Research in Third Level Institutions (PRTLI) ushered in a new era for research and innovation in Ireland. It has fundamentally altered the research landscape in Irish higher education. The programme was established to strengthen national research capabilities through investment in physical infrastructure and human capital. Its overarching vision was to propel Ireland towards establishing an international profile as a premier location for carrying out world-class research and development. Funding has been invested across the sciences (biosciences and biomedical, environment and marine, platform technology and materials), technologies (ICT and Advanced Communications) and social sciences and humanities. The specific objectives set out for the programme were:

a. To enable a strategic and planned approach by higher education institutions to the long-term development of their research capabilities, consistent with their existing and developing research strengths and capabilities and national goals.
b. To promote the development of high quality research capabilities in higher education institutions, so as to enhance the quality and relevance of graduate output and skills.

c. Within the framework of these objectives, to provide support for outstandingly talented individual researchers and teams within institutions, and to encourage co-operation between researchers both within the institutions and between institutions, having particular regard to the desirability of encouraging inter-institutional co-operation within the two parts of the binary system and within Ireland, the EU and internationally.

Since its launch, there have been five cycles of funding. The total investment over the five cycles has amounted to approximately €1.2 billion, including investment from non-exchequer sources. It is important to note this unprecedented level of investment was enabled by the contribution of Atlantic Philanthropies, which was central to effecting a real paradigm shift in Irish research. It co-funded the first three cycles, investing €178 million in total. Funding is provided for both capital and current expenditure: capital includes investment in buildings and equipment whilst current includes investment in research programmes and people. The physical footprint of PRTLI is visible in most Irish higher-education institutions: c. 80,000 additional square metres (four Croke Parks) of research space has been created under Cycles 1-4. In excess of 1,000 researchers and 2,000 postgraduate students have been directly funded, partly or wholly, by Cycles 1-4. Cycle 5 will deliver c.63, 868 additional square metres in research space and c.331 PhD students.

PRTLI specifically focused on building research infrastructure and basic research capability in institutions. It was not intended to fund specific research activities or defined research projects, rather the aim was to put in place the conditions that would allow the right type of activities and projects to proceed. PRTLI has provided a platform for other funding inputs to support research activities, for example, the Irish Research Council (IRC), Science Foundation Ireland (SFI), Enterprise Ireland (EI) and the Health Research Board (HRB). The capital and recurrent investments provide both the physical infrastructure which houses researchers funded by these agencies and in some cases, the skilled human capital (e.g. technicians, teaching buyout at postdoc level) necessary for the research to proceed. An independent report to the HEA in 2011 confirmed that PRTLI was pivotal in stimulating the development of research performance in Ireland. It put in place the research infrastructure, built basic research capability and drove a strategic approach to research activity in institutions.

Future investment needs

Investing in a well-equipped research environment is an investment in the tools that will keep Irish research at the cutting edge of research and innovation. In making decisions on future investment needs, we recommend the following guiding principles:

Focus on quality

Focus on excellence must be the primary consideration when investing in research infrastructures as only excellent research will ensure Ireland's place as a leader in research and innovation. A balance must be struck between maintaining excellence in areas of

strength in Ireland whilst identifying important and emerging areas where Ireland has the potential to lead. As noted by the expert panel appointed by the HEA and Forfás in 2006, it is critical that quality remains the focus of investments in research infrastructure.

Investment in human capital

The effective planning for the lifecycle of a project requires stable research investment. This includes investing in human capital and providing ongoing funding for the training of current and future staff to manage research capital projects. Furthermore, buildings and facilities need people to deliver the research for which they are designed and to create the maximum value from the investment. It is imperative that any investments in research capital is matched by appropriate investments in human capital. It is important to invest in the skills and training of people to populate and continually develop Ireland's research facilities. Stable career paths will help to attract, develop and retain the best researchers in Ireland as well as ensuring a pipeline of skilled researchers. We strongly concur with the UK's Department for Business, Innovation and Skills (BIS) statement that world-class facilities are nothing without highly-skilled and motivated people making use of them.

A broad research base

The grand social challenges (climate change, healthy ageing, food security) facing us as a global society and economy require expertise drawn across the full spectrum of disciplines – from the humanities to the social and natural sciences. Continued investment in research infrastructure across the whole breadth of the research base is essential to enable Ireland's researchers to be truly competitive on global scale.

An appropriate balance

It is important that there is an appropriate mix between existing and new initiatives and building sufficient flexibility to allow Irish researchers agility to respond to new opportunities whilst properly maintaining current infrastructure and the capacity to train future generations of researchers. The duration – and thus stability - of investments is also important, with many international infrastructural investments being based on longer timeframes than seen to date here.

Maintenance, operational costs and upgrades

€738.6 million has been invested through PRTLI in buildings and equipment. It is important that there is a long-term commitment to the maintenance, operational and upgrade costs of these facilities to ensure their future viability and competitiveness. Building a laboratory or a data system is merely the beginning of the lifecycle of research infrastructures, ongoing funding is necessary for maintenance, staffing, insurance and upgrades.

Humanities and social sciences (HSS)

For HSS, data are often the 'large infrastructure' that enables important research in HSS disciplines to advance, for example, the Digital Repository of Ireland (DRI) and the European Social Survey (ESS). The depth and breadth of these infrastructures are invaluable in

furthering research, policy and practice. Big Data is an area that offers potential for interdisciplinary and international research opportunities.

Efficiencies

It has been recognised that there is potential to achieve efficiencies through sharing, e.g. the LIRE (Large Items of Research Equipment) database. During the course of the Strategy, LIRE will be upgraded and actively promoted. In addition to achieving efficiencies, it can potentially lead to a pooling of capabilities and intelligence on assets management. Professor Luke Georghiou outlined the benefits from equipment sharing in a BIS/N8 report: (i) it can create concentrations of research activity between universities and industry; (ii) it can increase efficiency by reducing the number of items that need to be purchased and (iii) it allows capital items too large for a single institution to be purchased.

Landscape of research centres

The consultation paper does not recognise the central role of the research performers in the operation of research centres and this 'invisiblisation' of the institutions is concerning. Again, the paper posits that (p36 as on p10) "*in 2013, SFI had linkages with 72% of IDA Ireland job announcements …".* In fact, this should state that the higher education institutions, with the support of SFI, had linkages with 72% of IDA job announcements in 2013. It is the institutions that (with the assistance of funding such as that from SFI and combined with HEA core funding) run research centres, undertake the research projects and collaborations with industry, and provide the magnet of attraction for FDI.

The document also suggests (p36) that "*Critical to Tyndall's success is its focus on market-needs-driven research. This distinguishes the Institute from university based research*." While the distinctive nature of Tyndall is fully recognised, the Universities (and Institutes of Technology) also undertake market-driven-needs research. This explicitly underpins, for instance, their running of, and success, in the EI/ IDA Technology Centres and SFI Research Centres. The Strategy must recognise the integral engagement of the institutions in such initiatives and in the delivery of their results:

EI/ IDA Technology Centres

Centre	*Institutional involvement*
ARCH: Applied Research for Connected Health	*Host:* University College Dublin *Partners:* University of Limerick, Dublin City University, Maynooth University, NUI Galway, Dundalk Institute of Technology, Dublin Institute of Technology
CCAN: Collaborative Centre for Applied Nanotechnology	*Host:* Tyndall Institute *Partners:* Trinity College Dublin, University College Dublin, Dublin City University, NUI Galway
CeADAR: Centre for	*Host:* University College Dublin

Applied Data Analytics Research	Partners: University College Cork, Dublin Institute of Technology
DPTC: Dairy Processing Technology Centre	*Host:* University of Limerick *Partners:* University College Cork, University College Dublin, NUI Galway, Dublin City University, Trinity College Dublin, Dublin Institute of Technology, Institute of Technology Tallaght
FHI: Food for Health Ireland	*Host:* University College Dublin *Partners:* University of Limerick, University College Cork, Dublin City University, NUI Galway, Maynooth University
GRCTC: Financial Services Governance Risk/ Compliance	*Host:* University College Cork *Partners:* NUI Galway, University College Dublin
IC4: Irish Centre for Cloud Computing and Commerce	*Host:* Dublin City University *Partners:* University College Cork, Athlone Institute of Technology
ICMR: Irish Centre for Manufacturing Research	*Partners:* Dublin City University, Limerick Institute of Technology, Maynooth University, NUI Galway, Trinity College Dublin, Institute of Technology Tralee, University College Cork, University of Limerick
ICOMP: Irish Centre for Composites Research	*Host:* University of Limerick *Partners:* University College Dublin, Athlone Institute of Technology
IERC: International Energy Research Centre	*Host:* Tyndall Institute *Partners:* Cork Institute of Technology, Dublin Institute of Technology, Dublin City University, Limerick Institute of Technology, NUI Galway, Maynooth University, University College Cork, University College Dublin
IVI: Innovation Value Institute	*Host:* Maynooth University
Learnovate	*Host:* Trinity College Dublin *Partners:* University College Dublin, NUI Galway, Waterford Institute of Technology
MCCI: Microelectronics Circuit Centre Ireland	*Host:* Tyndall Institute *Partners:* University of Limerick, Maynooth University, University College Dublin, Cork Institute of Technology
PMTC: Pharmaceuticals Manufacturing Technology Centre	*Host:* University of Limerick *Partners:* University College Cork, Institute of Technology Tallaght, Waterford Institute of Technology, Cork Institute of Technology, Tyndall Institute, NUI Galway, NIBRT, Dublin City University, Dublin Institute of Technology
TCBB: Technology Centre for Biorefining and Bioenergy	*Host:* NUI Galway *Partners:* University College Dublin, University of Limerick, Trinity College Dublin

SFI Research Centres

Centre	*Institutions*
ADAPT: Centre for Digital Content Platform Research	*Host:* Trinity College Dublin *Partners:* Dublin City University, University College Dublin, Dublin Institute of Technology
AMBER: Advanced Materials and Bioengineering Research Centre	*Host:* Trinity College Dublin *Partners:* University College Cork, Royal College of Surgeons in Ireland
APC: Alimentary Pharmabiotic Centre	*Host:* University College Cork *Partners:* Cork Institute of Technology
CONNECT: Centre for Future Networks and Communications	*Host:* Trinity College Dublin *Partners:* Cork Institute of Technology, Dublin City University, Dublin Institute of Technology, Maynooth University, University College Cork, University College Dublin, University of Limerick, Waterford Institute of Technology, Tyndall
CURAM: Centre for Research in Medical Devices	*Host:* NUI Galway *Partners:* University College Cork, Dublin City University, Trinity College Dublin, University of Limerick, RCSI, University College Dublin
ICRAG: Irish Centre for Research in Applied Geosciences	*Host:* University College Dublin *Partners:* Trinity College Dublin, NUI Galway, University College Cork, Maynooth University
INFANT: Centre for Foetal and Neonatal Translational Research	*Host:* University College Cork *Partner:* RCSI
INSIGHT: Big Data and Analytics Research Centre	*Host:* University College Dublin *Partners:* Dublin City University, NUI Galway, University College Cork, Maynooth University, Tyndall Institute, Trinity College Dublin
IPIC: Irish Photonic Integration Centre	*Host:* Tyndall Institute *Partners:* Cork Institute of Technology, Dublin City University, University College Cork
LERO: Irish Software Research Centre	*Host:* University of Limerick *Partners:* Dublin City University, Dundalk Institute of Technology, NUI Galway, Maynooth University, Trinity College Dublin, University College Cork, University College Dublin
MaREI: Marine Renewable Energy Ireland	*Host:* University College Cork *Partners:* University of Limerick, NUI Galway, Maynooth University, University College Dublin, Cork Institute of Technology
SSPC: Solid State Pharmaceutical Cluster	*Host:* University of Limerick *Partners:* University College Cork, University College Dublin, Trinity College Dublin, Dublin City University, NUI Galway, Athlone Institute of Technology, Waterford Institute of Technology, NIBRT

Given the growing global importance of interdisciplinarity, the contribution that AHSS research initiatives such as the Digital Repository of Ireland and Trinity's Long Room Hub can make to Ireland's future development cannot be underestimated. They form an important part of our research centre landscape and of our ability to address future global challenges.

Applied research capacity

A very important development in this space will be the establishment of Technological Universities, defined under the National Strategy for Higher Education to 2030 as "*a higher education institution that operates at the highest academic level in an environment that is specifically focused on technology and its application*". Applications by consortia of Institutes of Technology are at varying stages of development and are being progressed in line with the process set out in the National Strategy for Higher Education.

With respect to the study concerning the market-focused research centre landscape in Ireland, we fully recognise that there is further potential to improve higher education-enterprise research collaborations in Ireland. This notwithstanding, the progress in recent years must to be taken into consideration when reflecting on the present Irish 'research landscape'. Between 2005 and 2012, the average number of licences, option or assignment agreements (LOAs) executed each year by HEIs with companies was up seven-fold to 85 and the number of spin-out companies created each year was averaging 22, an increase of nearly 450%. In the European Knowledge Transfer Report 2013, Ireland was ranked first in Europe based on a composite indicator of knowledge transfer activities.

The HEA's preliminary observations at the outset of this study (May 2014) remain relevant. Firstly, given the time that has elapsed and the developments that have taken place in the Ireland since the 2012 ACSTI report, it is important to identify whether a gap now exists (rather than validating a previously identified gap which could infer a pre-determined outcome) and what that gap specifically is. Secondly, assuming a gap is identified, any solution(s) proposed must be clearly contextualised within the wider remit of the national research system and must take cognisance of – and maximise – the potential offered by the national environment as well as drawing on international practice. Thirdly, where a new model is proposed, the implications for other existing elements of the research centre landscape need to be fully assessed and the linkages between any new model and the present landscape must be explored (in order to maximise the returns on the totality of Ireland's public research investment).

The draft report received (February 2015) notes that (with reference to the Technology Centres) "*their biggest challenge is to keep industry interested in the long term, and to realise and maintain a constant flow of industrial revenue from a limited set of potential industrial customers*". The issue of enterprise R&D capacity is clearly a pivotal factor in this exercise. Flowing from this – and even more fundamental - is evidence of industry demand and its absence from the draft final report. As noted by Technopolis (p9 of draft final report), "*Unlike what was expected, no data on the demand side were available*". It is

unclear how recommendations concerning market-focused research capacity can be formulated without such evidence as to the gap that is to be addressed. The draft paper also notes that one of the key differentiators between comparator countries and SFI Research Centres/ EI-IDA Technology Centres is that "*The overseas centres have significantly different funding models. In general, industry contributions are substantia*l". Given that evidence of industry demand is absent, the likelihood of this key trait being fulfilled in Ireland is far from certain.

Furthermore, it is risky to consider undertaking major changes to the Irish research landscape in the absence of this and in light of:

- Its possible cost to the taxpayer (especially if somewhere like NIBRT is seen as too small);
- Its ramifications for the existing Irish landscape which has improved performance significantly (please see above) and whose integral wider role in Ireland's talent development (through the interconnectivity between research and education within a higher education environment) is pivotal to Ireland's future economic success.

Two reasons offered are "*potential future demand*" and "*Irish industrial policies […] could actually be successful*" (p12 of draft final report). Stronger justification for such major changes is needed given the likely cost and potential consequences.

Key requirements of the future Irish research centre system are outlined in Section 6.2 of the draft final report:

DJEI/ Technopolis draft report	HEA comment
The need to offer higher TRL capacity with critical mass in lined with needs of industry.	In the first instance, evidence of the industry need is absent. Higher TRL capacity with critical mass can be offered through elements of the present system (with potential for enhancement recognised). In addition to the SFI Research Centres and EI/ IDA Technology Centres, Technology Gateways are relevant in this context. As are the forthcoming Technological Universities which are absent from the draft report.
The need to build a sustainable and long-term model.	The fact that overseas centres have longer-term funding horizons than Irish centres does not mean that present Irish research centres are incapable of having them: it rather implies that the current funding support system needs to be reviewed to enable the present centres build towards sustainability. Alignment of future investments with the present research system is pivotal.
A stronger market orientation in any new model.	Through the National Strategy for Higher Education, the Higher Education System Performance Framework 2014-16 is fostering industry-academic collaborative activity as

	a mainstream element of institutional activities. Such collaboration is recognised as central to the advancement of research performance and the development of talent. The Framework, as well as the individual institutional profiles now published annually by the HEA, provide enhanced transparency in respect of related research and knowledge transfer metrics. These metrics are increasingly translating below institutional level into discipline and individual performance and progression. To be successful, it is essential that Ireland's endeavours toward higher TRL levels leverage these broader reforms that are already underway.
A stronger participation of Irish-owned industry.	This is central to the report and is missing.

The draft report concludes that "*from our interviews, expert insights and the Stakeholder Group, the choice for Option 3 [(Development towards a Broad RTO model)] seems evident. Yet demand-side data is needed to build a strong argument for that*". The HEA is unclear as to the evidence underpinning this conclusion. As Technopolis themselves highlight, demand-side data is required to make that case. Furthermore, the risks outlined by Technopolis (p69/70 of draft final report) in pursuing such an approach are worth highlighting:

- "*These relatively large RTOs require a relatively long time to become established with a strong industrial client base;*
- *This model organisation would rely significantly on mostly large domestic and foreign industry funding; there is a risk the Irish system is too small/ volatile for such a continued base;*
- *Given its large size and required industry base, only a small number of these organisations could be supported in the Irish research centre system, thereby most likely not having a full sectoral/ technological coverage;*
- *There is a clear risk of competition for resources (including staff) with HEIs;*
- *Usually more difficult to provide services to (non-R&D performing) SMEs*".

Finally, it is noted that the report proposes this scenario as a solution to the issue that "*SFI research centres […] are slowly becoming 'too applied' for renewed SFI funding*". How this stated issue fits with the view posited that there is a gap in Ireland at higher TRL levels is unclear.

In light of the above as well as the emerging international trend for closer bonds between higher education institutions and previously 'standalone' research centres, we recommend that greater and deeper consideration be given to how constraints within the existing Irish research system can be unlocked. Opportunities for advancement include:

- Improved operational flexibility in identified high performance and high potential areas, for example in collaborative research at all parts of the TRL spectrum and in the winning of Horizon2020 monies for Ireland;

- Co-location and connectivity of research at higher 'TRL levels' with activity at the lower end of that 'spectrum' and with the talent development of many of Ireland's future employees and employers, i.e. our ~ 200,000 students currently enrolled in higher education;
- Pursuit of an additive rather than substitutive approach, building solidly on Ireland's investments in research and talent development over the last two decades.

DES and the HEA, with the higher education system, are committed to the national aim of forging deeper and easier links between enterprise and publicly funded research, thereby growing the return on Ireland's public investment in it. We look forward to continued close engagement with DJEI and its agencies on this critical cross-Government objective.

Pillar 5: Key Messages and Recommendations:

- ***Importantly, as per our preliminary views, it is the research and innovation performers themselves who will deliver this Strategy. Linked to this, the role of the higher education institutions in the landscape of research centres must be acknowledged. In the global research arena, Ireland's international reputation is very closely associated with the recognition and standing of our higher education institutions. Therefore their central role in the Irish research landscape must be recognised and enhanced in this Strategy.***
- ***In this context and with reference to the study on market-focused research capacity, DES and the HEA recommend that greater and deeper consideration be given to how constraints within the existing Irish research system can be unlocked. This will help build critical mass and minimise fragmentation.***
- ***In terms of relevant agency activities, the Strategy needs to recognise the roles of the agencies under the DES umbrella.***
- ***The HEA provides core funding to the higher education institutions which provides the national platform support for all education and research activity in Ireland's higher education sector. It also oversees the sector's strategic development through the Higher Education System Performance Framework 2014-16 and in keeping with the National Strategy for Higher Education to 2030.***
- ***The mission of the Irish Research Council is to enable and sustain a vibrant research community in Ireland. To address the broad skills and research needs within society, it supports excellent researchers in all disciplines from Arts to Zoology.***
- ***A sustainable supply of future talented skilled researchers and innovators requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge. The Strategy needs to recognise the role of education at primary, post-primary as well as higher level, in Ireland's research and innovation performance.***
- ***In considering Ireland's future infrastructural research investment priorities, excellence is a critical consideration. Investments in research capital must be matched by appropriate investments in human capital. Support needs to be balanced across existing as well as new initiatives and the maintenance of all is essential to their long-term viability.***
- ***The establishment of Technological Universities, as mandated under the National Strategy for Higher Education, will be an important development in the context of discussions on applied research capacity in Ireland.***

Pillar 6: World-class IP Regime and Dynamic Systems to Transfer Knowledge and Technology into Jobs

Intellectual Property

DES and the HEA welcome all advancements in Ireland's IP regime that makes it valuable, manageable and accessible for all stakeholders. In light of the significant public investment in research and in the interests of excellent science, we are committed to open access to research findings, facilities, outputs and datasets in a manner that is consistent with the National IP Protocol.

Knowledge transfer and the role of the institutions

As noted in the consultation paper, Ireland was ranked first by the European Commission with respect to knowledge transfer activities. Again, as with other Pillars, the role of the higher education institutions in delivering such results needs to be recognised in the Strategy. This pertains to the rankings cited on p46 and the 2013 statistics cited on p47. As noted earlier in our feedback:

- Between 2005 and 2012, the average number of licences, option or assignment agreements (LOAs) executed each year by higher education institutions with companies was up seven-fold to 85 and the number of spin-put companies created each year was averaging 22: an increase of nearly 450%.
- The Forfás evaluation of enterprise support programmes (referred to under Pillar 1 of the consultation paper) draws attention to the strengthening industry-academic collaborative dynamic in Ireland in the form of, for example:
  - Increased academic-industry linkages;
  - An increase in the research relevance of the research conducted in research groups;
  - Increased mobility of research staff to industry and enhanced in-firm capabilities.

Looking to the future, the impact of public investment in research needs to be defined much more comprehensively, in particular reflecting its contribution to talent development and the variety of routes through which knowledge gets transferred and diffused throughout the ecosystem. The work that is currently being undertaken by Knowledge Transfer Ireland (KTI) in this regard is welcomed.

The HEA is also working with KTI to align the indicators used in reviewing research and knowledge transfer activities, the aim with that being to better align the 'system's' expectations of the institutions.

Technology Gateways

The Technology Gateways, supported by Enterprise Ireland, and run by the Institutes of Technology, deliver very important services across the regions with particular respect to SMEs. They can be noted as follows:

Technology Gateway	*Host Institute*
APT: Polymer Technologies	Athlone Institute of Technology
CAPPA: Innovation through Light	Cork Institute of Technology
Command: Connected Media	Athlone Institute of Technology
CREST: Coatings Innovations	Dublin Institute of Technology
IMaR: Intelligent Mechatronics and RFID	Institute of Technology Tralee
MiCRA: Bio-Diagnostics	Institute of Technology Tallaght
MSTG: Mobile Services	Waterford Institute of Technology
PMBRC: Pharmaceutical and Healthcare	Waterford Institute of Technology
SEAM: Engineered Materials	Waterford Institute of Technology
Shannon ABC: Applied Biotechnology	Limerick Institute of Technology & Institute of Technology Tralee
TEC: Embedded Computing	Cork Institute of Technology
WiSAR: Wireless Solutions	Letterkenny Institute of Technology

Pillar 6: Key Messages and Recommendations:

- ***DES and the HEA welcome all advancements in Ireland's IP regime that makes it valuable, manageable and accessible for all stakeholders.***
- ***We are committed to open access to research findings, facilities, outputs and datasets in a manner that is consistent with the National IP Protocol.***
- ***The role of the institutions in Ireland's knowledge transfer performance to date must be recognised.***
- ***Looking to the future, the impact of public investment in research needs to be defined much more comprehensively, in particularly reflecting its contribution to talent development and the variety of routes through which knowledge gets transferred and diffused throughout the ecosystem.***

Pillar 7: Government-wide Goals on Innovation in Key Sectors for Job Creation and Societal Benefit

Global challenges will provide the foundation

Global societal challenges such as food security and renewable energy require policy actions right across technological, economic and societal domains, as well as national borders. They are being used more and more as the foundation for international research and innovation strategies, as illustrated in the Horizon2020 Societal Challenges. Their scale and global relevance will set the scene for Ireland's future success in international markets – creating the very demand that innovative companies in Ireland will strive to meet - and for our research activities. Consequently, they should logically be positioned as such in the new Strategy, reflecting Ireland's ambitions for global research relevance and impact.

Local strength will deliver the impact

Equally, the outcomes of research and innovation in addressing societal challenges will be felt at local level across the country. The role of DJEI-agency-supported companies in this is fully recognised and it is estimated that DJEI-agency-assisted companies make up approximately 15% of the employment base across the country. At the same time, the importance of supporting the wider economy should not be underestimated. Ireland's higher education graduates contribute to all aspects of Irish economy and society and this broad strength is illustrated by the disciplines with the highest numbers of graduates (2013):

1. Business and Administration (4,877)
2. Management and Administration (4,515)
3. Computer Science (3,107)
4. Nursing and Caring (2,924)
5. Biology and Biochemistry (1,817)
6. Education Science (1,804)
7. Social Work and Counselling (1,787)
8. Law (1,711)
9. Medicine (1,652)
10. Building and Civil Engineering (1,546)

At regional level, the HEA is working with the higher education institutions to promote balanced development through the establishment of HEI regional clusters. These will work to provide a cohesive offering in terms of both the education and research needs of the people and enterprises within a particular region. This approach is consistent with the EU's smart specialisation plans and the Strategy should therefore reflect this national development.

Health

Higher education enjoys a host of interactions with the health sector that are mutually beneficial and relevant to Ireland's research and innovation agenda. Not least of these are the nearly 36,000 students currently enrolled (in 2013/14) in Health and Welfare courses across Ireland's Universities and Institutes of Technology. The SSTI consultation paper

refers to the re-structuring of hospital groups and highlights the importance of the primary academic partners in each. These can be noted as follows:

Hospital Group	*Primary Academic Partner*
Dublin Midlands	Trinity College Dublin
Dublin East	University College Dublin
Dublin North-East	Royal College of Surgeons in Ireland
South/ South West	University College Cork
West/ North West	NUI Galway
Midwest	University of Limerick
Children's	All

Plans to establish a National Health Innovation Hub, as noted in the consultation paper, are underway. The demonstrator project preceding this stage of the Hub's development has been hosted by University College Cork.

Higher education institutions are also running several large-scale research activities, with the support of agencies such as SFI and Enterprise Ireland combined with the HEA's core funding, that are of shared interest with the health sector:

Centre	*Institutional Engagement*
APC: Alimentary Pharmabiotic Centre	*Host:* University College Cork *Partners:* Cork Institute of Technology
CURAM: Centre for Research in Medical Devices	*Host:* NUI Galway *Partners:* University College Cork, Dublin City University, Trinity College Dublin, University of Limerick, RCSI, University College Dublin
INFANT: Centre for Foetal and Neonatal Translational Research	*Host:* University College Cork *Partner:* RCSI
SSPC: Solid State Pharmaceutical Cluster	*Host:* University of Limerick *Partners:* University College Cork, University College Dublin, Trinity College Dublin, Dublin City University, NUI Galway, Athlone Institute of Technology, Waterford Institute of Technology, NIBRT
ARCH: Applied Research for Connected Health Technology Centre	*Host:* University College Dublin *Partners:* University of Limerick, Dublin City University, Maynooth University, NUI Galway, Dundalk Institute of Technology, Dublin Institute of Technology
FHI: Food for Health Ireland Technology Centre	*Host:* University College Dublin *Partners:* University of Limerick, University College Cork, Dublin City University, NUI Galway, Maynooth University
PMTC: Pharmaceuticals Manufacturing Technology Centre	*Host:* University of Limerick *Partners:* University College Cork, Institute of Technology Tallaght, Waterford Institute of Technology, Cork Institute of Technology, Tyndall

	Institute, NUI Galway, NIBRT, Dublin City University, Dublin Institute of Technology

The wider education system plays an important role in relevant initiatives such as health awareness as espoused under Healthy Ireland.

Marine

The 'Harvesting Our Ocean Wealth' Marine Plan identifies eight key enablers, including:

- Research, knowledge, technology and innovation
- Capacity, education, training and awareness

It advises that "*a skilled and experienced workforce that adapts to changing requirements and new opportunities is a pre-requisite for achieving our vision and goals*". University College Cork hosts MarEI – the Marine Renewable Energy Ireland Research Centre that is supported by SFI monies combined with HEA core funding. Its other academic partners in this initiative are University of Limerick, NUI Galway, Maynooth University, University College Dublin and Cork Institute of Technology. Its work covers:

- Operations, maintenance and reliability of marine renewable energy (MRE) devices;
- Enabling large-scale deployment of MRE devices;
- Connection of MRE devices to the national grid;
- Novel methods for storing the energy generated by MRE devices;
- Related marine governance, planning, economics and environmental issues.

Agriculture and Food

In agriculture and veterinary alone, nearly 4,000 students are enrolled in courses throughout the country. The higher education institutions are also very actively engaged in the research agenda of the agri/ food sector, as illustrated in its role in the following research and technology centres:

Centre	*Institutional engagement*
DPTC: Dairy Processing Technology Centre	Host: University of Limerick Partners: University College Cork, University College Dublin, NUI Galway, Dublin City University, Trinity College Dublin, Dublin Institute of Technology, Institute of Technology Tallaght
FHI: Food for Health Ireland Technology Centre	*Host:* University College Dublin *Partners:* University of Limerick, University College Cork, Dublin City University, NUI Galway, Maynooth University
APC: Alimentary Pharmabiotic Centre	*Host:* University College Cork *Partners:* Cork Institute of Technology

Proposals for the forthcoming Meat Technology Centre are currently being reviewed.

Energy

The higher education sector is also active in energy research:

Centre	*Institutional engagement*
IERC: International Energy Research Centre	*Host:* Tyndall Institute *Partners:* Cork Institute of Technology, Dublin Institute of Technology, Dublin City University, Limerick Institute of Technology, NUI Galway, Maynooth University, University College Cork, University College Dublin
MaREI: Marine Renewable Energy Ireland	*Host:* University College Cork *Partners:* University of Limerick, NUI Galway, Maynooth University, University College Dublin, Cork Institute of Technology

Again, the wider education system plays an important role in fostering awareness of energy and environmental issues from a young age.

Research for policy

The Irish Research Council (IRC), in keeping with its mission to "*enable a vibrant research community which will enrich Irish research, the economy and society*" supports 'research for policy' across a range of sectors and issues. For example:

- On 12 March last, it announced a partnership with The Wheel, a representative body for community and voluntary organisations and charities across Ireland. The IRC's objective is to ensure that high-quality research coming out of Ireland contributes to social innovation, and helps socially excluded and marginalised groups. With this in mind, it has awarded almost €400,000 in funding to more than 40 research projects under its Engaging Civic Society initiative, which includes the partnership with The Wheel.
- ÉMIGRÉ – Emigration in an Age of Austerity: undertaken by University College Cork in 2013 and funded by the IRC;
- The publication mentioned in the consultation paper of an independent study of recommendations from Inquiries into events in families and their interactions with State services was supported by the Department of Children and Youth Affairs and the IRC.

In Q2 2015, the IRC will launch its Research for Policy and Society Programme which will involve Government stakeholders. This programme will build on the IRC's existing partnerships with Government Departments and entities and its purpose is to provide peer-reviewed research that will underpin policy decisions.

Pillar 7: Key Messages and Recommendations

- ***The scale of societal challenges such as those in Horizon2020 and their global relevance will set the scene for Ireland's future success in international markets – creating the very demand that our innovative companies will strive to meet – and for our research activities.***
- ***Equally, the outcomes of research and innovation in addressing societal challenges will be felt at local level. Ireland's higher education graduates contribute to all aspects of Irish economy and society and this broad strength is illustrated in the range of disciplines pursued.***
- ***The higher education sector enjoys a host of productive linkages with other Government sectors primarily in the form of its relevant graduates, as well as its research centre activities.***
- ***The IRC, in keeping with its mission to "enable a vibrant research community which will enrich Irish research, the economy and society", supports 'research for policy' across a range of sectors and issues.***

Pillar 8: Research for Knowledge and Developing Human Capital

Future growth depends on innovation; future innovation depends on people

The OECD recognises that people are the lifeblood of innovative processes and outcomes. Closer to home, the 2015 Action Plan for Jobs recognises that "*key to innovation are people*" and the IDA's 2015-19 Winning strategy advises that "*The availability of talent will be the key differentiator for locations to win FDI in the future*".

Therefore, as emphasised in our preliminary views, the successful realisation of all aspects of this Strategy will depend on people and the human capital dimension must therefore be a unifying thread right throughout the Strategy. The first progress report (June 2014) on Research Prioritisation notes that "*human capital is the single most important enabler for the NRPE*". Ireland's research and innovation can only be as good as the people that it can educate, train, attract and retain. It will be people who conduct the research, work in companies to drive innovative performance and create new innovative companies. Ireland has the most youthful population in the EU with one quarter of the population aged 16 and under. This is the reservoir of talent that has the capacity to transform Ireland's national economic and societal development into the future. A sustainable supply of future skilled researchers and innovators requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge.

"*Our people are the cornerstone of our success – known for their innovativeness and flexibility. Competition for talent is global – and talent is mobile. Ireland will be that place which nurtures talent to meet the needs of an advanced economy, developing its own people and attracting talent from around the world*." -Department of Jobs, Enterprise and Innovation, July 2014

Higher education and human capital development

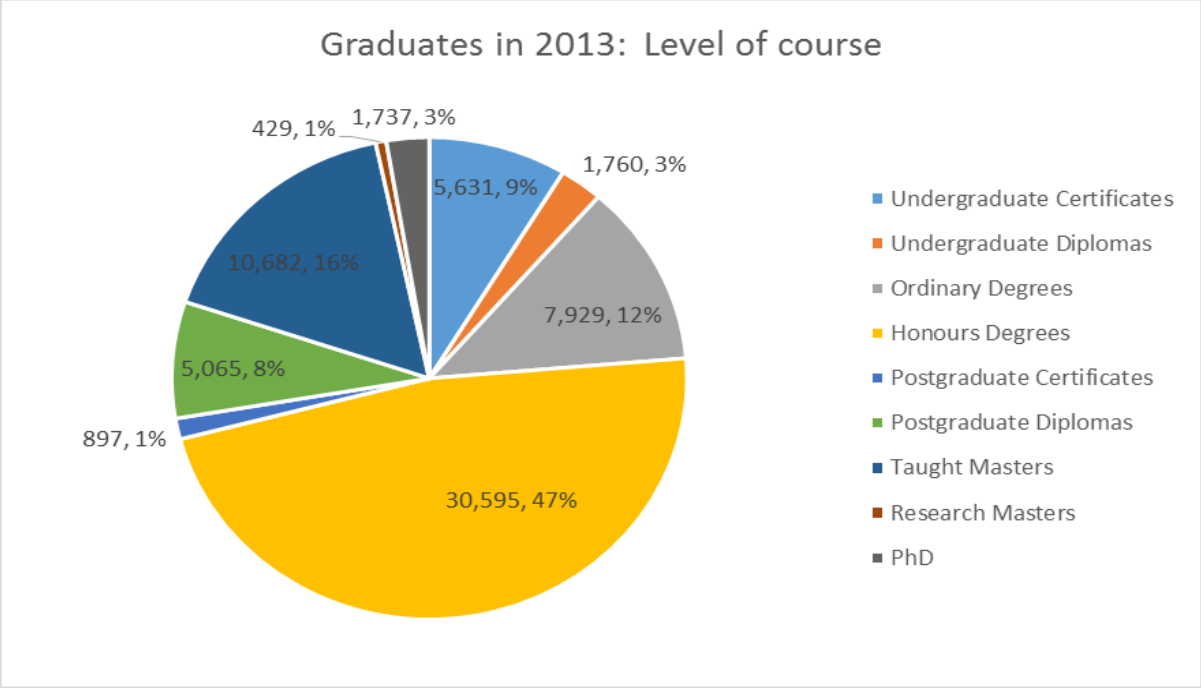
P65 of the consultation paper notes the work of SFI with respect to human capital development. The role of the actual education system in education needs to be highlighted in the Strategy. Job creation is inextricably connected to the employability of our people. Jobs will only be successfully created when people gain employment; and people can only gain employment if they are employable. In order therefore to deliver jobs through innovation, Ireland must have all of the following ingredients:

- Successful innovative companies that can offer jobs;
- Graduates and researchers with the right skills to take up employment in these companies;
- Entrepreneurial individuals that can create innovative companies, i.e. acting as job 'shapers' as well as jobseekers.

Ireland's graduates form an integral part of this mix. They are highly employable as demonstrated by the fact that, in 2012 when the national average un

employment rate was approximately 14%, that of university graduates came in around half that at 7%. The Expert Group on Future Funding for Higher Education, being chaired by Peter Cassells, notes that graduates' "*share of employment in Ireland is currently 13 percentage points higher than the EU-15 average*", appropriately reflecting the progress made by Ireland with respect to the educational attainment of its citizens and the knowledge intensity of its economy. The Cassells Group also highlights the projections that "*48% of the job openings in the Irish economy to 2025 will be for graduates*".

Over the six-year period to 2014, the higher education system delivered 25,000 extra student places. At present, it produces approximately 65,000 graduates annually.

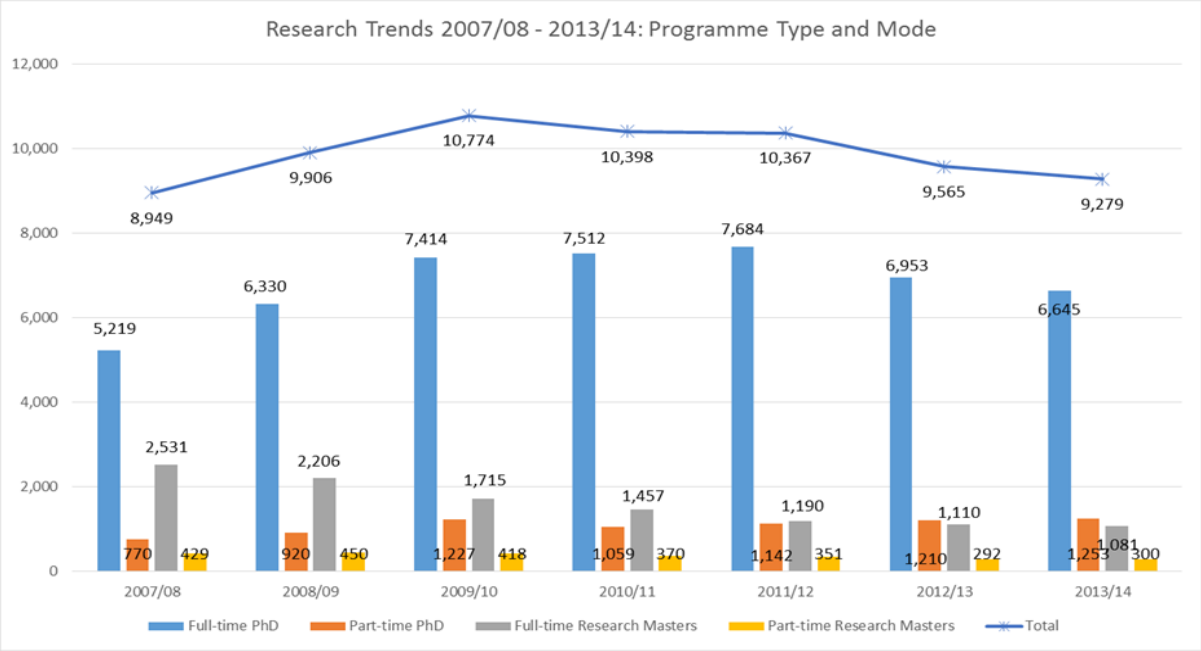


Substantial and steady increases in the demand for higher education will be experienced in the 2015-2020 period and beyond. Based on demographic drivers and labour market requirements for higher skills, it is predicted that the number of new entrants to higher education will increase by 29% between 2013 and 2028.

Looking specifically at doctoral education, the objective under SSTI 2006-2013 of doubling Ireland's PhD output has been successfully delivered by the higher education providers. Acting on the National Strategy for Higher Education to 2030, the HEA and Quality and Qualifications Ireland (QQI) in partnership with the institutions are now launching the National Framework for Doctoral Education, the purpose of which is to:

- Facilitate consistent excellence in the quality of postgraduate education and training;
- Enable and encourage higher education institutions to work more closely in the delivery of an improved learner experience and outcome;
- Maximise the employability of doctoral graduates across a broad range of employment sectors by ensuring that the acquisition of discipline-specific knowledge is complemented by the development of transferable skills;
- Underpin the international standing of the Irish doctoral award.

However, PhD enrolments have been decreasing in recent as a result of several factors such as reduced funding and less staff available for research supervision. While the number of graduates does not flow through automatically from the number of enrolments, the trend is concerning, especially when, for example, the Action Plan for Jobs 2015 is calling for an increase in the number of researchers going into enterprise.



At such a time when Ireland is both at the forefront of international good practice in doctoral provision and there is a shared objective to increase the number of researchers going into enterprise, it is imperative that we re-align our PhD targets to match our national ambitions as a research-intensive nation (while understanding that, given the duration of a doctorate, the trajectory for bringing doctoral levels back on track travels beyond the lifetime of this Strategy). The availability of researcher skills is critical to attracting globally mobile R&D investment and to developing an innovative indigenous sector. Trinity College Dublin, in partnership with LinkedIn, recently carried out an analysis of 11,000 PhD graduates in Ireland over the last 20 years. It shows the doubling of PhD graduates working in industry over the period 2000 to 2010. It also finds that PhD graduates have a broader technical skillset and take up relatively senior positions within companies.

The National Strategy for Higher Education has set in train a series of advancements on the part of the higher education sector. The imperative attaching to human capital development is recognised under the Higher Education Performance Framework System-Level Objective 1: "*to meet Ireland's human capital needs across the spectrum of skills by engaged institutions through a diverse mix of provision across the system and through both core funding and specifically targeted initiatives*". System-Level Objective 4 is "*to maintain*

an open and excellent public research system focused on the Government's priority areas and the achievement of other societal objectives and to maximise research collaborations and knowledge exchange between and among public and private sector research actors".

Based on the seven system-level objectives, the HEA has entered a mission-based performance compact with each higher education institution (http://www.hea.ie/en/policy/national-strategy/higher-education-system-performance-2014-16). These are reviewed through a Strategic Dialogue process with the institutions. The first System Performance Progress Report (July 2014), while fully recognising the potential still to be realised and issues to be addressed, recognises the progress that is being made . It provides a solid basis for advancing and implementing national research objectives through the funding of higher education. It gives greater clarity of purpose and visibility of performance across all Government priorities, including – yet not limited to – research, knowledge exchange and innovation.

The role of the wider education system

In a similar vein at the other end of the education spectrum, a sustainable supply of future talented skilled researchers and innovators requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge. The Strategy needs to recognise the role of education at primary, post-primary as well as higher level, to Ireland's research and innovation performance. A critical early ingredient in maximising employment in Ireland is how well people are educated before they enter the labour market for the first time. Talent development starts a long time before people start looking for jobs. Because of its key role in a person's development, as well as its contribution to mitigating social inequalities and promoting better student outcomes, pre-primary education has become a policy priority in many countries. Results from the OECD's Programme for International Student Assessment (PISA) show that, in most countries, pupils who have attended pre-primary education programmes tend to perform better at age 15 than those who have not (OECD, Education at a Glance 2014: Highlights).

In 2013/14, there were 536,000 students enrolled in primary schools. Initiatives particularly relevant to the SSTI include the development of primary mathematics that will be accompanied by dedicated continuing professional development. During the same period, there were 333,000 students at second level as well as 34,000 undertaking PLC courses. A number of curricular enhancements are salient in this context, including the introduction of new specifications for mathematics ("Project Maths") and preparations to improve the Leaving Certificate Biology, Chemistry and Physics courses, with skills such as problem-solving and enquiry-based learning being prioritised. Work on other subjects, particularly in technology and engineering areas, will be commenced on a phased basis in the future. The new Junior Cycle Student Awards also emphasise skills development including creativity, working with others and communication.

The national imperative for a solid vibrant research base

The concept of 'research for knowledge' used in the NRPE can be somewhat misleading. Research, by definition, is the creation of new knowledge; if research is not producing knowledge, it is simply not research. Fundamental research, by its very definition, poses fundamental questions. It opens new fields and creates previously unforeseen opportunities. It is complex and challenging and, as such, it is essential to the formation of high calibre researchers with the ability to manage complexity and to spot new opportunities. Closer-to-market research is equally invaluable through its role in translating identified opportunities into tangible solutions that have economic value and societal impact. A strong functioning innovation ecosystem will show distinctive strengths in research from fundamental to applied, with well-developed diffusion pathways. The consultation document does not adequately reflect the vital importance of basic research.

Support for excellent research across the full spectrum of fields is also pivotal. The growing interdisciplinary nature of research and the role of humanities in societal challenges as illustrated, for instance, in Horizon 2020, mean that support for such areas must be protected and enhanced if Ireland is to succeed in the global arena. Current trends indicate a concerning fall in research investments in certain fields of study. This stems from a 'perfect storm' of:

- Competitive funding being focused on specific near-term commercial areas, and
- Core funding available for research being constrained by the massive upward student demand for educational resources.

If left unchecked, this may lead to a situation where new research priorities are identified but the relevant capacity in Ireland is no longer present. We must sustain an excellent and vibrant base so that, as priorities evolve in the future, we are best placed to deliver on them. To get Ireland's research base back on the best track for maximum impact, consideration needs to be given to the optimal portfolio of 'priority' and other research activities and related funding instruments. This should involve a clear understanding of the developmental trajectories of the research performers, be they companies, institutions or individual researchers, and the appropriate policy interventions that will enable them to optimise their performance.

Cohesive researcher development

Success in initiatives like Horizon 2020 will be maximised if researchers are being supported systematically from early-stage and onwards to improve their – and with that, Ireland's – research impact. The Strategy needs to advance a cohesive progressive suite of supports for researchers that will build their research performance and thereby deliver improved economic and societal returns for Ireland. This starts with doctoral education where the recent decline in enrolments must be addressed. The importance of such a graduated approach can be seen, for instance, in the European Research Council model of starter, mid-career and advanced awards and this must be mirrored at national level. In addition to supporting the Action Plan for Jobs 2015 call to increase the number of researchers going

into enterprise, more systematic development of Ireland's researcher community will strengthen the research base with which enterprise can collaborate.

It will include:

- Recognition that the quality of our undergraduate education will shape the quality of our doctoral students, i.e. our embryonic researchers;
- Cohesive and progressive support for researchers in Ireland so that they can progress from doctoral level right through to H2020 success as befits their potential;
- Improved channels for researcher mobility in a range of directions, for example, between enterprise and higher education, internationally, etc;
- Clear commitment to gender equality by research performers and funders.

The strength of the Irish research base is also an important factor in the quality and relevance of teaching in our higher education system. It exposes our ~200,000 students to leading research techniques and practices that they can then use in later employment, many for which will be in industry. It ensures that they are learning from staff with an understanding of, and access to, the most up-to-date knowledge in the field. And it is this calibre of education that will prove pivotal to Ireland's future economic success, as highlighted for example in the 2015 Action Plan for Jobs:
"Ireland's competitive advantage in international markets, as well as the competitiveness of our regions, will increasingly be driven by the availability of world-class skills at all levels".

Governance structures

P69 of the consultation paper refers to the Chief Scientific Adviser. As noted under our Pillar 2 feedback, in recent years, a plethora of governance/ 'oversight' groups in the STI space have been set up. Simplified yet comprehensive governance structures (within which the role of the Chief Scientific Adviser sits) representing the whole of Government and engaging the critical research and innovation performers outside Government will be essential to the successful implementation of the full SSTI 2015-2020.

Pillar 8: Key Messages and Recommendations:

- ***Future growth depends on innovation; future innovation depends on people and they are the lifeblood of this Strategy. In order to maximise the Strategy's impact on employment as well as other national priorities, Ireland's next generation of researchers and innovators require – and deserve – the best possible start from our higher education system. This translates into strong institutions that are adequately resourced to educate those ~200,000 students enrolled across the country such that these students are empowered to secure jobs and create companies, as well as shaping and contributing to Irish society.***
- ***The National Strategy for Higher Education and its implementation through the Higher Education System Performance Framework 2014-16 are driving higher education system coherence and progress against a range of Government policy objectives.***
- ***A sustainable supply of future talent requires an effective education pipeline that equips students at all levels with the right mix of skills and knowledge. The Strategy needs to recognise the role of education at primary, post-primary as well as higher level, in Ireland's research and innovation performance.***
- ***It is imperative that Ireland has a solid vibrant research base that is active in research from fundamental to applied, with well-developed diffusion pathways. The consultation document does not adequately reflect the vital importance of basic research.***
- ***To get Ireland's research base back on track, consideration needs to be given to the optimal portfolio of "priority" and other research activities and related funding instruments. This should involve a clear understanding of the developmental trajectories of the research performers themselves, be they companies, institutions or individual researchers, and the appropriate policy interventions that will enable them to optimise their performance.***
- ***The extent to which researchers are being supported systematically from early-stage and onwards to improve their research impact will dictate Ireland's success in initiatives like the EU's Horizon2020. This starts with doctoral enrolments where the recent decline in enrolments must be addressed. The Strategy needs to advance a cohesive progressive suite of supports for researchers that will build their research performance and thereby deliver improved economic and societal returns for Ireland. It will be enabled by increased investment by the Irish Research Council in research that is awarded competitively on the basis on excellence and not limited to pre-defined NRPE areas.***
- ***Such cohesive researcher development will include a clear commitment to gender equality by research performers and funders.***
- ***Simplified yet comprehensive governance structures (within which the role of the Chief Scientific Adviser sits) representing the whole of Government and engaging the critical research and innovation performers outside Government will be essential to the successful implementation of the full SSTI 2015-2020.***