



RDS Committee of Science & Technology

Response to the Interdepartmental Committee Consultation Paper for Successor to Strategy for Science, Technology and Innovation

March 23, 2015

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Introduction

In formulating its response the RDS Committee of Science & Technology has sought to address many of the key questions under each pillar as outlined in the Consultation document.

The consultation paper presents an impressive framework for the public funding of Science, Technology and Innovation (STI), and its linkage to jobs and the Irish economy. The current strategy, and the proposed future strategy, brings together many strands of activity in a co-ordinated fashion. However, some trends and aspects of the policy are a cause of concern for the long-term development and sustainability of STI in Ireland and this submission highlights key areas for consideration to ensure the continued growth of STI in Ireland.

Overall Recommendations

1. Investment

The realisation of the importance of investment in STI led to a significant increase in funding in Ireland in the first decade of this century. However, since 2009 when GBAORD¹ %GNP² stood at 0.64% investment has declined by about 5% every year and for 2014 stands at 0.47%. This is below the EU average of 0.64% and less than half that of comparable small countries with whom Ireland competes. Although the intent of this policy is laudable, it is at variance with the evidence.

- **Recommendation:** Continue significant reinvestment in STI in line with EU average investment and that of Ireland's core global competitors.

2. Balance of Funding

With GERD³ roughly flat in absolute terms since 2009, we note that BERD⁴ has increased while HERD⁵ has decreased by about 15%. This shows support for industry in preference to, and at the expense of, the higher education sector.

- **Recommendation:**
 - A) Reinstate funding to higher education establishments as these are the institutions that nurture and train future talent.
 - B) Balance funding across fundamental and applied research to create robustness, resilience against economic fluctuations, breadth of knowledge, and a healthy ecosystem for research and innovation.

¹ GBAORD – Government Budget Appropriations or Outlays on Research and Development

² GNP - Gross national income

³ GERD – Gross Expenditure on Research and Development

⁴ BERD – Business Expenditure on Research and Development

⁵ HERD – Higher Education Research and Development

3. Researchers' careers, recognition and mobility mechanisms

In light of the need for human capital to perform research and to supply industry the recent evidence of declining Ph.D. numbers is of concern. Ph.D. students are cost effective as for relatively little expenditure they can have a double impact: contributing to existing R&D projects while being trained in the skills industry needs in the future. STI research/education and specific job-training are related but not synonymous and caution is advised where prescribing training too narrowly, as this can reduce the vision and ability of the next generation. Research and innovation potential can also be limited where quality of PhD training and mentoring is not consistent across Institutions.

- **Recommendation:** Significantly increase funding for PhD students without prescriptions on their research. Invest in the development of a clear career structure beyond the doctoral and post-doctoral level to ensure the next generation of STI researchers stay in Ireland.

4. Education

The importance of STEM within the Irish education system needs to be supported from the ground up – starting with primary school aged children and across secondary, tertiary and 4th level education. It is crucial to engage and support this development through, for example, initiatives in Initial Teacher Education, the development of a framework for Continuous Professional Development in teaching and by supporting parental engagement in children's education through informal learning opportunities.

- **Recommendation:** Drive positive change in Irish education across all levels through a sustained commitment to support formal and informal STEM education initiatives and to raise awareness that the skills inherent in these subjects are of crucial importance to the ability of Ireland's future generation to critically assess the world around them.

Pillar 1 Investment in STI and key goals/targets

Question 1. What should Ireland's ambition be in STI?

Question 2. Ireland is currently an innovation follower and lags other small developed countries in R&D intensity. Should we have more ambitious targets for investment?

By limiting research to follow one of 14 priority areas, there is the danger of stifling genuine innovation as researchers tailor their ambition to predefined goals. Funding of basic research should be in balance with research areas which have been prioritised under the current strategy. Two mechanisms that would, over time, allow Ireland to instigate rather than merely follow are to:

- (i) reward research excellence (without limits on the areas) and
- (ii) increase links with international collaborators.

Question 3. How can that level of ambition be justified? Where would we target increased funding and how could this be justified?

Increased funding should be spent on the best research. The ambition can be justified by the documentary evidence linking public investment in STI with economic output, and in particular the success of similar small countries who invest more heavily in STI.

The Swiss Federal Institute of Technology Zurich (ETH Zurich) in a study⁶ on the role of basic research in the sciences provides empirical evidence to support the assumption that the closer a country operates in the technological area, the more resources should be invested in basic research. Basic research supports and strengthens innovation while a higher volume of innovation in turn improves the efficiency of basic research.

An example of the linkage is provided by Israel which has spent over 4% of its GDP on research over the past 10 years and where GDP has increased on average by over 5% year-on-year⁷.

⁶ Gersbach H, Sneider M and Scheller O, (2008) On the Design of Basic Research Policy.

⁷ <http://stats.oecd.org>

Pillar 2 Prioritised Approach to Public Research Funding

Question 1. How can research prioritisation better serve our national objectives of a strong sustainable economy and a better society?

The decision to concentrate funding on 14 priority areas that are '*most likely to give demonstrable economic and societal return*' has significant long-term risks and represents a dangerous trend for the long-term sustainability and competitiveness of this country. There are three areas of key concern in this regard:

- There is no safety-net if these areas do not in fact deliver the promised rewards: the proposed policy is very exposed to technology, societal or industrial shifts.
- It results in all researchers being trained in narrowly focussed areas: consequently, Ireland may not have the experts to respond to whatever key technologies or EU funding policy exists in 2035.
- There is a corresponding lack of expertise in all other STI areas, including the underpinning core disciplines as well as areas from which new breakthroughs and innovations may occur.

Question 2. How best do we identify emerging areas of opportunity and challenge i.e. horizon scanning?

The model proposed in the consultation document is not formulated to facilitate horizon scanning as it is reactive, responding to defined priorities, rather than proactive and searching for new opportunities. The best way to achieve horizon scanning is to support the best researchers, without limitation on their research areas, which then provides the diversity and research strength upon which to choose to invest.

Pillar 3 Enterprise-level R&D and Innovation Performance

- *Please Note: There is no response submitted under this Pillar.*

Pillar 4 International Collaboration and Engagement

Question 1. How can we further increase/strengthen the effectiveness of our international collaboration and engagement across all areas of STI investment in pursuit of economic and societal goals?

Increased involvement in international collaborations appears to be a particularly efficient mechanism for knowledge transfer to Irish-based researchers and companies and for increasing the reputations of both abroad. This can be achieved by supporting the involvement of scientists based in Ireland in more international collaborations, particularly interdisciplinary projects, where cross-fertilisation of tools and techniques lead to new knowledge in the form of spin-offs, or competitive advantage for participating companies.

Question 2. What additional measures can be taken to maximise the engagement of industry as a partner in this regard?

It is important to have a coherent approach to international cooperation and to promote Ireland as a research and university location. In particular it is recommended to invest in projects that require collaboration with industry for scientific success i.e. frontier challenges at the edge of what is technologically feasible. A survey of European scientific projects with significant EU investment may also highlight potential opportunities for enhanced Irish engagement.

Pillar 5 Organisational/Institutional arrangements to enhance research excellence and deliver jobs

Question 3. How can Ireland optimise its strategic advantages of location, scale and environmental quality as a fundamental component of its research infrastructure?

Ireland's rich environmental and cultural background provides an ideal setting to encourage and enhance fundamental creativity, particularly in pure research. Its situation at the edge of the Atlantic provides an excellent inspirational location for both the Americas and Europe.

While technological advances may flourish within a collegiate atmosphere, which is already found in our many excellent technical institutions, pure science benefits from time to contemplate without commercial or administrative pressures. Independent centres for research in the past and present have encouraged world renowned pure research from scientists and mathematicians and the environment in Ireland is conducive to such thought processes.

Ireland can provide a positive catalytic environment for all research which ultimately is the base of all future scientific achievement. This aspect of scientific life should not be lost in the ever pressing pursuit of commercial and social requirements.

Question 4. How can we further increase/strengthen the effectiveness of our national collaboration and engagement across all areas of STI investment in pursuit of economic and societal goals?

Promote a climate of openness and transparency to encourage the community to buy-in to the process. Engage with, and use the expertise and opinions of the community in developing strategy.

Pillar 6 World class IP regime and dynamic systems to transfer knowledge and technology into jobs

Question 2. In terms of Intellectual Property policy, are there specific interventions or supports of a legislative or non-legislative nature that would improve the business environment and act as an incentive to create and sustain an innovative culture?

Strengthen the role of Technology Transfer offices, or embed dedicated IP Fellows within Universities, to work with researchers to spin-off their ideas into industry more efficiently, and to generate income from the EU.

Pillar 7 Government-wide goals on innovation in key sectors for job creation and societal benefit

Question 3. How can we address national challenges and also provide economic opportunities through development of new products, processes, systems?

Question 4. How can we address local and national challenges that are also regional and global challenges - how can Ireland through its research turn national challenges into global opportunities in areas such as sustainable land use, urban and rural development, and vulnerabilities to global trends and changes?

The Agri-food industry is one of Ireland's largest indigenous and export industries, operating to world-class standards. Although considerable challenges presently occur and will continue to exist in this sector, a decade of opportunities is envisaged as part of Food Harvest 2020.

Ireland has a responsibility to be smart and effective in the way we produce higher quality food and to be responsible and diligent in tackling our greenhouse gas emissions commitments. In addressing this challenge, and as one of the most recent signatories of the Global Alliance for Climate Smart Agriculture, Ireland can become an international leader in Climate Smart Agriculture which has potential to increase farm productivity and incomes; build resilience to the impacts of climate change; and reduce agricultural greenhouse gas emissions.⁸

⁸ Minister Simon Coveney TD, launched the RDS and the Institute for International and European Affairs (IIEA) Leadership Forum on Climate Smart Agriculture. <http://www.rds.ie/index.jsp?p=106&n=697>

Pillar 8 Research for knowledge and developing human capital

Question 1. What more can we do to best harness the potential of our knowledge base for sustainable economic and social well-being?

Question 2. What additional steps can government take to ensure the development of human capital across the population to ensure the success of the new Strategy?

The strategy to promote the University as the best place for the advancement of science has been very successful. Science has become the backbone of society, the prerequisite for progress and economic growth but the future STI strategy should be broadened to reward all scientific excellence, thus ensuring a secure and robust knowledge base for the future.

The quality of teaching at third-level is being impacted by the prioritisation by Universities of funding for research and not teaching. It is important to rebalance the allocation of funds to ensure that the next generation of STI researchers in Ireland are provided with world-class educational opportunities at third-level. In addition, over 408,000 young people have emigrated from Ireland since 2010⁹, the loss of such a significant cohort of Ireland's young, educated workforce is of great concern to the future of Irish innovation, research and education.

To ensure that Ireland continues to perform competitively at international levels in STI, it is crucial to support STEM education at all levels in Irish education – from primary school through to secondary, tertiary and the fourth level.

It is of great concern to note that children are losing interest in science and maths at a very young age. In part this may be due to how science is taught at primary school level as many primary school teachers did not experience science instruction as part of their initial teacher training. Ireland is not unique in this situation which is reflected in many European countries and revisiting teacher education and programmes of continued professional development is needed to support a sustained renewal in science education across Europe¹⁰. To achieve this, Ireland needs to develop a clear framework for Continuous Professional Development for the teaching profession. The current fragmented, and at times non-accredited nature, of continuous learning opportunities for teachers, in particular at primary school level, does not incentivise individuals to engage in CPD opportunities.

Ireland must encourage PhD and Master-level research scientists to see teaching as an appropriate career path and ensure that clear paths of entry to the teaching profession are a part of this strategy. At secondary level, following a bachelor

⁹ CSO 2014

<http://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimatesapril2014/#.VQXBU9KsUYE>

¹⁰ www.alllea.org/Content/ALLEA/WG%20Science%20Education/ALLEA%20Report_A%20renewal%20of%20science%20education%20in%20europe.pdf

degree, trainee teachers can expect to spend a further €12,000 on fees alone on the new 2-year Masters course but since February 2012 there are no longer any incentives for those with higher degrees to go into teacher training¹¹.

Many other professions have strong structures to support continuous learning throughout an individual's career but the absence of such a framework in the teaching community is a risk to the long term sustainability of the Irish education system to support the development of STEM skills throughout the tiers of learning. It is important to recognise that not every child will go on to pursue a career in a STEM-related field, but the skills inherent in these subjects are of crucial importance to the ability of Ireland's future generation to critically assess the world around them.

Question 3. How can we ensure that the requisite links between research and scholarship are maintained across all RPOs?

Scholarship should inform research, and teaching should be research-led. Small awards / studentships can ensure that teachers at RPOs remain as active researchers and deliver high-quality education. There is a danger of a two-tier system consisting of researchers who do not teach and teachers who do not research.

Question 4. In order to achieve a sustainable research capacity, are the outputs of our research system at doctoral and postdoctoral level the right ones in terms of volume, quality and relevant discipline?

The recent dip in Ph.D. numbers suggest volume is falling. Ph.D. funding should be increased since, as previously noted, it has the potential to be cost-effective, providing research outputs during training. Quality can be assured by funding doctoral and postdoctoral researchers to work on projects of high scientific merit, under the guidance of the best researchers. In this regard, the model of ever-larger, management heavy, research teams needs some re-evaluation. Students perform best in compact teams where they and the PI have ownership of their research and the student has direct contact with senior researchers.

Question 6. How can we better leverage our research talent into the economy? How can those individuals active in research (and those seeking to be), both in the public and private sectors, be best supported to perform and progress including through optimum researchers' careers, recognition and mobility mechanisms.

The existing culture of short term contracts for post-doctoral researchers generates a significant lack of stability and long term vision in the sector. There needs to be a greater focus on the development of a career path for researchers beyond post-

¹¹ www.asti.ie/pay-and-conditions/pay/allowances

doctoral stage, to ensure that Ireland retains the pool of talented researchers it has generated at the 4th level.

Question 7. How can gender equality in publicly funded research activity be further enhanced?

Firstly, address the root cause and increase the number of women entering STEM from a young age. Secondly, address the short-term insecurity of the research ladder. There are many reports¹²¹³ highlighting the key issues which contribute to the lower numbers of girls and women engaged in STEM education and research. As this is a key concern for both government and industry there is potential to develop collaborative solutions to address this issue.

Question 9. Should research and innovation performers be supported to engage citizens more actively in the innovation process to achieve optimal outreach to the public?

The growing importance of STI for Irish society requires new forms of dialogue to foster social acceptance of technological advances and to communicate the value of fundamental research. It is important to develop a strategy to shape this dialogue, to develop an incentive system for scientists to communicate their research and to encourage ethics discourses at Universities and Institutes of Technology.

To ensure the long term sustainability of STI in Ireland, is it important to engage the key influencers of Ireland's next generation - parents, families and teachers, to promote dialogue about the value and importance of STEM education, skills and careers, for Ireland's economy and culture. Through joint industry, academic and educational initiatives, Ireland has the potential to become a world-leader in public engagement in STEM and informal opportunities for learning outside of the classroom. Importantly, this also hinges on the development of tools to measure the impact of informal learning opportunities to ensure meaningful interaction and engagement between those directly involved in STI and the citizens of Ireland.

¹² <http://www.intel.com/content/www/us/en/technology-in-education/making-her-future.html>

¹³ <http://www.accenture.com/ie-en/company/sponsorships/Pages/powering-economic-growth.aspx>