RESEARCH

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Overview of a Year in Research
A Turning Point for Pure Basic and Frontier Research

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I n this piece, Dr Eucharia Meehan spotlights reasons to remember 2017 in relation to Research, including Ireland's re-commitment to supporting pure basic and frontier research, its investment in an Irish node of the global radio telescope LOFAR, and the announcement in Budget 2018 that Ireland will join the European Space Observatory in 2018.

2017 will be remembered by many in the research system as the year Ireland re-committed to supporting (albeit on a modest level) pure basic and frontier research. In late 2016, in Budget 2017, an acknowledgement had emerged of the imbalance in the system, between the competitive funding available for fundamental, longer-term research and for nearer-term, more predictable impact research. But it was only in April 2017 that the research community really believed a turning point had been reached. The launch of the Irish Research Council Laureate (frontier research) Awards for both the early and mid-career stages indicated that a real change was under way.

The programme, which is modelled on the prestigious European Research Council (ERC) awards, will uniquely reward ambitious (higher-risk) ideas and excellent individuals. It will be a key cultivating mechanism and stepping stone to the ERC programmes for the Irish research community. Not only this, but the government then announced in October (Budget 2018) that funding would be provided under the Laureate programme for later-stage career researchers (Advanced awards). This ensures a full suite of opportunities for researchers across all disciplines and all career stages. It comes not a moment too soon given that there was only one ERC Advanced Award in Ireland in 2017, received by Professor Tom Ray, an astrophysicist from the Dublin Institute for Advanced Studies (DIAS).

The second reason 2017 is a seminal year for pure basic and frontier research is rooted in the decisions to invest in global research infrastructures. This type of investment is critical for Ireland taking its place in the world research and science ecosystem. I will first mention, in particular, the investment made in an Irish node of a global radio telescope called LOFAR, the node being called I-LOFAR. The government, research institutions (including DIAS), private entities, and individuals all came together to make this a reality. The radio telescope will be based, very appropriately, at Birr Castle, which has a long association with Irish astronomy and research. A further instance of such forward-looking investment was the subsequent

announcement in Budget 2018 that Ireland will join the European Space Observatory (ESO) in 2018. Again this investment will reap benefits not only for the research system but for public and private entities alike.

Through these decisions Ireland is, at a strategic level, taking small steps to play its role in global research and 'big science'. Whilst the government and its agencies made decisions to support these infrastructure initiatives, congratulations must be extended to those members of the research community for their persistence and advocacy, which will bring Irish research to a better place.

Research landscape evolution – national and European

Alongside these international developments, the national research landscape continued to evolve in line with national policy as set down in Innovation 2020. In September the forthcoming establishment of four new centres focused on national economic research priority areas was announced. These are co-funded by Science Foundation Ireland (SFI), the private sector, and the host higher education institutions (HEIs), and represent an investment of €72m. Centres in Smart Manufacturing, Bioeconomy, Neurotherapeutics, and 3D Manufacturing have been announced, bringing to 18 the number of centres being established by SFI and the HEIs. Four more centres are to be selected for establishment when funds become available.

In parallel with these developments, a movement grew in 2017 to acknowledge the benefits of supporting societally orientated research. Whilst initially driven by the adoption of a Societal Challenge approach by Horizon 2020, there is now more appreciation of the need for research to address national, European, and global issues – even in the absence of a technological or economic imperative.

At a national level, the publication early in 2017 of the 'Engaged Research' policy and practical guide by Campus Engage and the Irish Research Council (IRC) set the scene. Further initiatives by both the IRC and the Health Research Board (HRB) to engage societal stakeholders have ensured this agenda has developed some green shoots. Examples include the support of research to contribute to attaining the Sustainable Development Goals, partnering with NGOs and inter-government entities to enable this, and supporting medical patient engagement with research. There is increasing interest among NGOs and government departments in this approach. It is hoped that a Research Prioritisation 'refresh', while focused on economic impact, will take cognisance of the need for this broader approach, not least in view of the growing global focus on research which would contribute to the Sustainable Development Goals.

The latter also has been advised as a focus point by an Expert Group set up by the European Commission to advise on the next Framework Programme, FP9. Professor Mark Ferguson, chief science adviser to the Irish government and director general of SFI, was a member of this advisory group; their report, referred to as the Lamy Report, is available online at: https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf. Ireland recently made its preliminary submission on FP9.

A movement grew in 2017 to acknowledge the benefits of supporting societally orientated research.

The big unknown in developing FP9 is the UK's relationship with it. It is widely acknowledged in the research community that the UK is a significant contributor to the European Research Area. In 2017, policy makers and research institutions considered the impact of Brexit on national and European research. In the higher education and research domain, the Department of Education and Skills, Higher Education Authority (HEA), IRC, and SFI have all advised and are developing approaches to mitigate negative consequences of Brexit for the Irish higher education and research system. You can read more on this elsewhere in this publication. It is hoped that matters will be much clearer by the time we publish the Education Matters Yearbook 2018.

On a more positive note, Ireland's drawdown from Horizon 2020 reached €475m, and there was a very welcome acknowledgement of the efforts of the research system to engage with H2020 through a mid-term EU H2020 Champions awards ceremony in the summer.

High-level policy developments
Earlier in the year, a 'refresh' of the Research Prioritisation Report (2012) was initiated by the Department of Business, Enterprise, and Innovation, to conclude by early 2018. The output from this is highly anticipated by the research performing system.

Other areas of focus in 2017 included the advancement of gender equality in research. The HRB, IRC, and SFI's announcement in December 2016 that they would all require institutions applying to them to have a Bronze Athena Swan award by the end of 2019 really is focusing minds. The HEA published the first progress report a year after the Report of the Expert Group: HEA National Review of Gender Equality in Irish Higher Education Institutions (June 2016). The new data shows there were only small improvements (1–2%) in addressing the under-representation of women at senior levels and on the governance and management of institutions between 2015 and 2016.

Regrettably, the critical matter of funding for the higher education system also remains a challenge and is not yet fully resolved. There was a very welcome modest increase in overall funding for the system and a proposal to increase the employer contribution to the National Training Fund in Budget 2018. Not unconnected with this is the fact that the positioning of Ireland's HE institutions in the much-derided institutional rankings remained much the same. But going back to the thorny question of a broader, more sustainable approach to funding the system, this will hopefully emerge in 2018.

Challenges at national level are also impacting on the higher education and research system. Accommodation for students, academic staff, and international researchers is now a very real problem. I say this totally aware of the more chronic problem that accommodation and housing are for many people in Irish society. But in looking back on the year in research, the consequence of this broader national issue for research and academia cannot go unmentioned.

Change at the helm

2017 was also a major year of changes in the leadership of Irish higher education and research. For the first time in the country's history, a Minister of State for Higher Education was appointed after the early summer election. Minister Mary Mitchell O'Connor, who had experience in the Jobs, Enterprise and Innovation portfolio in the previous administration, became the first Minister for Higher Education at a key juncture for the system. Minister John Halligan was reappointed to the Skills, Research, and Innovation portfolio and continued to champion the importance of research funding. There were also changes at the helm of key agencies. Dr Graham Love took over stewardship of the HEA. Peter Brown was appointed director of the Irish Research Council and it would be remiss of me not to say Happy 15th Birthday to the IRC. An event marking the anniversary was held in December.

Evolving issues for 2018 and beyond

Finally, the big policy issue that arose this year in different guises, and which will continue to absorb much time and focus in the coming years, was how researchers and systems enable access to knowledge created through public research investment. In the European context, this manifests itself in the debates on open access, open data, and open science policies. In open access, tensions have increased between the main publishing houses and the broader community, but in particular funding agencies.

Internationally in recent months there have been interesting salvos from entities such as the Gates Foundation pushing for more open access to research and data. ResearchGate, an open access portal, appears to be running afoul of publishing houses over what is available through it. Access to data will be an especially important area in the next decade, and you can read more about this elsewhere in this publication.

At a more local and granular level, the HEA is reviewing how institutions deal with intellectual property and any benefit from it. On a positive note, statistics from Knowledge Transfer Ireland indicate a trend of growing performance in the transfer of knowledge by the higher education and research performing system here in Ireland.

In conclusion to this piece, it is clear that openness on various levels will continue to be a key driver of policy. In a broader context, when one considers the challenges to the validity of research and science, the matter is not trivial. In an unprecedented move, researchers all over the world took to the streets in May to 'March for Science'. The IRC asked us in 2016 and 2017 to 'Love Irish Research', and we need to continue to do so, but we also need to 'Believe in Science' as requested by SFI in recent months. Engagement by research performers, researchers, and funders with the broad public, and defence of good research and science, are now more critical than ever.

Not Merely an Economy
Research Funding and Irish Higher Education

Pól Ó Dochartaigh
MRIA, Registrar and Deputy President of NUI Galway

Professor O'Doherty warns of the danger of focusing too narrowly on applied research, and collaboration with industry, to the detriment of research in the humanities and social sciences. The latter promotes a better understanding of society, enabling us to face the challenge of change and benefit from the advantages that will undoubtedly come with it.

In 2010, when I was at Ulster University, I asked the vice president for research for £10,000 to employ a post-doctoral researcher for a few months. My research background was in German-Jewish literature and history, but for a few years I had been picking up references to Jews in Irish literature, of which I had always been an avid reader but never a scholar. I thought there might be more but needed someone with expertise in the field.

The researcher I was able to employ, Barry Montgomery, found so much material that it became clear there was a full-scale research project to be conducted on this. His preliminary findings instantly debunked the myth, put to me by various people, that the topic consisted of 'Bloom, Bloom, and Bloom', with maybe David Marcus thrown in by the more well-informed. I co-opted a professor of Irish literature at Ulster, Elmer Kennedy-Andrews, as my co-investigator and applied to the UK's Arts and Humanities Research Council (AHRC) for a £408,000 grant, and we were successful. The project ran for three years, and our team has discovered hundreds of references to Jews in Irish literature, including in obscure Gaelic manuscripts.

Now ongoing as a collaboration between Ulster University and NUI Galway, the project will lead to a significant volume on the subject, the first of its kind, now in preparation. We created an exhibition telling the story, in twelve panels, which has been in seven locations in both parts of Ireland and in three locations in the USA (New York, California, and Washington, DC). In 2018 it will travel to Britain and Canada. We are illuminating a little-known aspect of Irish literature and what it says about Irish identity in the context of ethnic and cultural diversity.

Different venues for the exhibition have yielded their own surprises. Colleagues in Dublin unearthed little-known documentation in the Royal Irish Academy (RIA) archives. In Waterford, courtesy of archivist Kieran Cronin, the exhibition featured newly uncovered material on Waterford's little-known Jewish community, small but thriving in the late nineteenth and early twentieth centuries. In

Belfast we exhibited various artefacts, including the keys to the old Great Victoria Street synagogue. In Galway, courtesy of archivists Kieran Hoare and Barry Houlihan, we displayed rare materials relating to Jewish theatre groups and plays with Jewish themes put on in Belfast and Dublin in the twentieth century.

All of this richness has reached a wider audience, and provoked discussion on the nature of Irish identity and whether it was ever really the monolith some think it was, even in the first decades after Partition. This is important research in the context of social changes taking place in Ireland today, but it was made possible courtesy of a UK grant. If we had been dependent on the current research funding environment in the Republic, this material would have remained buried.

Of course, everyone understands that after 2008 there was a need to batten down the hatches, as the property bubble burst and unemployment soared. No one could blame any government that put a large degree of emphasis on applied research. Some of the industries that are key to Ireland's economic recovery enjoy the fruits of research that is conducted in our universities, and our graduates and others find work in those industries. Medical technologies constitute one branch of industry that has become extremely important to Ireland's economic well-being (and, in health terms, not just Ireland's), and it would be a fool who decried the successful partnerships created in this field on the back of Irish and international industriousness, intelligence, and originality. Science Foundation Ireland (SFI), Enterprise Ireland, and other investors have also been vital not only in attracting non-Irish talent to Ireland but also in bringing back talented Irish people who would otherwise remain overseas, to our detriment.

But we have had almost ten years of this narrow focus, and a new approach is needed. Quite apart from the fear that the current strategy has sometimes seemed too narrow even in STEM terms (it has been argued that income and industrial collaboration sometimes appear to be more important metrics than hitting the research highs in terms of peer-reviewed research, which would enhance reputations and enable more prestigious international collaborations), it will cost Ireland in the long term both financially and socially if it is continued.

If we look at the German research ecosystem, we see significant funding for research in universities and research institutes across all disciplines and including both fundamental and applied research. The Helmholtz Association 'pursues the long-term research goals of state and society to maintain and improve the livelihoods of the population, in six key areas: Energy, Earth and Environment, Health, Aeronautics, Space and Transport, Key Technologies'. It has an annual budget of €4 billion, 70 per cent of it from state funds, while the individual centres are responsible for raising the other 30 per cent through projects. The Fraunhofer Society, which sponsors 69 Fraunhofer Institutes in Germany as well as global collaborations, is dedicated to applied research and industrial collaborations and enjoyed an annual budget in 2016 of €2.1 billion, of which 70 per cent came from industrial and state contracts.

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But Germany also has the Max Planck Society, which currently sponsors 83 Max Planck Institutes and facilities to 'conduct basic research in the service of the general public in the natural sciences, life sciences, social sciences and the humanities'. Staff in the Institutes publish 15,000 internationally peer-reviewed articles a year, the Society enjoys an annual budget of €1.8 billion largely from public finances, and 18 Nobel Prize winners have come from its ranks since it was founded in 1948. Some of this pure research will provide the ideas, called 'intellectual property' these days, on which applied research will build. In addition, the German Research Society (DFG) has an annual budget of €3 billion to distribute across the full range of disciplines, largely via the universities.

Or take the UK system. For years they have had a national Research Excellence Framework (REF, until 2008 the RAE) and seven research councils, which are used to disburse significant amounts of research funding. In the REF, submissions are graded not only by the excellence of publications (originality, significance, and rigour) but also by the research environment of the discipline in its institution, and by the impact of the research, crucially judged as 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia'. £1.6 billion annually in Quality Research funding is disbursed under this performance measurement across the entire range of disciplines from History, Law and Languages to Medicine, Engineering and Maths.

18 Nobel Prize winners have come from its ranks since it [Max Planck Society] was founded in 1948.

But there is an additional competitive environment. The research councils, among them the Medical Research Council (MRC), the Engineering and Physical Sciences Research Council (EPSRC), and the AHRC, award billions each year based on competitive research application calls. Of course, it is no surprise that the lion's share of this goes to the STEM disciplines, nor would anyone seriously expect otherwise. The MRC alone had an annual budget of £755m in 2016–17. Yet within that framework the UK government also found an annual budget of £105m for the Arts and Humanities. That is not huge, but it is enough to create a competitive environment in which the Arts and Humanities can contribute research to promote a better understanding of our society, and they are not exempted from the discourse of 'impact'. In 2018 the research councils will be merged into a new structure, UK Research and Innovation, which will aim to 'make it easier to fund cross-disciplinary studies and create an integrated research and innovation system'. It will have an annual budget of £6 billion. Crucially, like the DFG, its remit will cover the full range of disciplines and types of research.

Contrast their holistic approach to research funding coverage with the Irish situation. In 2016 the Irish Research Council (IRC) had an annual budget of almost €35m, of which just over €31m came from government, but two-thirds of this is used for postgraduate and postdoctoral bursaries across all disciplines (just over half go to humanities and social sciences), and half of the remainder is for collaboration with industry. Beyond that, basic research and the arts and humanities have to find private sponsors or look outside the country.

Science Foundation Ireland is devoted entirely to applied research and collaboration with industry, and had an annual budget in 2016 of €195m. The Health Research Board (HRB) distributed an additional €43 million for health projects. Between them, SFI and the HRB perform an important function that is analogous in many ways to the STEM research councils in the UK and Fraunhofer and Helmholtz in Germany, and investment in this kind of research, some of which additionally comes from Enterprise Ireland and industry itself, is an essential part of any contemporary national research ecosystem. It has certainly boosted the Irish economy, amongst other things in the area of medical technologies, where we are now among the world leaders. That is to be welcomed.

Health and wealth, though crucial to our well-being, are not the sum total of human existence.

Yet there is another critical aspect to our narrow approach. The funding that the research environments in other countries provide creates a pipeline in which early-career researchers can secure small grants that enable them to build a track record that makes them attractive to international collaborators and competitive for larger European grants. Ireland has set itself ambitious targets for drawing down European funding, yet we tie our own hands in narrowly defining and funding the areas in which we will promote or own talent. Admittedly (and somewhat disgracefully), EU funding initiatives have increasingly been going the same narrowly industrial route, but they are not exclusively so, and they have the potential, ironically, to make much of the humanities and social science research currently being undertaken more applied. Yet we don't invest in developing this.

Part of that may be because the research funding culture in this country is as yet immature. As late as the 1990s it was virtually non-existent, even though we had many researchers of international repute in our institutions. The creation of the IRCHSS and IRCSET in the early 2000s was a welcome development, and the IRC has continued their traditions. And the crash of 2008 has played a wider role, for there is a bigger issue around the chronic underfunding of third-level education in Ireland, whether teaching or research. All in all, there are many reasons that can be given for focussing on applied research and industrial collaboration.

Current public funding for research is simply unambitious and far too narrowly focussed.

But health and wealth, though crucial to our well-being, are not the sum total of human existence, and nor should they be the sum total of our curiosity as driven by research in universities. Our much smaller country can never hope to unlock the levels of funding outlined in Britain and Germany above, but in two-thirds of the areas described we don't even try. To take just one example: An equivalent budget per head of population to the £105m that the AHRC enjoys would be around €10m in Ireland, but this modest sum could unlock significant creative energy in the Arts and Humanities in Irish universities and build the track records that would later unlock international funding. Daniel Carey, director of the Moore Institute at NUI Galway and vice president of the RIA, puts it thus:

> Experience has taught us that a failure to invest in infrastructure leads to serious problems down the road. The same applies to neglected investment in the humanities. We have performed at the highest level in this domain, but our capacity to do so will not survive unless we treat it as a priority to be supported by funding.

As our society changes, investment in the humanities and social sciences will enable us both to respond to any threats that might come from change and to benefit from the advantages that will also undoubtedly come from change. In a rapidly evolving Irish society, current public funding for research is simply unambitious and far too narrowly focussed.

Professor Pól Ó Dochartaigh, MRIA, is Registrar and Deputy President of NUI Galway and a former President of the Association for German Studies in Great Britain and Ireland.

Pictured on 15 October 2017 as a new partnership was announced between Irish Research Council and Arts Council to encourage collaboration between research and arts communities (L-R): Peter Brown, Director of the Irish Research Council; Orlaith McBride, Director of the Arts Council; Sheila Pratschke, Chair of the Arts Council; Professor Jane Ohlmeyer, Chair of the Irish Research Council.

Open Access to Publications and to Data from Publicly Funded Research

Ireland and the World

Alan Smeaton

Professor of Computing and Founding Director of the Insight Centre for Data Analytics at Dublin City University

Open Access is a movement within scholarly research across all disciplines whereby the outputs, including publications and data, are made freely available to everyone without restriction. In the case of Open Access to data, it also covers data from public bodies like local governments. In Ireland we are slowly making progress with open access to publications and poor progress to research data while our Open Access to data from public bodies is progressing well.

Open access is a term normally reserved for describing how the outputs of research – covering publications and data – can be made openly accessible without restriction, to anybody. Traditionally, research outputs have typically been disseminated by publishing books or journal papers using the support and services of (academic) publishers, which have grown into huge businesses on the back of that. Conference or workshop presentations are also published, again by traditional publishers, and around this has grown the business model by which publishers operate: selling journal subscriptions and books to libraries, and charging a lot for doing so.

Open access is a noble aspiration which goes against this well-established model and has been enabled by the emergence of the internet and digital technologies, especially over the last couple of decades. Open access ensures that anyone, anywhere, at any time, can access research papers, book chapters, workshop papers, and even data used in experiments or analyses, and they can reuse this data or these publications without restriction.

In Ireland, almost all our higher education institutions (HEIs) have created online digital repositories or libraries for the research outputs of our scholars and scientists where their work has been funded by the taxpayer. These repositories are managed by our HEI libraries and have thereby created a new role and responsibility for the libraries. As a platform for disseminating research and scholarly outputs, institutional repositories are a safe bet in that they are funded and operate reliably; materials deposited in them are manually selected and curated by our librarians to ensure they do not break copyright or other restrictions when they are made available under open access. And because they are online digital repositories, the content is easily accessible.

The functionality offered by each HEI repository is basically the same. They accept 'deposits' from scholars and scientists, usually PDF files of papers, book chapters, or research theses. These are

manually checked by the library's curator for copyright conformance, then published in the online repository and thus made accessible. The underlying software systems are all interoperable and most are open source, so it doesn't matter if an institution uses DSpace, Greenstone, or EPrints (all of which are freely available), because these systems 'talk' to each other and allow content to be moved from one system to another.

Open Access is a noble aspiration which has been enabled by the emergence of the internet and digital technologies.

As an example of an institution's repository, Dublin City University's 'DORAS' currently has more than 7,000 items of content, each in PDF, broken into the following categories:

» Research article or paper (1,567)
» Book (18)
» Book section such as a chapter (214)
» Conference or workshop paper (2,462)
» Monograph (80)
» Research thesis (2,571)
» Working paper (128).

The research thesis category is an interesting one. It is there because DCU has, for many years, insisted that research theses from graduating students be made available on DORAS. Of the 2,571 theses, 1,830 are PhD theses, some going back to 1985, while the rest are at master's degree level.

One of the advantages of open source software is that statistics on access are automatically generated and can be made available to researchers for things like project reviews or funding applications. In the case of DORAS, for the calendar year 2016 alone, there were over 924,000 downloads of the PDFs of these 7,000 publications, which is part of a year-on-year increase in access.

In Ireland, almost all our Higher Education Institutions have created online digital repositories or libraries for the research outputs of our scholars and scientists where their work has been funded by the taxpayer.

Open access through deposit in institutional repositories is called 'green open access'. It is not the only avenue for open access publication. Many traditional publishers now offer an open access model where the author pays, usually a four-figure sum, to have their article hosted, disseminated, and promoted using the weight and impact of the publisher; this is called 'gold open access'. While it is valid as a form of open access dissemination, the 'author pays' part dissuades or prevents many researchers and scholars from using it.

Institutional open access repositories are not the only such repositories available: many open access hosting services have sprung up recently, such as ResearchGate and Academia.edu. These do not charge authors for publishing, and they offer great support for networking on their websites.

So why do scholars and researchers publish under open access? The trend is driven by several reasons. Increasing access to publications means they will be downloaded more and read by more people, which means they will then be cited more by other scholars and researchers; this is borne out repeatedly by organisations from the Wellcome Trust to the journal Nature. One study found that articles published in Nature Communications are viewed three times more than non-open-access content.

Open access also leads to more rapid dissemination, so the scientific and scholarly processes move faster and the wheels turn more quickly when newly published material reaches its target audience. It also leads to wider collaboration and more interdisciplinary follow-on work. A personal anecdote will illustrate this.

Open access leads to more rapid dissemination, wider collaboration and more interdisciplinary follow-on work.

One of my PhD students published his thesis on DORAS, and part of his work developed an algorithm for detecting periodicity in lifelogs or digital records of everyday activities. The thesis was found and read by a colleague, whom I'd never met, who works in chronobiology at the Royal College of Surgeons in Ireland (RCSI). She introduced us to her former colleagues at Glasgow University who are performing a chronobiologial analysis of accelerometer data from 100,000 people in the UK. Our team in DCU has now been brought into that work in Glasgow, and we have applied our periodicity-detection algorithm to their dataset. This is leading to further publications, all because the PhD thesis is available under open access in DCU.

Another reason open access is increasingly popular is that it is seen as a deliverable from publicly funded research. Many research funding bodies now mandate that research output from projects they fund be made available under open access. Projects funded under the EU's Horizon 2020 programme must make their outputs openly available, though it does not count ResearchGate or Academic.edu as open access publishing. Irish research funding agencies, including the Irish Research Council (IRC) and Science Foundation Ireland (SFI), also oblige their funded researchers to publish outputs under open access. While SFI does not specify which repository should be used, the IRC is more direct, stating that it 'should ideally be a local institutional repository to which the appropriate rights must be granted to replicate to other repositories'.

Content [of institutional repositories] is regularly crawled by web spiders and indexed by search services, including Google Scholar.

At a recent launch of newly funded research, one of our funding agencies pointed to the fact that approximately 40 per cent of publications from its funding were available under open access – a good number but not good enough yet. The Insight Centre at DCU has 436 research publications from the last four years available as open access, representing over 90 per cent of our research outputs in that period. Among the missing ones, some are embargoed until after their date of publication or because they are regarded as being in press. There is no reason we can't aim for 100 per cent of outputs available under open access.

One of the reasons why institutional repositories lead to increased visibility of research is that their content is regularly crawled by web spiders and indexed by search services, including Google Scholar. This is done precisely because their content is trusted, curated, and will not cause problems with copyright. The repositories also structure their metadata in a way that is easy for web spiders to assimilate. All of this helps to square the circle, because content from these repositories is then more easily found by people searching the internet.

However, all is not perfect in the world of open access publication. There are dangers from what are known as 'predatory publishers'. These are businesses which have emerged recently with a pay-to-publish business

model for scholarly publication but whose quality of publication is very poor, with low editorial standards, sloppy presentation, and even in some cases fake editors and fake editorial boards. As with everything on the internet, authors and readers have to be careful about the websites they trust. There are literally hundreds of these open access predatory publishers, cashing in on the huge push among researchers and scholars to publish their output.

So far in this article I have discussed open access to publications but not to data. The push for open access to data comes from the requirement to make new research outputs easily replicable by others, to verify and check research results, and to extend and build on that research. Some academic publishers now require that any data used in experiments in research papers must be made available under open access. This is helping to change people's approach to open access.

Almost 5,500 datasets are now available from public bodies on Ireland's Open Data Portal… this is a fabulous resource.

Open access to data can refer to any kind of data, from scientific experiments to surveys to data from public bodies, including governments. In March 2014, Ireland hosted the third plenary meeting of the Research Data Alliance (RDA), a global body whose remit is to develop and promote the standards to allow research data and public data to be easily shared and exchanged, and to make such data easily discoverable. More than 500 delegates from across the world gathered in Croke Park to present findings and to discuss and advance this agenda.

In Ireland, Open Data Fingal was the first local government portal created to publish open data (which is the term used to describe open access to data from public sources). That led to the establishment of Dublinked, which published public data about the city of Dublin, which in turn led to the establishment of a national open data portal, data.gov.ie.

Following the RDA meeting in 2014, and recognising the increasing importance of open data, in 2015 the government announced the formation of an Open Data Governance Board, chaired by Emer Coleman. In summer 2017 it published Ireland's Open Data Strategy 2017–2022, developed in conjunction with the Open Data Unit in the Department of Public Expenditure & Reform. The strategy involved a wide range of stakeholder consultation, including public consultation. It identifies seven strategic themes, including broadening the range of public bodies publishing open data; improving the quality, quantity, and range of datasets; continued encouragement of the use of open data; evaluating the impacts, benefits, and risks of the initiative; and more. It also has an implementation plan with aggressive timescales.

Almost 5,500 datasets are now available from public bodies on Ireland's Open Data Portal, and this is constantly increasing. Like open access to our research publications, this is a fabulous resource. One may not think of many use cases for data on sightings of hares in Ireland in 2006–2007, as published by the National Biodiversity Data Centre, or for data on life expectancy in Ireland by age and gender in 1994, 2004, and 2014, as published by Eurostat, but it is when datasets are combined and cross-correlated that their value increases.

So as we watch open access to research outputs develop and grow in importance, and we see the increasing availability of open data, what should we look out for? Mostly it's about two things. Firstly, we should encourage those who have not yet embraced open access to publications, research data, and public data, to do so for their own and everyone else's benefit. This includes encouraging our research funding agencies to more strictly enforce the open access principles in their policies. Eventually this will reach a tipping point where open access becomes the norm because people can see its benefits. We're not quite there yet. The second thing we should watch for is the opportunities that open access offers to everyone – not just researchers and journalists but all citizens. Open access is about everyone's access to data and content from public bodies, whether research funding bodies or local authorities, and that is something we should all have an interest in.

New Director of Irish Research Council

Peter Brown has been appointed Director of the Irish Research Council. From 2015 to 2017, he was Deputy Director of the Council, and Senior Manager with the Higher Education Authority from 2003 to 2014. Previously, he held roles with Dublin Institute of Technology and in the private sector.

Since May 2017, following the departure of former Council Director Dr Eucharia Meehan, Mr Brown has been Interim Director.

Brown's priority in his role as Director will be "to consolidate the Council's unique role within the Irish research eco-system".

"By investing in exceptional individuals working at the cutting edge of new knowledge, we future-proof Irish research and its place in a globally-connected world," he said.

"I am looking forward to leading the Council on this agenda over the coming years, working closely with Council members, a very committed staff team, the Higher Education Authority and Department of Education and Skills and the wider set of research stakeholders."

Opening Ireland's Research System
An Agenda for all Levels

Patricia Clark
Co-Chair, National Open Research Forum; Programme Manager Policy and EU funding, Health Research Board; National Delegate for Health, Horizon2020

I reland must open its heart and its mind in the drive to make research more transparent, collaborative and efficient, Dr Patricia Clark writes. The change to open science is seen as inevitable, welcomed by many and already practiced by some. The challenges and rewards are high.

The change to 'open'

There is a fundamental shift across Europe towards making research more transparent, collaborative, and efficient. This is reflected in the move to 'open science' promoted by the EU Commission[1] and other leading research funders.

Open science covers many aspects of opening up research to allow others to participate at all stages, and to benefit from it as freely as possible once it has been completed. The emphasis is most often on providing access to published findings and data, but it also includes such features as post-publication peer review, open source software, and citizen science, where the wider public engage directly in research to enhance and openly demonstrate its societal impact.

The change to 'open' in our digital era is evidenced by new forms of collaboration, more co-authored articles, new online publication formats, the wide range of online research tools, the emergence of new open access journals, and the calls for new measurements of impact.

While change is seen as inevitable, welcomed by many, and already practised by some, the speed and complexity of this change is daunting. Barriers are deeply rooted in the practices and culture of research, and there are many unanswered questions. Success requires complex research policies underpinned by funding, but ultimately it depends on the researchers themselves implementing change. Cultural change on such a large scale demands a whole-systems approach that engages all levels. So what path are we travelling? And how are we doing?

Fast policy agenda

Policy-makers have strongly embraced open science in shaping their vision and strategic recommendations. The early focus has been on open access to publication and on open data. Leading by example, the European Commission made open access to publications an obligation for its EU-funded Horizon 2020 grantees. In 2017 its open research data pilot was extended to cover all thematic areas. Its vision is that public research grants should come with the condition of

developing a data management plan, should include such plans in the project's costs, and, ideally, should respect the FAIR principles: Findable, Accessible, Interoperable, and Researchable.[2]

EU policy is developing along a number of lines:

1. Developing research infrastructures for open science to improve data hosting, access, and governance, with the development of a common framework for research data and the creation of a European Open Science Cloud (EOSC).
2. Creating incentives for open sciences and removing barriers to open sciences (e.g. in researchers' careers) as well as mainstreaming and further promoting open access policies on research data and research publications.
3. Embedding open science in society as a socio-economic driver (where open science makes science more responsible to societal and economic expectations).

The European Commission's high-level expert group, the Open Science Policy Platform (OSPP 2016–2018)[3], is currently advising on implementation across eight action areas: FAIR open data, the EOSC, altmetrics, new business models for scholarly communication, rewards, research integrity, open science skills, and citizen science. This work is continuing rapidly. Reports on EOSC governance and open access publishing in Europe have been adopted. Three further reports – on altmetrics, skills, and research careers – are in the pipeline.

Further plans are being prepared. Demonstrators on the EOSC pilot have been selected, and an EOSC roadmap is being prepared. The Commission is aiming at 100 per cent compliance with the requirements for open access to publications. It is considering launching its own EU open publishing platform. A full open science monitoring service is expected in early 2018. A formal EU Communication on open science is also scheduled for 2018.

In parallel there are legislative changes afoot with implications for open science, most notably the national implementation of the General Data Protection Regulation due by May 2018, and a new Copyright Directive with implications for Text and Data Mining practices.

What are we doing?

Irish experts are engaged in many international discussions, helping to shape the agenda and bringing this perspective back home. For example, Irish players are included in both the open science policy platform and three of its working groups.

There is a steady stream of visitors to Ireland for discussions. These include Professor Barend Mons, then chair of the high-level expert group of the EOSC initiative, the Dutch Go FAIR implementation team, the Research Data Alliance Dublin, the UK Digital Curation Centre, and the CESSDA (Consortium of European Social Science Data Archives) ERIC, among others.

A National Open Research Forum (NORF) has been established to deliver an Irish agenda. It is co-chaired by the Higher Education Authority (HEA) and the Health Research Board (HRB), with secretariat from the Department of Business, Enterprise and Innovation (DBEI). It has encompassed and broadened the membership of a previous National Open Access committee, combining the expertise of representatives from policy, research funding, research performing, library sector, and other key stakeholders in the research system across Ireland. Working groups are addressing key areas of open access publications, open research data, infrastructure, and human resources that are needed to deliver for Ireland. The Forum directly supports the implementation of Recommendation 4.7 of Innovation 2020 national research strategy: to 'support national and European open access policies and principles'.[4]

How are we doing?

Looking briefly at the open publication and open data areas in the Irish system, there has been a long and strong movement towards open access for research publications. Ireland's transition to open access is viewed as iterative and substantive, with government bodies and funding agencies adopting open access policies over several years.[5] These policies have been developed through consensus-building among stakeholders and culminated in the 'National Principles for Open Access Policy Statement', which outlines a framework for open access in Ireland.

In May 2016 the EU Competitiveness Council Conclusions called for full open access to scientific publications in Europe by 2020.

But there is a gap. We need to strengthen our implementation and to measure our national performance – or someone else will measure it for us. In May 2016 the EU Competitiveness Council Conclusions called for full open access to scientific publications in Europe by 2020. We have a lot of work to do to reach this goal.

Discussions on open data are more complicated. The development of national principles for research data are in train, to be accompanied by a common data management/stewardship plan (DMP) and implementation. Key barriers to be considered include deficiencies in skills and training, infrastructural needs, ethical and legal issues, funding, evaluation, and rewarding open practices.

Why would researchers invest time and effort in practising open data when career performance is still judged almost purely by the number of publications in high-impact journals? We need to change this traditional approach and reward data management and publishing datasets for others to use. We also need to look at the crossover with other agendas, such as how open science can underpin or enhance the national policy on research integrity.

For the HRB and its funded researchers, our new HRB Open Research platform will bring all these strands together – open access publication, open data, open peer review, funding, recognition, and rewards – into a single approach so we can learn and shape our open science policies and practices. It will be an interesting journey.

Getting personal

Ireland has a responsive research system with a track record of competing successfully in Europe. To maintain and develop our success, we need to change the way we research, to take advantage of the opportunities and address the barriers to open science. Open science must not become an idea we all agree upon but urge others to take the first step forward. This is personal.

FOOTNOTES

4. The EU Commission has defined this more open scientific process as follows: 'Open Science represents a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools. The idea captures a systemic change to the way science and research have been carried out for the last fifty years: shifting from the standard practices of publishing research results in scientific publications towards sharing and using all available knowledge at an earlier stage in the research process.' (Open Innovation, Open Science, Open to the World – a Vision for Europe, European Commission, 2016.)

5. Wilkinson, M.D. et al. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Sci. Data*, 3:160018. doi: 10.1038/sdata.2016.18

6. Details on the Open Science Policy Platform, including detail of members, plans, minutes of meetings, working groups, and reports, are available at: https://ec.europa.eu/research/openscience/.

7. Interdepartmental Committee on Science, Technology and Innovation (Dec. 2015). Innovation 2020 Excellence Talent Impact. Ireland's strategy for research, development, science and technology. Available at: https://dbei.gov.ie/en/Publications/Publication-files/Innovation-2020.pdf.

8. Dempster, S. (Dec. 2014). Open Knowledge. PASTEUR4OA Case Study. Ireland: The Transition to Open Access. Available at: www.pasteur4oa.eu.

Andrew Grene scholarships

The recipients of the 2016 and 2017 Andrew Grene Postgraduate Scholarships in Conflict Resolution were celebrated at an award ceremony in the headquarters of the Department of Foreign Affairs and Trade on 21 June 2017. Andrew Grene (1965–2010) was a dual Irish-American citizen who worked with the United Nations. He was the sole Irish citizen lost in the Haiti earthquake of 2010.
Pictured here are (l-r): Andrea Salvi and Chiara Mizzoni.

University Research Centres and the Innovation Ecosystem

Interplay between research and education

Ned Costello

Chief Executive of the Irish Universities Association, previously head of national research policy at the Department of Enterprise and Employment.

Ned Costello writes here in a personal capacity about Research, Research Centres and the overall research ecosystem.

The decision by Mostek and Fujitsu to explore the establishment of a chip fabrication facility in Ireland in the late 1970s was possibly the seminal event in the genesis of university-based research centres. The Mostek facility never proceeded, but it highlighted the need to have a research infrastructure to enhance Ireland's attractiveness to foreign direct investment (FDI) in what we now call the ICT (Information and Communications Technology) sector.

On foot of this, the entrepreneurially pioneering work of Professor Gerry Wrixon at UCC led to the establishment of the National Microelectronics Research Centre (NMRC) in the old Lee Maltings beside the River Lee. The NMRC quickly established itself as a competitive player in European research, its early years being synchronous with the then EEC's first flagship collaborative research programme, Esprit, the forerunner of the Framework Programmes for Research and the current Horizon 2020.

Supported by European structural funds, Ireland then developed its first Programmes in Advanced Technology (PATs), predominantly centred on a distributed system of university-based collaborative research centres. In the decade or so when the PATs existed, there was a constant debate about how close to the market they should be positioned. I will return to this later.

The NMRC continued to thrive but faced a significant decision in the mid-1990s when there was a debate about whether the centre should move off-campus or remain linked to the university in its next phase of growth. Ultimately, because of the synergies between the university and the NMRC, the government decided that the centre should remain closely linked to the university, while according it some strategic autonomy. Administrative efficiency partly supported the decision, but the key rationale was the central importance of the links between the centre and the college in the interplay between research and education. This dynamic was (and is) vital in keeping staff at the forefront of research and returning that

knowledge to the education of graduate and undergraduate students; it continues to thrive at the NMRCs successor, the Tyndall National Institute.

In terms of policy implications, the emphasis on advanced research and publications is significant, as it drives the constant renewal of staff learning. This is further supported by the symbiotic relationship that PhD students and postdoctoral researchers have with principal investigators. By contrast, one of the factors which led to the demise of Ireland's small number of stand-alone research centres (such as the Institute for Industrial Research and Standards (IIRS)) was the stagnation that can result from an ageing staff who do not benefit from a higher education research environment.

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The IIRS experience, and that of the PATs, also illuminated the tensions in the market orientation of research centres. The PATs were to a fair extent 'sold' to a political and administrative system which was then highly sceptical of research, on the basis that investment in them would yield quick returns in the form of income from industry. The fact that their funding came from the Structural Funds Operational Programmes for Industry supported this orientation.

Ultimately this approach failed, since it progressively moved the centres away from research and towards consultancy. Without a strong pipeline of research, the foundations of the market-oriented work were weakened over time. The shift towards a highly applied or consultancy focus also meant the centres were failing to address a market failure in doing work which the private sector finds uneconomic or too risky to undertake.

The policy learning from this experience resulted in the next major phase of investment in science, technology, and innovation (STI) from the mid-1990s onwards. This placed a strong emphasis on internationally excellent scientific research, human capital, and a balance between concentration in centres and more individual awards. This was reflected in policy in the Strategy for Science, Technology and Innovation 2007–2013, which also emphasised the importance of more coherence in the broad swathe of publicly funded research and the co-evolution of research in the public system and industry. The strategy envisioned a more complex ecosystem, ranging from non-oriented research to collaborative centres such as the SFI CSETS (which, while based in universities and engaging in oriented basic research, would have an industrial collaboration agenda), and centres driven directly by industry-defined research agendas – the EI technology centres.

There is a large pachyderm in the room: funding.

Political and economic change (the great crisis) over the past decade shifted the dial again. SFI's legislative remit was extended to applied research, and a much more tightly defined approach to research prioritisation was introduced. Interestingly, the latter applied only to public funds and not to the disposition of state subventions to industrial research, including the burgeoning tax credit. As such, the policy approach that was pursued marked a move away from the co-evolutionary paradigm espoused by the SSTI. In recent years, there has been continuing pressure towards agglomeration in the system through research centres, and pressure to see those centres focus more on higher technology-readiness levels (TRLs).

Some would argue that these movements threaten to destabilise the ecosystem by creating excessive homogenisation. There is a danger that the system will, in the mode of the classic strategic management dilemma, get stuck in the middle: close enough neither to the marketplace to satisfy industry demands, nor to the frontiers of knowledge to generate the research outcomes which grow the next generation of educators, researchers, and entrepreneurs. These risks are magnified by a weakening of system steering mechanisms and, particularly, the abolition of the Advisory Science Council. This mechanism was hardly perfect and would need significant rejuvenation in the form of a science and innovation body of actors from the public and enterprise systems. Such a body would have a purview of the entire ecosystem, without executive responsibility for any individual part. It could play a useful role in advising government on overall strategy.

A Science and Innovation Advisory Council could play an important role in assessing performance and balance of the overall ecosystem.

A Science and Innovation Advisory Council could play an important role in assessing performance and balance of the overall ecosystem. It could look at emerging bibliometric data which contains some warning signs that concentration in the system is impacting negatively on our overall scientific performance. It would also be the ideal place to look at the full spectrum of investment in public research and avoid excessive concentration on the major research funders when assessing the overall disposition of government spend on research. And it would be the ideal forum to assess and debate the findings of the current Technology Futures exercise. This exercise is not simply a rehash of the prioritisation process; it has the potential to significantly shape our research and industrial policy priorities and, as such, has enormous significance. It may well lay the foundations for a more sophisticated challenge–based approach to research and innovation: a pull approach which would balance the current emphasis on top–down push in the system.

Finally, there is the rather large pachyderm in the room: funding. Underinvestment in the system is a destabilising force. It encourages homogenisation in policy, programmes, and structures simply because there are not enough funds to address differentiated needs and priorities adequately. It also encourages defensiveness among budget holders and beggar–my–neighbour approaches where the only way to secure additional funding is by reducing a competitor's resources. The absence of an external advisory body does not help in this regard either.

To sum up: The next phase of our innovation ecosystem should be characterised by greater differentiation and better balance in instruments and structures; greater openness and debate in policy– and strategy–making; and enhanced performance and competitiveness of both, across the HE system and industry, which contributes to short– and long–term competitiveness, along with an appropriate level of resourcing. Notwithstanding Ireland's relatively short history of investment in research, we have much to learn from the peregrinations in policy and structural approaches over the past three and a half decades. We should use that learning judiciously as we move forward.

The Research Expertise Exchange (REX)

The Research Expertise Exchange (REX) is an online community to support teachers across all sectors in Irish education to connect and collaborate with other teacher researchers, educational experts and professional researchers.

Educational research in Ireland has entered an exciting new period of development with the publication in 2017 of the Teaching Council's Research Support Framework, which will support teacher-led research in Ireland at a national level.

You can join the growing community of active educational and teacher researchers on REX by signing up for free at: http://www.researchexpertiseexchange.com/

Pictured below are members of the REX Project Development Team:

(L-R): Dr Jennifer McMahon University of Limerick; Des Carswell, Mary Immaculate College, Limerick; Dr Tony Hall & Dr Kevin Davison, NUI Galway; Marie Ryan & Dr Marek McGann (Coordinator), Mary Immaculate College, Limerick.

PINE FOREST ART CENTRE

Set in the Dublin Mountains amidst beautiful scenery, for 40 years now Pine Forest Art Centre has been providing camps and courses for children and young people which combine creativity with fun.

**Summer Courses for 4-16 year olds,
Schools Activity Days from March to June,
Halloween Workshops,
Christmas Workshops,**

**Easter Courses,
Portfolio Preparation Courses,
Birthday Parties,
Parent/Adult and Child Art Activity mornings.**

Summer Camps
The Centre runs two-week summer camps during July and August for children aged 5 -12 years and teenagers aged 13-16 years. Activities are many and varied - participants paint, sculpt, sketch, make pottery and clay items, weave, do batik and paper crafts.

Portfolio Preparation
There is also a Portfolio Preparation course during the summer for young people aged 16-19 years. This course is provided with a view to helping young people organise and expand portfolios with Art College and /or Leaving Cert in mind.

Courses during the year
The Centre runs courses during the Halloween, Christmas and Easter Holidays. Birthday Parties and Team building events.

School Groups Activity Days
School Art and Craft activity days are available from March to June.

Parent and Child Art & Craft Days
Held on the last Sunday of each month.

PINE FOREST ART CENTRE

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Image of the Year

The then Taoiseach Mr. Enda Kenny leaving the European Union's Heads of Government meeting in Brussels on Saturday 29 April 2017, having just secured approval that the question of Ireland and its border with Northern Ireland would be one of three issues to be resolved before the 27 EU members would enter into trade negotiations with the UK.

Photo provided to Education Matters by the RTÉ News Room.