The Social Sciences and the Science, Technology, Engineering and Mathematics Disciplines in Ireland

Expert Statement: Royal Irish Academy Social Sciences Committee

November 2018

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Introduction

The goal of this Expert Statement is to discuss the current state of the relationship between the social sciences and the science, technology, engineering and mathematics (STEM) disciplines in Ireland. It addresses the disciplinary differences between the social sciences and STEM, examines them with respect to knowledge production, delineates current sites of collaboration and potential future opportunities, and considers the future of such collaborations vis-à-vis science and technology policy and practice.

The social sciences broadly advance our understanding of the human condition at many levels: individual to small, medium, large, and even global. The social processes that underpin human interaction are collaborative, complex, and multifaceted. The social sciences, using theoretical frameworks and empirical methods appropriate to understanding human phenomena, produce research that is incremental in how it adds to our collective knowledge and are often critical of easy solutions to 'wicked problems' (Rittel & Webber 1973).

All of our lives are lived in a 'STEM-driven' world. Therefore, it makes sense that the social sciences study STEM subjects, but with different theoretical lenses, tools, and outcomes. Furthermore, the social sciences have a role to play at every stage of research, from conceptualising and identifying goals and aims to evaluating the acceptance and use (or non-use) of applied solutions.

One point of intersection is the increasing crossover of methods. The social sciences are increasingly adopting many of the methodologies that have characterised the STEM disciplines. Experimental methods derived from science have long been used in psychology. In economics, the use of experimental methods has generated a whole new field: behavioural economics (Chetty 2015). Randomised controlled trials, the 'gold standard' of evidence in medicine, are increasingly being adopted in the social sciences (although not without controversy). Individuals are assigned to groups with different interventions applied to each (again, behavioural economics has been a pioneer in this arena, but education and even policy making have benefited). There is an abundance of large-scale 'e-science' and 'e-social science' platforms for collaborative work and large-scale data analyses ('Big Data') studies of online social phenomena.

The STEM disciplines are also adopting methods and approaches from the social sciences. For example, research impact statements articulate the role of research in influencing social, cultural, economic and legal impacts that go beyond the results of scientific research and commercialisation to show uptake outside of the academy. Such impacts often include end-user evaluations, such as usability studies for technology and impact assessments drawing on social science methods such as surveys and focus groups. Public engagement and communication, co-production of science (such as in citizen science), and education outside of the academy are some of the ways that STEM disciplines borrow from the social sciences. Evaluating such impacts often relies on social science research methods such as focus groups, participatory design, interviews, surveys, and policy-making. Impact statements are a routine part of the Research Excellence Framework assessments in the United Kingdom.

Background

The Higher Education Authority (HEA) publishes annual statistics on the number of graduates and postgraduates across HEA-funded institutions in the Republic of Ireland. The full dataset, 'All Graduates by Level and Field of Study', lists all part- and full-time graduates from HEA-funded institutions. The following table summarises the social science and STEM graduates and postgraduates for 2016. Trade and professional programmes that are included in the broader categories of STEM and social sciences are included. Health-related programmes have been excluded from STEM in the HEA data. The table has been extracted from the HEA dataset entitled All Graduates by Level and Field of Study, 2016 (http://hea.ie/statistics-archive/).

Table: 2016 Social science and STEM graduates from HEA-funded institutions

Topic	Graduates (Total: 48,769)	Postgraduates (Total: 20,864)	Percentage of total students*
Social sciences, journalism, and information	2435	1597	5%/8%
Natural sciences, mathematics, and statistics	4448	1249	9%/6%
Information and communication technologies	2782	1436	6%/7%
Engineering, manufacturing, and construction	5624	1240	12%/6%
Agriculture, forestry, fisheries, and veterinary	1004	127	2%/<1%
	Total STEM graduates: 13,858	Total STEM postgraduates: 4052	28%/19%

* Percentage of graduates/percentage of postgraduates.

These percentages of social science graduates roughly tally with overall European social science graduates. According to the statistical office of the European Union, Eurostat, in 2015 the social sciences, journalism, information, business, administration, and law saw the largest number of students (these fields are reported collectively): approximately 32% of all third-level students in Europe.

With respect to research funding, Clancy, who has written the most comprehensive assessment of higher education in Ireland (2015), writes that in 2005, 20% of Irish research and development funding went to the social sciences and this was generally on par with eighteen other EU countries. However, numerous agencies and departments as well as societies, philanthropic organisations, and other institutions award grants and other financial supports for research.

Ireland has also captured European funding for the social sciences. Under Horizon 2020, Ireland has enjoyed significant success in the Marie Skłodowska-Curie Actions (MSCA). One quarter of the projects funded under individual fellowships and international training networks were in the social sciences and humanities. Social sciences have also received funding through other schemes, such as the European Research Council individual awards and other Horizon 2020 (H2020) schemes.

At the European level in general, funding for social sciences has increased, but only as a constituent part of other projects. Schögler and König (2017) write: 'Within the European Union's multiannual research framework, the thematic programme dedicated to the social sciences and, to a lesser extent, humanities, continues to have an ambiguous and fragile relationship with these fields. This becomes apparent in the processes shown above leading up to Horizon 2020. Yet, on a long-term trajectory, given the increasing relevance of the [Framework Programme] format for research policy in Europe at all levels of this polity, the overall role of the social sciences programme within the recent FP editions has been significantly raised.'

The European Commission has also released three evaluations on the integration of the social sciences and humanities (SSH) into the H2020 scheme, most recently in May 2018 (Directorate-General of Research and Innovation 2018a). This most recent report indicates that quantitative integration of SSH (by numbers of funded proposals that explicitly flag SSH topics) has declined since 2014 but remains 'satisfactory' by the Commission's stated metrics. The report also notes that there has been a slight decrease in share of budget going to SSH partners over time. Other concerns flagged by the evaluation include wildly uneven integration of SSH across relevant programmes. Fully a quarter of programmes funded across all SSH topics do not actually include SSH contributions; in some Societal Challenges, more than half to two-thirds do not include SSH contributions. These figures represent a decrease in integration of SSH topics. Economics is by far the most well represented social science discipline, with a strong showing by political science, business, and sociology. Many other social sciences are barely represented.

The most positive outcome has been the slight increase in proposals funded under Societal Challenge 6 (Europe in a changing world – Inclusive, innovative and reflective societies) which has proved to be the most successful social science and humanities led programme in H2020. This particular strand represents the largest source of funding for SSH researchers, with improvement in budget and quality of integration. What is worrisome, however, is that the SC6 cluster of funding programmes is slated to be removed in the draft Horizon Europe funding schemes, the successor to H2020.

Social Sciences and STEM: Sites of Collaboration

The Royal Irish Academy is one site of collaboration across the disciplines. The ten multidisciplinary committees of the RIA are tasked with building public engagement and understanding of the scholarly disciplines; they provide expertise to the Academy in its policy formulation and guide the Academy in its advisory and international collaborative capacity. The committees collaborate to propose and organise public engagement events, publications, Expert Statements such as this one, and long-standing research projects.

The funders of Irish research and other scholarly societies are a crucial site of mutual engagement of the social sciences and STEM. The Irish Research Council has had several interdisciplinary calls for proposals, including one under the 2018 COALESCE scheme that calls specifically for an Arts/Humanities/Social Science lead in partnership with a STEM researcher to address some aspects of the United Nations Sustainable Development Goals. Science Foundation Ireland's research centres constitute another important and visible mechanism through which STEM/social science collaborations can and do occur. At the time of this writing (summer 2018), there are seventeen such research centres in Ireland. They are large, multi-sited collaborations of higher education institutions, industry/enterprise, and other stakeholders, with an organisational mandate for fostering research, education, and commercial development. These centres vary in their integration of social sciences into their core work, but several of them are tackling what might be termed 'socio-technical areas' such as digital content and media, perinatal research, and mission-critical information systems. Each centre also has an education and public engagement remit which has potential for social science collaboration.

Education from primary school through lifelong learning is an important site for multidisciplinary engagement. A 2016 policy brief issued by the European Commission on science education calls for a more 'integrative approach' to education by which science/STEM are linked to the other disciplines at all levels. Rather than the social sciences/humanities being treated as 'afterthoughts' to STEM education, the brief points out that it is necessary to take the non-STEM disciplines as starting points for education and inquiry. They also make the point that STEM education for all citizens at different life stages can promote evidence-based decision-making and enhance the capacity of citizens to engage confidently in complex scientific discussion and debate. Cultural heritage institutions like the Science Gallery at Trinity College Dublin have always been involved with formal and informal STEM education as well.

At the European level, a significant part of the funding landscape is built on the importance of the STEM/social science relationship; the European Commission has put its clout behind numerous research and education initiatives and has funded a number of other major STEM/social science projects in Ireland under the H2020 scheme. H2020 aims to fully integrate the social sciences and humanities into all of its objectives and challenges, recognising that large problems are best tackled by the coordination of multidisciplinary research methods and theory and cross-disciplinary collaboration.

Opportunities and Challenges

Implementing the European Commission 2015 science policy goals in Ireland is one opportunity for STEM/social science engagement that would transcend specific grants and programmes while still supporting them. The three goals set out in the 2018 report written by the Research, Innovation and Science Policy Experts (RISE) High Level Group are termed Open Innovation, Open Science, and Open to the World (Directorate-General for Research and Innovation 2018b). While these are not explicit policies or funding streams, they represent areas of focus where the social sciences and STEM are already mutually engaged. These European Commission priorities, articulated to support and reinforce Horizon 2020 and other EC funding programmes, suggest significant potential for future social science/STEM collaborations as well. To give some examples, in the open innovation arena, the emphasis on co-creation, knowledge distribution, and citizen engagement and participation argues for social science expertise in disciplines and processes such as science and technology governance, social/group dynamics, regulatory frameworks, and communication, to name a few. Similarly, social scientists who are studying and engaging in Open Science would argue for social science engagement across the knowledge cycle: understanding digital methods, collaborative tools, scientific knowledge, research ethics, and data sharing. Lastly, the Open to the World subtheme involves global cooperation on complex policy and scientific issues, equity of access to knowledge, international research evaluation systems, and science and technology policy.

On the education side, the collaboration of STEM and the social sciences provides opportunities for lifelong learning and engagement. Recent controversies, such as the Facebook/Cambridge Analytica data misuses, argue strongly for the need for ethical training for Irish-trained STEM graduates to acquire the skills needed to think critically and deeply about the ethical, legal, and social dimensions of their work. However, there is also a need to train social scientists to have the knowledge, confidence and tools to intervene in public debates and policy-making about technological and scientific developments. Multidisciplinary education outside of the classroom is imperative: citizens, policymakers, entrepreneurs, and other private sector employees need knowledge and awareness of current issues and venues for deliberation and discussion.

Social scientists are often funded to perform comprehensive technology and science evaluations of policy and programmes in arenas such as health technology and biotechnology. These social scientists may be employed by non-profit organisations, academic institutions,

consultancies, and other public–private partnerships to provide science and technology impact assessments.

The Irish Research Council has noted that collaborations, especially multidisciplinary ones, are built on ad-hoc interpersonal relationships. To create stronger networks, the Council has been sponsoring regular workshops to network researchers from different disciplines who may be working on similar topics (such as health), with an eye to fostering larger teams that could apply successfully for larger European grants. However, this approach to networking need not be limited to funding opportunities but instead could be developed to foster other initiatives and interests. For example, the work of the Royal Irish Academy in providing platforms for cross-disciplinary public engagement, talks and workshops, and publication activities is a model that could be taken up by other institutional actors.

There are still significant barriers and challenges to STEM/social science and these are not limited to the Irish context. Disciplines find their homes not just in university departments and laboratories, but also in journals and publication venues and other institutional structures. Practically speaking, what this means is that disciplines work in ways that are often unintelligible to those in other disciplines. As a result, interdisciplinary scholarship is difficult because all stakeholders must negotiate new ways of working, a common language, and understanding of how 'the other' creates and evaluates knowledge. The further apart disciplines are, the more costs collaborators incur in bridging gaps, raising the stakes for all (Kaplan et al. 2017). Interdisciplinary scholarship is riskier and takes longer to have impact; both of these factors can hinder career establishment and advancement for researchers (Rafols et al. 2012).

There are pragmatic considerations involved in collaboration as well. The funding of research infrastructures – even the idea of what constitutes research infrastructures – varies widely across disciplines. These infrastructures are not just tools, but are also constituted of networks, institutions, and other 'human' components that require effort to fund and maintain. The level of funding available to researchers in the STEM disciplines and social science can make collaboration difficult as well. In general, collaboration, especially within large-scale projects, is still outside the norm for social scientists; social scientists collaborate less than their STEM counterparts (at least by measures such as co-authorship and grants; other studies suggest that social scientists engage in small-scale collaboration to a degree comparable to that of their STEM colleagues). Thus, for social scientists, there may be multiple 'cultural' barriers to overcome if they are to engage in successful collaborations with STEM researchers: the culture of the STEM subject and the prevailing cultures of the social sciences.

Recent Policy Initiatives

In late 2017, the Department of Education and Skills released its STEM Education Policy Statement for 2017–2026 with four pillars and associated high-level actions. The vision for STEM education says the following: 'In line with our ambition to have the best education and training service in Europe by 2026, Ireland will be internationally recognised as providing the highest quality STEM education experience for learners that nurtures curiosity, inquiry, problem-solving, creativity, ethical behaviour, confidence, and persistence, along with the excitement of collaborative innovation'. The report also includes the statement: 'Learners should develop skills to enable them to be active citizens, ensure personal well-being, engage with modern communications and media in a critical way and make informed and ethical choices.' Educators and learners at all levels need to increasingly consider ethical engagement and contextual knowledge as a core component of STEM education in Ireland. Our fundamental concerns are sociotechnical ones, and to engage in intellectual debate about them requires a populace and a STEM workforce with developed critical analytical skills.

The Republic of Ireland's National Development Plan 2018–2027/Project Ireland 2040 has the potential to create challenges for the social sciences in Ireland. Released in February 2018, it discusses the establishment of four new funds to address core priorities. The report indicates that funding for research and development proposals will be allocated in the areas of rural renewal, urban regeneration, climate action, and research and development activities in new technologies with a commercial 'game changing' focus. The social sciences and humanities need to be part of this engagement. The report indicates that €300 million will be allocated to Science Foundation Ireland Research Centres but funding for the Irish Research Council, the Health Research Board, and the Higher Education Authority receive no mention. Given the complex multidisciplinary nature of challenges like climate change and rural renewal mentioned in the report, there is no doubt that the social sciences will need to be involved, and supported with scaffolds for research, education, and infrastructure.

Conclusion

Over the coming decades, the Irish government will need to invest in the resources required to embed the STEM/social science partnership in future research, education, and innovation policy and strategy. Collaboration between STEM and the social sciences is absolutely vital to research, economic growth, and education. Collaboration is also vital to creating a society worth having. Climate change, health care and well-being, agriculture and the built environment, to name a few areas of need, are not just technical and scientific challenges; they are social ones. The active collaboration and deep engagement of the social sciences and STEM result in technological solutions to complex problems that are innovative, responsible and responsive to citizens, culturally situated and appropriate. The social sciences, in partnership with STEM, are ideally placed to help us create such a future.

Challenges in funding, research cultures, incentives for collaboration, and unequal infrastructures remain barriers. However, on an optimistic note, European and international trends point the way forward; humanities and social sciences are increasingly mainstream components of STEM research and education, so there are best practices and models that Ireland can follow. There is more than academic and commercial research at stake. Students and citizens need tools, language, and confidence to engage in scientific debates and be critical participants in them. If Ireland intends to address its challenges for the next decades, it must do so on a robust base of research and evidence. The social sciences are best positioned to lead on the study of the big problems that engage society. The only way such a goal can be accomplished is by acknowledgement that such challenges are 'too big' for an overly narrow focus on commercially oriented STEM research. To this end, we would argue for more training and support for interdisciplinary initiatives that acknowledge and honour the numerous perspectives of the social sciences (and humanities) and, perhaps most importantly, 'normalise' multidisciplinarity as an essential part of Irish research and development.

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Acknowledgements

The Royal Irish Academy's Social Sciences Committee acknowledges and thanks the author of this expert statement, Kalpana Shankar (University College Dublin), who is a member of the Social Sciences Committee. The views expressed herein are not necessarily shared by individual Members of the Royal Irish Academy.

The Social Sciences Committee also acknowledges and is grateful for the contributions of the anonymous reviewers of this expert statement.

Further information:
Pauline McNamara, Programme Manager
Royal Irish Academy
p.mcnamara@ria.ie
+353 1 609 0604

Royal Irish Academy
19 Dawson Street
Dublin 2
D02 HH58

info@ria.ie
00 353 (0) 1 676 2570

www.ria.ie