Paradoxes of Irish scientific culture

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In the first invention of Ireland as a country, in the late 19th and early 20th centuries, literature, performing arts, national language, and mythic Celtic culture had defining roles. Only as natural history, and then peripherally, did science form part of the emerging public culture.

It has been argued that Ireland 're-invented' itself over the past quarter-century[1] as the Celtic Tiger, with an open economy, modernising society, young population, flexible education system, partnership politics, strident consumerism, and global cultural reach. In that re-invention, first technology, then increasingly, 'research', 'science' and 'knowledge' have been important themes. Where the public presentation of Ireland as a place to do business earlier stressed the youth of the population and can-do attitudes, it now places knowledge – mainly the useful knowledge of science and technology – at the heart of affairs. The Industrial Development Authority has trade-marked the phrase, Knowledge is in our Nature.

There is some substance to this shift: public spending commitments to science have been at unprecedented levels over the past decade. The public funding of R&D has increased over four-fold in a decade, and from 0.35% of GNP to 0.63%. This still leaves Ireland just below EU and just above OECD averages for percentage of GNP spent on public funding of R&D but the rate of growth in R&D spending since 2003 has been surpassed, among comparator countries, only by Luxembourg. That investment has been maintained despite the significant drop in public spending from autumn 2008 onwards. This commitment was underlined by the Minister for Finance Brian Lenihan in his Budget speech of October 2008, expanded in the Smart Economy policy document of December 2008, and reaffirmed in the Budget speech of April 2009.

When the new Irish state was defining its place in the world, science had a very different emphasis. Ernest Walton returned to TCD in the 1930s from the Rutherford Laboratory in Cambridge where he did Nobel Prize-winning work on nuclear fission to a department with one technician, whose salary accounted for one half of the £460 annual budget for equipment and running expenses[2]. There was not much difference between the scientific infrastructure in the mid-20th century of that department, with its distinguished history, and the facilities enjoyed and often provided by the gentlemen scientists of the 19th century, a time when "many of Ireland's scientists … were among the world's leading scientific figures".[3]

It has been argued that it was a "major deficiency of the Revival" that it excluded a more significant role for science[4], that "the new nation failed to create an atmosphere in which good science could flourish"[5], and that "no nation-building process can be complete unless it is possible on the home ground to translate science into relevant industrial technology". [6] Whatever the reasons, even forty years ago, academic science was barely at critical mass in Ireland. But in a series of steps from the 1970s and accelerating through the 1980s and 1990s, science in Ireland has grown rapidly with the characteristics of 'post-academic'[7] or 'mode-2'[8] science. The country now has a dozen major research centres of industrial scale and

in corporate organisational form, as well as many more, smaller units with ambitions to grow to such scale. The science being done in these centres is strongly socially contextualised through industry links and through its connection to strategic priorities, and it is highly collaborative across disciplines and competitive between institutions.

The 1996 White Paper on Science Technology and Innovation laid strong emphasis on the need for public confidence or 'comfort' in scientific and technological developments.[9] From the mid-1990s the government funded a campaign to promote greater awareness of science and technology. As Discover Science and Engineering, that initiative now has a budget of €5 million that is mainly committed to programmes to boost young people's interest in science and technology, and specifically in higher-level studies and careers in these domains.

A broader-based concern about the public culture of science was expressed in the influential Technology Foresight reports of 1999, on the basis of which Science Foundation Ireland was established as the major channel for scientific research funding. The sectoral report on health and life sciences, which advocated successfully a strong orientation to biotechnology, also advocated a National Conversation on Biotechnology, stating that "a communications strategy in biotechnology that uses a partnership approach with ongoing, transparent and open dialogue should be a priority of any initiative".[10] This call reflected in particular the then recent controversy about genetically modified foods and crops, but also the common assumption that higher levels of scientific activity required higher levels of public engagement, or, conversely, that the ambition to attain higher levels of scientific activity could be threatened by inadequate levels of public engagement.

So, if Ireland has in some sense been reinvented as a country that has given science and technology a central place has there developed a concomitant or consequent new public culture of science? There are many possible elements to a country's 'scientific culture' and there must be some uncertainty as to the possibility of assessing it with any degree of precision. Some comparisons can be fairly readily made: even a fairly casual visitor to France may be struck by the much greater presence of science and scientists in everyday life than in Ireland. The Cité des Sciences et de l'Industrie in Paris and Futuroscope in Poitiers are major visitor attractions for which there is no equivalent in Ireland, with the modest exception of W5 science centre in Belfast. Scientists have a much higher profile in public and political life in many European countries than in Ireland – Britain, France, Germany and Italy, for example, have their highly visible, even celebrity, scientists.

It should be noted, however, that there have been many recent initiatives in putting-science-into-culture ("mise-en-culture"), as French physicist and science critic, Jean-Marc Lévy-Leblond calls it.[11] To cite just a few: government agencies and scientific institutions have sponsored science magazine and documentary television programmes on the national broadcaster; The Irish Times has published a weekly science page since 1997, and sponsored public lectures by leading international scientists; the Science Gallery opened in Trinity College Dublin in 2008, drawing tens of thousands of mainly young adults to exhibitions exploring interconnections between arts and sciences; the largest research centres all have public education and

outreach units of significant scale; Alchemist Café hosts monthly debates on science topics.

Bauer, Allum and Miller have suggested that it may be possible to devise a template to profile a country's scientific culture, using substantially but not exclusively the information obtained from national surveys of public attitudes to science and technology, specifically the series of surveys done in EU member states since the 1970s.[12] Pardo and Calvo[13] have critiqued these Eurobarometer surveys both in terms of questionnaire content and typical data interpretation but another critic, de Cheveigné[14], acknowledges the value of the series over time and space.

One group of researchers with extensive experience of these surveys has suggested that differences between countries in their attitudinal responses can be analysed in terms of levels of industrialisation.[15] This commentary was based on the results of a 1992 Eurobarometer survey on science and technology; later, rapid industrialisation of some countries, including Ireland, together with the expansion of the EU to the south and to the east, makes it more difficult to draw these distinctions. Another view is that differences between countries, as shown in these surveys, may be attributable at least as much to the population's age profile as to economy or culture.[16] But comparative analysis of such survey data does seem to point to differences and similarities that appear economically, socially and culturally bound.

As a member state of the European Union (formerly European Community) since 1973, Ireland has featured in all of the many EU-level surveys of knowledge of and attitudes to science. The general Eurobarometer surveys on science and technology, the more focused surveys on the new science of biotechnology, and the one-off surveys on individual topics in science offer a view of the Irish public's awareness of and engagement with science in the context of 12, then 15, then 25, and now 27 member states over 30 years.

These surveys indicate that the Irish 'turn to science' in public policy and investment has happened as much in spite of as because of the levels of public attention and support. The surveys situate the population of Ireland as generally less aware of, less attentive to and less interested in developments in science than the average for the EU, including, significantly, the enlarged EU.

This was the clear evidence of the 1977 survey, Science and European Public Opinion: Irish respondents' interest in and attention to science were below-EC-average levels and sometimes close to, or at, the lowest levels. Interestingly, although Irish respondents saw their lives as changing, and changing for the better, they did not attribute a large role to science in this change. One possible interpretation of this is that 'science' was not very salient in public perceptions and not yet prominent in public policy. In the Programme for National Development 1978-81[17], for example, science and technology were covered in four largely aspirational paragraphs.

Later surveys are sampled here to illustrate some trends and patterns and it emerges that the Irish population's relative position in the EC / EU has changed little over three decades. For this analysis, I have excluded the often-cited findings about literacy or knowledge; these surveys present to respondents various propositions

about the natural world which the respondents are asked to rate as true or false. Any respondent has a 50 per cent chance of guessing right, so these survey responses present even greater difficulties in interpretation than the responses to questions on awareness or interest. This has not deterred some analysts from seeking to derive an index of scientific culture from a computation of literacy and attitudinal survey responses. But doing this implies assigning meaning to the precise survey numbers beyond what they can reasonably carry.

My more modest ambition is to show patterns of responses from Ireland, in comparative context, derived from a review of 12 selected surveys. The comparative context is indicated by recording the EU average response, the range of responses (e.g. highest and lowest levels of agreement) and the Irish response. This approach allows responses to be characterised as 'low' or 'high' without any normative implication. The questions chosen to illustrate the pattern of responses represent a cross-section of the much larger number of questions used.

In a further attempt to facilitate reading and analysis of the survey data I have categorised findings under five headings

- awareness – responses to questions such as 'have you heard of …?'
- attention – responses to questions on media consumption and other habits that indicate level of attention to science
- informedness – responses to questions that ask respondents to rate how informed they consider themselves on given topics
- interest – responses to questions that ask respondents to rate how interested they consider themselves in given topics
- disposition – responses to questions in which respondents are asked to indicate their level of agreement with various propositions about science and technology

Table 1: Selected results from EU surveys on S&T attitudes

Section 1: Awareness					
Question	Date	EU average	EU maximum	EU minimum	Ireland
Have you heard of GM foods? (yes)	2005a	80	92 (SE)	52 (LT)	68
Have you heard of nanotechnology? (yes)	2005a	44	69 (DK)	26 (IE)	26
How familiar are you with stem cell research? (very + fairly)	2005a	30	61 (DK)	9 (LT, EL)	34
Have you heard of EC funding of medical and health research? (yes)	2006	44	63 (EL)	22 (UK)	25
Have you heard of (Irish, etc.) researchers working on EU collaborative research in medicine and health? (yes)	2006	52	72 (FR)	28 (IE)	28

Section 2: Attention	Date	EU average	EU maximum	EU minimum	Ireland
Do you talk (frequently + occasionally) about biotechnology?	2005a	32	50 (DK)	18 (IE)	18
How often do you read articles on science in the press or on the Internet? (regularly)	2005b	19	38 (NL)	10 (IT)	16
How often do you read articles on science in the press or magazines? (regularly + occasionally)	2007b	49	79 (SE)	30 (HU)	34
How often do you watch TV programmes on science? (regularly + occasionally)	2007b	61	84 (LU)	48 (IE)	48
Section 3: Interest					
How interested are you in new scientific discoveries? (very)	1989	35	52 (FR)	21 (PT)	28
How interested are you in new scientific discoveries? (very)	2005b	30	64 (CY)	11 (LT)	21
How interested are you in medical and health research? (very + fairly)	2006	71	93 (EL)	47 (LT)	66
How interested are you in scientific research? (very + fairly)	2007b	57	80 (SE)	24 (BG)	41
How interested are you (young people) in science and technology news? (very + moderately)	2008b	67	86 (PT)	53 (IE)	53
Section 4: Informedness					
How informed are you on new scientific discoveries? (very well + moderately well)	2005b	61	78 (EL)	36 (LT)	51
How informed are you on radioactive waste? (well)	2008c	25	52 (SE)	15 (BG)	21
How informed are you on biodiversity loss? (very well + well)	2007a	38	53 (DE)	20 (IT)	25
How informed are you on the consequences of climate change? (well)	2008a	56	85 (SE)	34 (PT)	59
Section 5: Disposition					
Science-led change is too rapid (agree + strongly agree)	1989	58	75 (EL)	51 (PT, UK)	54
Science-led change is too rapid (agree + strongly agree)	2005b	60	94 (EL)	42 (IE)	42
We are too dependent on science, not enough on faith	1989	46	57 (ES)	35 (BE)	45
We are too dependent on science, not enough on faith	2005b	40	63 (MT)	24 (NL)	41
Biotechnology research brings benefits in foods (quite agree + definitely agree)	1996	54	70 (NL)	31 (AT)	58
Do you agree GM food technology should be encouraged? (agree + totally agree)	2005a	27	46 (CZ)	13 (LU)	29
Do you support embryonic stem cell research? (with usual regulation + with tighter regulation?	2005a	59	73 (BE)	31 (SI)	36

Survey sources:
1989: Europeans and science and technology
1996: Europeans and modern biotechnology
2005a: Europeans and biotechnology
2005b: Europeans and science and technology
2006: Medical and health research: special survey
2007a: Attitudes of Europeans towards the issue of biodiversity
2007b: Scientific research in the media
2008a: Europeans' attitudes towards climate change
2008b: Young people and science
2008c: Attitudes towards radioactive waste

Country codes:
AT, Austria; BE, Belgium; BG, Bulgaria; CY, Cyprus; CZ, Czech Republic; DE, Germany; DK, Denmark; EE, Estonia; EL, Greece; ES, Spain; FR, France; HU, Hungary; IT, Italy'; LT, Lithuania; LU, Luxembourg; MT, Malta; NL, Netherlands; PT, Portugal ; SE, Sweden; SI, Slovenia; SK, Slovakia; UK, United Kingdom

Section 1 of Table 1 (Awareness) shows Irish respondents are significantly less aware than the EU average of nanotechnology and of the presence [in Ireland] of EU-funded biomedical research. The effects of the very significant publicity around GM foods in the late 1990s appear to have evaporated – nearly one third of the adult population said in 2005 it was not aware of GM foods. In 2005, public controversy was more focused on stem cell research, and this may be reflected in the EU-average levels of reported familiarity in Ireland with stem cell research.

Section 2 (Attention) presents responses to questions that address respondents' behaviour, as distinct from questions about (self-reported) interest, where respondents may be more prone to overstatement. Responses on media consumption relating to science place Ireland as having low or lowest levels of attention to science.

Section 3 (Interest) shows findings from 1989 and 2005 Eurobarometer S&T surveys and two other special surveys in 2007 and 2008 that are broadly similar for Ireland, although the composition of the EU had changed significantly over the period. Irish respondents recorded a level of interest in scientific, medical and technological discoveries and inventions on both dates that was mid-way between the EU average and the lowest point, with two exceptions: the level of interest in medical research was closer to the average than to the lowest point; the special survey of young people placed Irish respondents at the lowest levels of interest in news about science and technology. This finding is of particular interest in view of the youth orientation of Discover Science and Engineering.

Section 4 (Informedness) shows responses to questions about how informed people feel about certain topics. The responses may also be evidence of how people feel about those whom they consider responsible for providing information as much as how they feel about themselves. In the 2005 general S&T survey Irish respondents' informedness placed them below EU average in relation to scientific discoveries in general, at or about EU average for climate change and radioactive waste, but

significantly below average in relation to biodiversity loss, where there is a very high level of 'not at all informed' responses.

Section 5 (Disposition) presents a small sample of responses to questions where respondents are asked to rate their level of agreement with supplied propositions, including two repeated questions from 1989 and 2005: at both dates Ireland is seen close to EU averages in support for the pace of science-led change and for the relative dependence on science and faith. When it comes to support for, or recognition of the importance of, biotechnological research and GM foods, Ireland is also an average member-state, but it is significantly less supportive of stem cell research than the EU average. There is majority support for embryonic stem cell research, with usual or tighter regulation, in 15 of the 25 member states. Ireland is grouped with Portugal and five newer member states in the level of its support, but also in having higher proportions of respondents in the 'don't know' category than in any other.

The high level of don't-know (DK) responses on this topic is repeated in many other surveys: Irish DK responses are among the highest in the EU. In their review of four 1990s Eurobarometer surveys on biotechnology as they applied to Ireland Morris and Adley said of the 1991 survey, "One of the most noteworthy results was the high number of 'don't know' responses that were obtained in the Irish survey. The highest numbers of 'don't know' responses to questions about both biotechnology and genetic engineering were found in Ireland, Greece and Portugal." [18] These three countries also recorded the lowest scores on knowledge of biotechnology, suggesting a link between 'ignorance' of one kind (giving incorrect answers) and 'ignorance' of another (saying you don't know). But Morris and Adley also noted that Irish respondents were in the top three member states in terms of support for biotechnology and genetic engineering applications. Thus, paradoxically, low levels of knowledge and high levels of uncertainty were matched with high levels of confidence.

Pardo and Calvo in their critical analysis of Eurobarometer surveys refer to the considerable variation of DK responses between countries, as well as very wide differentials in DK responses according to level of education.[19] Bauer, Allum and Miller advise care in interpreting these DK responses on Eurobarometer surveys, drawing attention to the possible effect of different fieldwork protocols that might arise from the five-yearly change of Eurobarometer contractors and, with it, of fieldwork protocols.[20] However, in their benchmarking study for the EC, Miller et al drew attention to the DK responses in the 1992 and 2001 Eurobarometer S&T surveys, commenting that "for Ireland, there is a danger that the 'disinterest through ignorance' features noted in 1992 may be leading to a downward spiral into a 'don't-know, don't care' situation as far as RTD culture and PUS is concerned".[21]

Such a normative view ignores the very considerable debate in the social sciences about don't-know responses. For example, in relation to psychological inquiries, Beatty et al propose that one kind of don't-know response may represent avoidance, and another a truthful don't know.[22] They also identify the possible untruthful substantive response, where the respondent "may really not know the answer to a question, but feel that admitting ignorance is somehow undesirable".

In at least some of the cases referred to here, and in respect of which Ireland appears as an outlier, don't-know responses may be an authentic statement on matters that are new, uncertain and maybe even unknowable. Table 2 shows findings from three surveys in which the high levels of Irish don't-know responses could mean at least three different things – unwillingness to state an attitude, e.g. on science in the media, due to low level of consumption of such media content; uncertainty of attitude or reluctance to state an attitude e.g. on embryonic stem cell research; ignorance of claimed benefits and therefore reluctance to state an attitude e.g. on food biotechnology. (We can only speculate whether the response would have been different if the alternative terminology, genetic modification, had been used in the last case.)

Table 2: Selected results from EU surveys on S&T attitudes - Don't Know responses

Question	Date	EU average	EU maximum	EU minimum	Ireland
Are you satisfied with media information on scientific research?	2007b	20	47 (BG)	4 (EL)	38
Do you find media information on science useful?	2007b	8	22 (IE)	2 (SK)	22
Do you find media information on science difficult to understand?	2007b	8	23 (BG, IE)	0 (EL)	23
Do you support embryonic stem cell research?	2005a	15	36 (EE)	2 (EL)	34
Biotechnology research brings benefits in foods	1996	9	16 (AT, BE, IE)	4 (IT, NL, SE)	16

Survey sources:
1996: Europeans and modern biotechnology
2005a: Europeans and biotechnology
2007b: Scientific research in the media

Country codes:
AT, Austria; BE, Belgium; BG, Bulgaria; EE, Estonia; EL, Greece; IE, Ireland; IT, Italy; NL, Netherlands; SE, Sweden; SK, Slovakia

The samples from EU surveys presented here also indicate that variations in don't-know responses may also reflect different attitudes to surveys: it is notable that Greek and Cypriot respondents show the lowest levels of DK responses, but these countries also record high or highest levels of awareness, interest and informedness. This suggests that the confidence with which people in different cultures hold and express their attitudes is a factor in survey responses.

This complicating factor reminds us of the caution that is required in interpreting attitude surveys on a cross-cultural basis. Yet it seems difficult to avoid pointing to a paradox in the Irish case – the significant changes in public policy on and public investment in scientific and technological research and in science and technology awareness activities have happened despite continuing low levels of public and political attention and interest in science and technology, and they appear to have had negligible, measurable impact on the public culture of science and technology. While there is increased public engagement with science among the already interested public through formal and informal initiatives, of which the Science Gallery

in Trinity College is one of the most notable, there is little evidence that this is impinging on the broader public.

To make sense of this, we have to look beyond possible explanations focusing on the limits of attitude surveys and to consider the cultural strains of the post-colonial and modernisation experiences, and the character of Irish public, political and civic culture in general. Reflection on the evidence available from EU surveys and on the cultural and historical factors that could provide relevant context for such evidence should lead to critical reflection on the dominant policy paradigm of the knowledge economy, and indeed on the muted discussion of the different emphases on knowledge economy and knowledge society. In either version, this policy orientation assumes or requires a public that is in significant proportions interested and informed in science and technology.

As the economic crisis deepened from late 2008 onwards, the knowledge economy model began to come under more critical scrutiny. Finbarr Bradley was among a small number of economists and other social scientists who had been questioning some of its assumptions from earlier date[23], and arguing that "the State should link its science, technology and innovation policies to those of cultural renewal and sustainability. Spending on R&D alone is not sufficient to generate an innovation culture. If the social context is ignored, the billions now devoted to R&D will not lead to a knowledge society".[24]

Science Foundation Ireland which is one of the principal agents of the knowledge economy found, in a commissioned survey, that one quarter of the population felt very well or well informed about the term, 'knowledge economy', the remaining three-quarters being unsure of their responses or not feeling well informed[25]. However, a clear majority, in the same survey, supported investment in scientific research. The paradox to which this and other surveys draw attention is that the Irish population is willing to make an act of faith in science without apparently knowing or caring much about what is being done in science, in their name. From the perspective of technocratic policy-making, these findings present no dilemma. From the perspective of reconciling knowledge production, culture and democracy, they clearly do.

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