

evidence

Forfás and the HEA

Research strengths in Ireland:  
a bibliometric study of the  
public research base

Extension report:  
Public Research Organisations

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## Introduction

This report is an extension of a previous report carried out for Forfás and the Higher Education Authority as part of an assessment of research activity in Ireland. The project as a whole is a mapping exercise that takes stock of Ireland's activity in research across all disciplines so as to provide an informed catalogue of research activity.

The Irish Government's Strategy for Science Technology and Innovation (SSTI) outlines steps that Ireland is expected to take to develop a world class research system. Critical to the success of the SSTI is the degree to which the outputs (people with world class education, ideas, knowledge) of this investment are relevant to and impact on the enterprise base. The SSTI provides mechanisms for the transfer of knowledge from research organisations and higher education institutions (HEIs).

Against this background, it is proposed to map existing and emerging fields of research activity and strengths in higher education institutions (HEIs) and other public research organisations (PROs). The latter group was not discussed

explicitly in the first report, where the focus of attention was on the research activity per field of science rather than on the HEI at which the research was conducted. The HEI analysis was conducted in order to determine the geographic location of a large part of the underlying Irish research base and thus to facilitate a map of actual and potential links with the enterprise sector. Subsequently, it was decided to analyse more fully the research in the PROs in order to obtain a more complete analysis across the totality of the public research base.

This report first analyses output by year and by "project" research area for each of the PROs. The report notes that only some of them have a significant publication record, suitable for further analysis. Citation impact is analysed overall for five organisations and at a more detailed level for Teagasc, the major publishing organisation. Co-authorship between Teagasc and HEIs is also analysed.

## 5.01 Public Research Organisations: Number of papers by year and for 10-year period

<b>Public Research Organisation</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>10-year total</b>
Central & Regional Fisheries Board (C&RFB)	2	6	4	4	2	5	1	2	2	2	30
Central Bank	1	2	1	1	2	1	2	3	5	6	24
Department of Agriculture, Fisheries and Food (DAFF)	15	12	18	19	16	14	13	13	30	13	163
Department of the Environment, Heritage & Local Government (DEHLG)		2	2	1		3	3	7	1	4	23
Dublin Institute for Advanced Studies (DIAS)	55	42	40	46	42	40	62	84	84	73	568
Economic and Social Research Institute (ESRI)	7	8	13	13	11	9	5	10	4	24	104
Enterprise Ireland	3	4	7	2	3	4	1	3	2	1	30
Environmental Protection Agency (EPA)	3	1			2	1	1	5	2	6	21
Food Safety Authority of Ireland (FSA)	2	3	4	1	1	1	6	4	4	6	32
Health Research Board (HRB)	12	12	8	2	8	6	11	10	12	9	90
Marine Institute	6	5	9	12	17	15	9	17	19	25	134
Met Éireann	1	2	1	4	1	5	3	4	5	1	27
Radiological Protection Institute of Ireland (RPII)	5	3	6	8	1	3	4	4	6	5	45
Teagasc	103	127	120	137	122	117	115	157	180	189	1367

Note: Only PROs with >20 publications over the ten year period are shown.

## 5.02 Public Research Organisations: Number of papers for 10-year period in project research areas

	Clinical medicine	Pre-clinical & health	Biological sciences: Organismal Biology	Biological sciences: Molecular & Cellular Biology	Biotechnology	Agricultural biotechnology and engineering (including Food and Beverage science)	Agricultural sciences	Earth & environmental sciences	Mathematics	Physics and materials sciences	Chemical sciences	Computer and information sciences	Civil engineering	Electrical engineering, electronic engineering, information engineering	Mechanical engineering	Economics and business	Social sciences	Psychology	Humanities
C&RFB		2	21				10	7			2								
Central Bank							1		1							22	9		
DAFF	1	24	3	23	9	8	130	1			2							3	
DEHLG			17			1	2	11											
Enterprise Ireland	2	2		1	1		2	5		19	2			3	1				
EPA			6			1	4	16			2			1				1	
ESRI	1	12	1				2	7	4				1			50	63		
FSA	4	13		8	7	9	5												
HRB	48	34	2	45														1	5
Marine Institute	1	18	79	10	1	4	60	30			16								
Met Éireann						1	2	21	4	3			3	1	1				
RPII	28	25	1			1	4	35			4				29			2	
Teagasc	11	52	124	281	221	649	593	35	4	1	88	4	3	18	2	11	7	7	

Note: Only PROs with >20 publications over the ten year period are shown. The total publications for each PRO differs from those in Table 5.01 because some publications fit into more than one project area and are, therefore, shown twice.

## Commentary

### **5.01 Output by year**

The publication output of Public Research Organisations (Table in Section 5.01) can be compared to that of the Irish HE sector analysed in section 2.01. UCD, TCD and UCC publish about 800-1,000 journal articles per year.

Only Teagasc has published more than 100 papers per year (1,367 over the ten-year period 1998-2007), which is in line with relatively specialist HE institutions such as DIT and DIAS. Other PROs publish rather fewer papers, with only DAFF (163 papers in ten years), ESRI (104 papers) and the Marine Institute (134 papers) exceeding an average of ten papers per year. The Health Research Board was just under this with 90 papers over the decade.

There is generally no trend in volume changes over the period. The exceptions to this are Teagasc and the Marine Institute which have a rising annual volume. In both cases this rose around 2001, dropped back somewhat to 2004 and then rose more markedly in the most recent few years.

### **5.02 Output by “project” research area**

Publications by PROs are spread across all research areas. Relative volumes by research area are not necessarily meaningful, because some areas are broader categories than others and some basic research areas are more likely to be addressed by HE institutions.

It is evident that there is a particular concentration of PRO output in the areas around biology, agriculture and environment. Several PROs appear to be active

in publication in each of these research areas. The concentration in physics and materials sciences is accounted for primarily by DIAS.

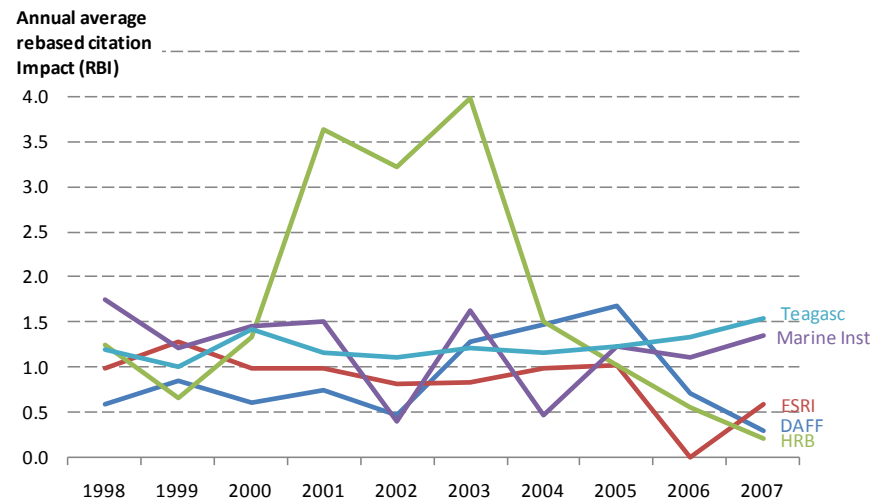
Teagasc produces by far the largest part of the PRO research output in most science and technology research areas. DAFF has a concentrated output in Agricultural sciences while Teagasc accounts for almost all the Agricultural biotechnology. The Marine Institute is a major contributor in Organismal biology. ESRI is the dominant publishing PRO in Economics and in Social sciences.

### **Subsequent analysis**

The number of citations received per paper (a statistic known as citation impact) can be used as an index of quality. The number of citations a paper receives depends on the year of publication (older papers have had time to accumulate more citations) and the subject area (papers in different subjects are cited at different rates). Therefore, citation impact figures are frequently normalized to the world average for the relevant year and subject to give the rebased citation impact (RBI).

RBI will be analysed for those PROs with a sufficient volume to make this meaningful (around ten papers or more per year). At the “project” research area level, however, only Teagasc has sufficient diverse output for a disaggregated analysis to be informative.

### 5.03 Public Research Organisations: annual overall citation impact relative to world baselines



#### Commentary

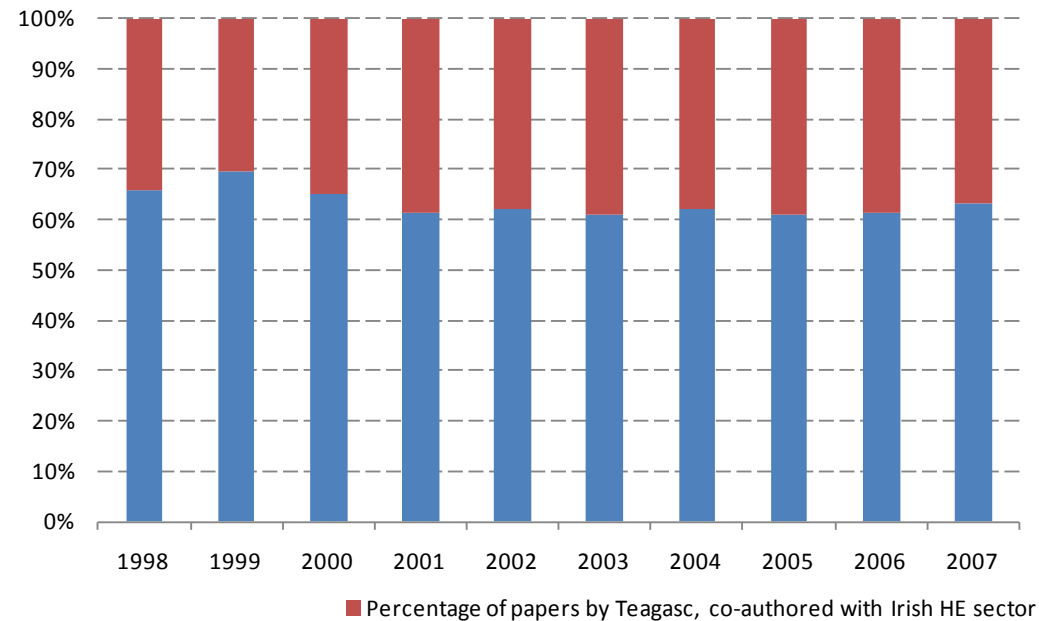
Citation impact is analysed by year and by subject area and then data are collated to produce the aggregate data displayed above. Impact within year and subject area is compared to a world baseline in order to calculate the citation index in the graph, where world average = 1.0. Teagasc has the greatest output, providing reliable and stable indicators. It has an overall citation impact that is consistently above world average (> 1.0) and, while the trend is not steep, performance has improved since 2001.

Other PROs have much smaller annual output, which means that indicators can be more easily affected by exceptional outlier values (e.g. an unusually highly-cited paper), are less reliable when disaggregated and may be volatile from year to year.

HRB's impact is particularly variable. It was markedly above world average in the early 2000s, but its output volume was particularly small at that time and the outcome is affected by just one or two papers associated with very large international health studies in which HRB participated. The spike in 2001 does not appear to be linked with any Irish HEI.

Because of differences in the nature of the work undertaken, organisations engaging in directed policy research (such as the ESRI and HRB) often have a lower citation impact than institutions undertaking academic research. Teagasc is unusual in this regard because on average 40% of papers published by Teagasc are co-authored with a Higher Education Institute resulting in the higher than expected citation impact observed in the above chart.

## 5.04 Teagasc: annual percentage of papers co-authored with the HE sector



### Commentary

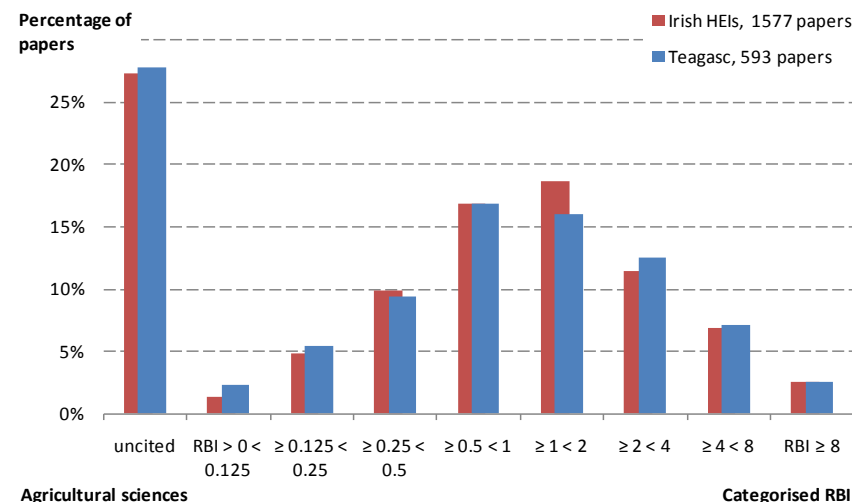
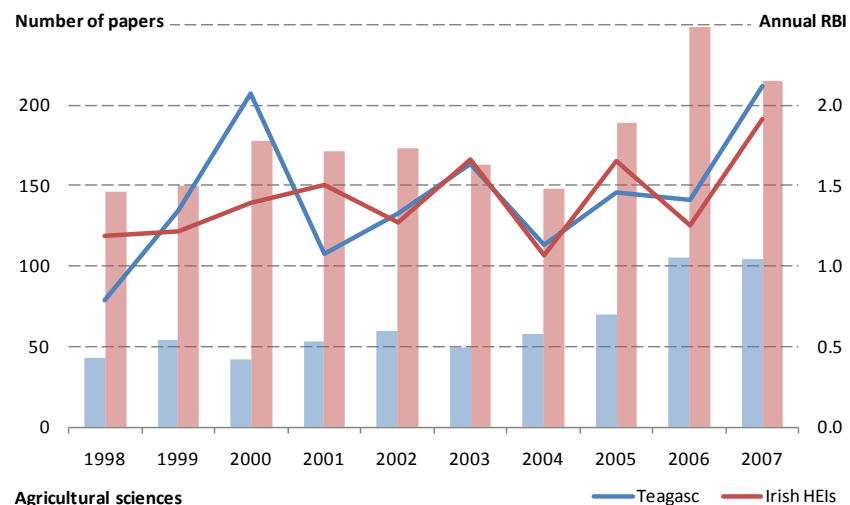
Teagasc has produced over 100 papers per year in every year since 1998, rising to about 189 journal articles in 2007 (Table in Section 5.01).

About one-third of those outputs have also had a co-author from an Irish HEI. This indicates a strong level of interaction compared with research institutes and

universities in, for example, the UK – for which extensive data are available. There is no evident trend in co-authorship. The percentage has varied between 30% and 40% across the period.



### 5.05.01 Teagasc: citation impact relative to world baselines in “project” research areas (Agricultural sciences)



### Commentary

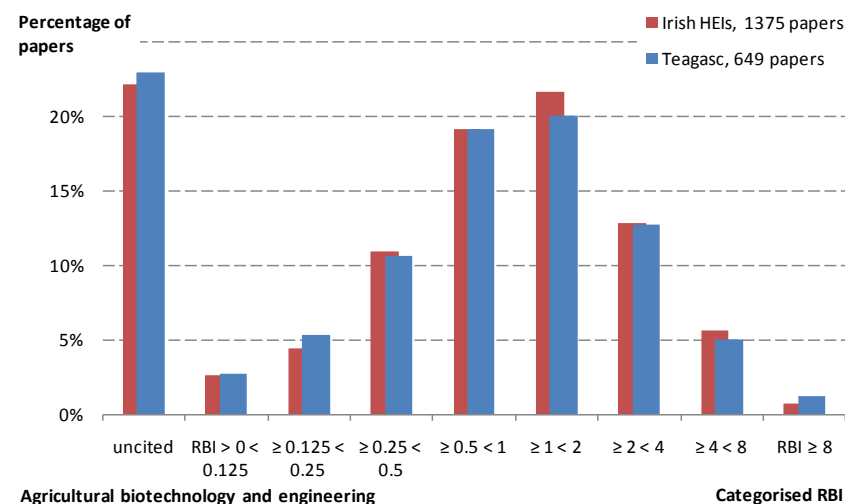
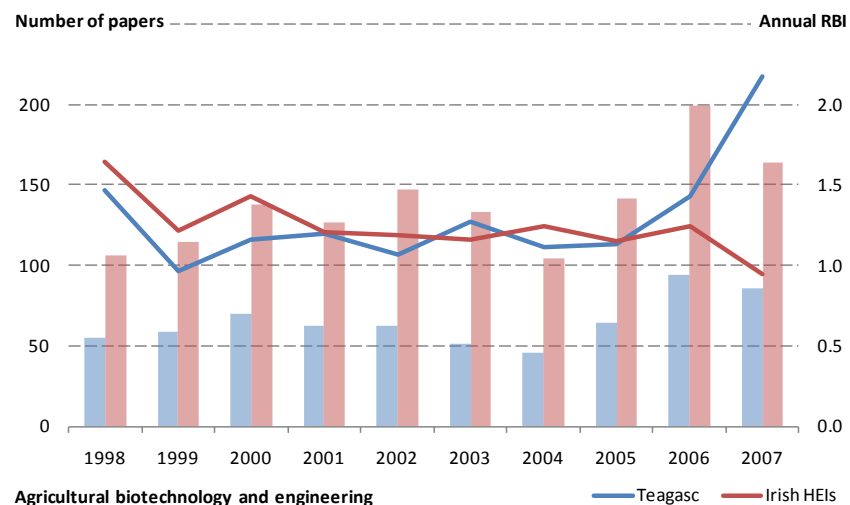
Bars = volume (LH axis); line = impact (RH axis).

Agricultural sciences is a major publishing area for Teagasc with around 50 papers per year, recently rising to about 100. The total HEI output is about three times that of Teagasc early in the period but has not grown as much.

The citation impact of the HEIs and Teagasc is very similar and both perform around or just below 1.5 times world average. It is unclear whether the outcome for 2007 marks improvement or a positive ‘blip’ which may settle. Generally, over the period as a whole, Teagasc has achieved a slightly higher average.

The Impact Profile® for Teagasc and the HEIs produces an interesting outcome. They produce similar proportions of uncited papers. The modal impact group for the HEIs is just above world average ( $\geq 1 < 2$ ) whereas for Teagasc it is just below ( $\geq 0.5 < 1$ ). However, in the impact categories above 2 x world average, Teagasc has a higher proportion of papers. Thus the impression is that Teagasc has a flatter profile, indicating a wider variance in outcome with both more low-impact papers and relatively more exceptionally high-impact papers. The HEI outcome is more consistent but lacks that high-impact shift.

## 5.05.02 Teagasc: citation impact relative to world baselines in “project” research areas (Agricultural biotechnology and engineering)



### Commentary

Bars = volume (LH axis); line = impact (RH axis).

Agricultural biotechnology is an important publishing area for Teagasc with around 50 papers per year, which declined in 2004 but recently rose to about 80. The total HEI output is about twice that of Teagasc and shows a similar profile, perhaps due to common funding initiatives. The citation impact of the HEIs and Teagasc is very similar and both perform around or just below 1.2 times world average. Teagasc has shown a marked improvement since 2005 which now sets it well above the HEIs. Generally, over the period as a whole, Teagasc had a slightly lower average.

The Impact Profiles® for Teagasc and the HEIs are very similar. They produce similar proportions of uncited papers. The modal impact group for both is just above world average ( $\geq 1 < 2$ ) but Teagasc has a somewhat greater spread and a less marked peak. In the highest impact category (papers with  $\text{RBI} \geq 8$  times world average) Teagasc has 1.2% of its output compared with 0.7% for the HEIs. It is this excess which contributes to the upswing in overall impact in the left-hand line-graph.