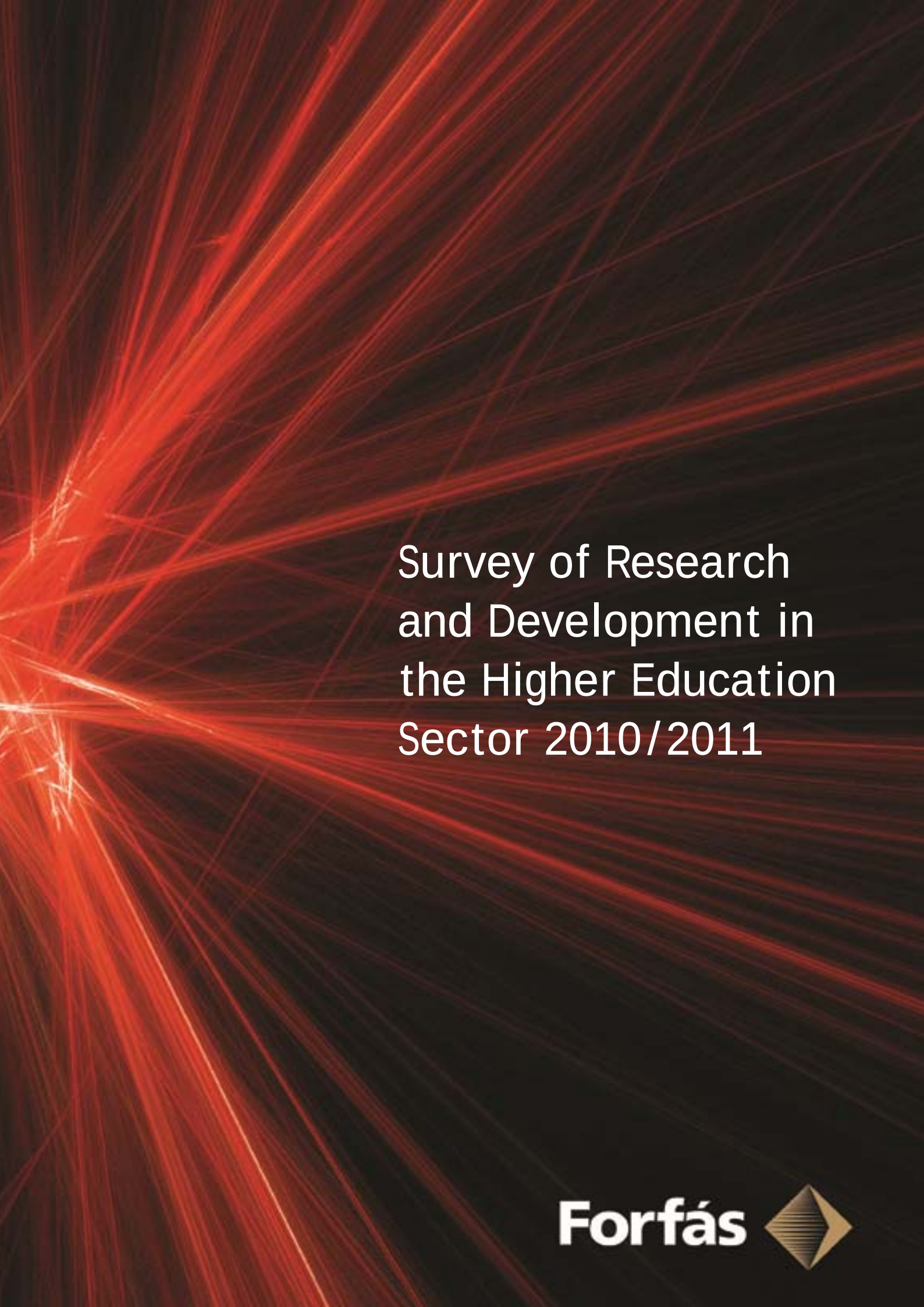
Survey of Research and Development in the Higher Education Sector 2010/2011



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Foreword

As Ireland moves from a policy focus on economic stabilization to growth over the medium term, sustained investment in research and development in the higher education sector remains of vital importance to enable the economy to recover and grow in the future. In the context of the Action Plan for Jobs and related statements of Government policy, the Government has affirmed its commitment to science, technology and innovation (STI), with higher education performed research remaining a central pillar in its STI strategy. Through the adoption of research prioritisation and the other initiatives around research and innovation announced in the Action Plan for Jobs, the Government has provided a clear message as to the importance it attaches to higher education research for both economic development and societal impact.

The higher education sector provides a national base of skills and knowledge and complements the research undertaken in business sector firms and public sector institutes, which are usually more applied and developmental in their focus. Forfás monitors research and development activity, in various sectors of the economy, through regular surveys. Surveys are carried out on the R&D activities of the business sector, the higher education sector and the government sector. This survey is carried out every two years and the current report focuses on the R&D activities performed within the higher education sector in the 2010/2011 academic year. The time-lag in publication of these results is to allow for finalisation of the personnel and financial data by the relevant higher education institutions. Included in this survey are all universities and institutes of technology. The data from this report, and other Forfás R&D reports, feed into wider OECD and Eurostat reports, as well as forming part of Forfás' ongoing policy advice to the government. The methodology and procedures followed in carrying out this survey are as recommended by the OECD in the *Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development.* More detailed methodology is provided in Appendix 1.

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Executive Summary

This report presents the results of a survey of the research and development (R&D) activities of the higher education sector – the Higher Education R&D Survey (HERD) – for the academic year 2010/11. Expenditures and human resources devoted to research work in the higher education sector are measured biennially by Forfás in the HERD survey. The sector includes universities and institutes of technology engaged in research and development activities.

Increased public and private investment in R&D in recent years has placed Ireland in a strong position to become a more knowledge driven economy by not only increasing the funding available for research but also by increasing the stock of third-level researchers and research personnel engaged in research work in the country.

The main findings of the HERD 2010 survey are now summarised.

Table 1 - Summary of key results, 2000-2010, current prices

	2000	2002	2004	2006	2008	2010
Higher education expenditure on R&D (HERD)	€238m	€322m	€492m	€600m	€750m	€708m
HERD as a % of GNP	0.26	0.30	0.39	0.39	0.49	0.54
Ireland's rank out of 35 countries	26	23	19	19	15	14
Total researchers (FTE) in HE sector	2,148	2,797	4,151	4,672	6,174	5,729
Researchers per 1000 labour force - Ireland's rank out of 35 countries	17	13	14	15	15	15

Source: OECD, Main Science and Technology Indicators, June 2012

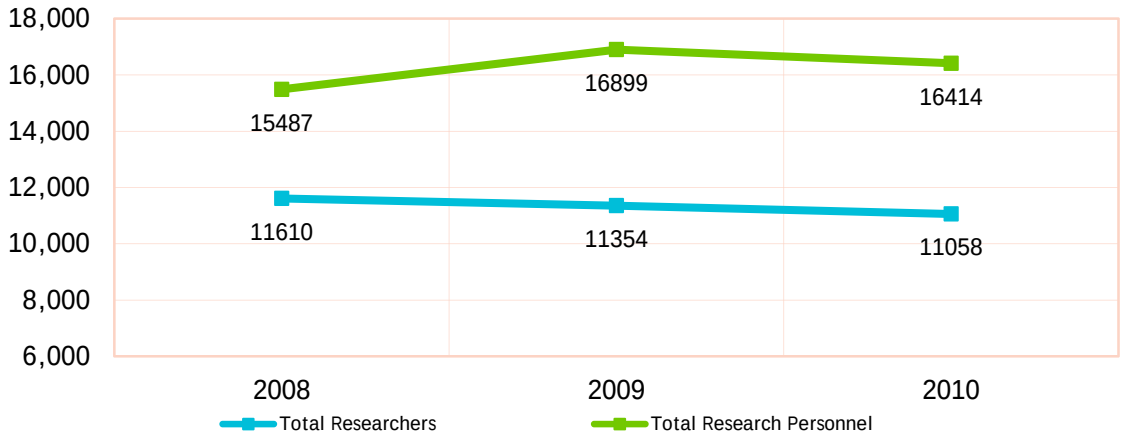
R&D expenditure:

- The findings show that up to 2008 Ireland was making progress to increase the amount of R&D undertaken in the higher education sector. In the period 2002-2008 R&D expenditure performed in the higher education sector (HERD) had more than tripled in nominal terms, peaking at almost €750m in 2008. However, 2010 has witnessed a contraction in HERD, with a 5.5 per cent decline reported by higher education institutes in Ireland. Total HERD stands at €708 million in 2010.
- Despite this, Ireland's relative performance compared to its Gross National Product (GNP), sometimes referred to as the HERD intensity, improved somewhat in 2010, moving from 0.49 per cent in 2008 to 0.54 per cent in 2010. Between 2000 and 2010, HERD as a percentage of GNP (the HERD intensity) increased from 0.26 per cent to 0.54

per cent. As R&D expenditure declined between 2008 and 2010, the 0.05 per cent increase between 2008 and 2010 was due wholly to the reduction in GNP during this two-year period.

- Ireland's position relative to other OECD countries has improved steadily since 2000 enabling it to close the gap between domestic R&D performance and that of our major competitors internationally; Ireland is now ranked 14th out of 35 countries in terms of its HERD intensity rate, up from 26th in 2000.
- Irish HERD as a percentage of publicly funded R&D is unusually high relative to other EU Member States. This is because the other main element of public R&D funding, Government Expenditure on R&D (GovERD), forms a relatively low proportion of state-backed R&D in Ireland, at just €85m in 2011, down from €140m in 2008. Thus, public expenditure on R&D has fallen to €794m in 2010 (from €890m in 2008).
- Gross expenditure on R&D (GERD), which includes public and private R&D (private R&D is comprised of Business Expenditure on R&D (BERD)) as a percentage of GNP now stands at 2.05 per cent in 2010, up from 1.67 per cent in 2008; this increase is attributable to the large rise in BERD during these years and also to the contraction in GNP.

Figure 1 - Total researchers (headcount) in the higher education sector, 2008-2010

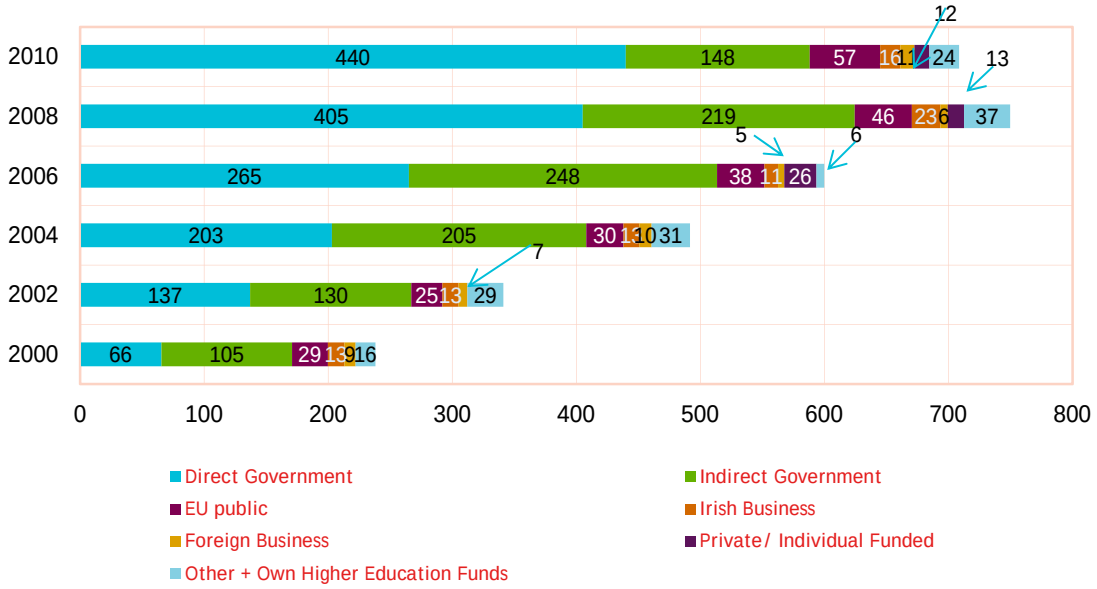


Source: Forfás HERD data

Human resources dedicated to higher education R&D activities:

- In 2010 the total number of researchers employed by the higher education sector fell from 11,610 in 2008 to 11,058, a decrease of 4.8 per cent.
- The number of researchers in Full-Time Equivalent (FTE) terms (amount of time spent on research) almost tripled from 2000 to 2008, peaking at 6,174 FTEs. This has fallen back somewhat to 5,729 FTEs in 2010, a fall of 7.2 per cent, significantly more than the decrease in the total headcount of research personnel.
- The magnitude of the fall in FTEs compared to the fall in total research personnel indicates that less time is being spent undertaking research by research personnel.
- Ireland's performance in terms of higher education researchers (headcount) per 1,000 of the labour force, ranks 15th position out of 35 countries at 5.3 per 1,000.

Figure 2 - Sources of research funding in current prices (€millions) 2000-2010

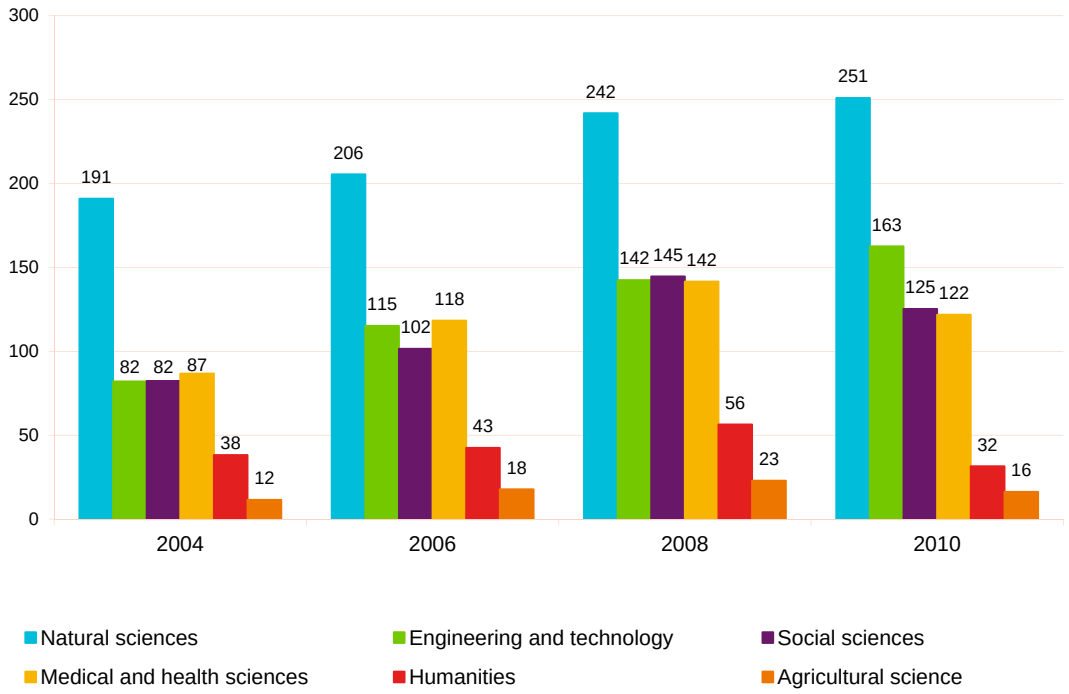


Source: Forfás HERD data

Sources of funding:

- The main source of research funding in the higher education sector comes directly from government. Direct government funding has increased from €66 million in 2000 to €440 million in 2010, an almost seven-fold increase over the period.
- The agencies and government departments providing funding in 2010 include: Science Foundation Ireland (€135.8 million or 30.9 per cent), the HEA's Programme for Research in Third-Level Institutions, both current and capital funding (€74.2 million or 16.9 per cent), Enterprise Ireland (€49.1 million or 11.2 per cent), the Health Research Board (€28.7 million or 6.5 per cent), the Irish Research Council for Science, Engineering & Technology (€23.3 million or 5.3 per cent) and the remaining 29.3 per cent from Teagasc, other HEA funding, IRCHSS and other state bodies.
- Indirect government funding comes mainly through the proportion of the Higher Education Authority's (HEA) block grant dedicated to R&D. While indirect government funding was roughly on a par with, or higher than, direct funding up to 2006, in the two-year period between 2008 and 2010 it decreased by 32.4 per cent to €148 million, the lowest it has been since 2002.
- Total government funding, (both direct and indirect) accounted for 83 per cent of all research income in the higher education sector in 2010, on a par with the share of total funding in 2008 and slightly below the 86 per cent level recorded in 2006.
- Irish and foreign businesses, EU public funding, and contributions from private individuals and philanthropists make up the remaining 17 per cent of funding, with EU monies being the most significant source (€57 million in 2010).

Figure 3 - Higher education expenditure on R&D by fields of science (€millions), 2004-2010, current prices



Source: Forfás HERD data

Higher education R&D activities by field of science:

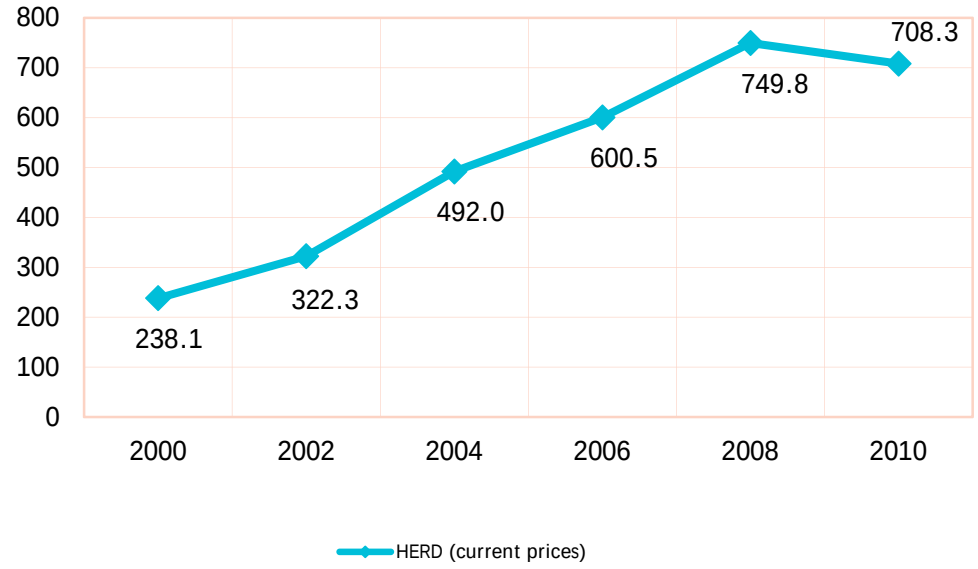
- When HERD expenditure is broken down by field of science it can be seen that the largest proportion of R&D spend for some time has been in the field of natural sciences. The 2010 figure of €251 million shows an increase of 3.8 per cent over the 2008 figure.
- R&D expenditure on social sciences has shown steady increases, peaking in 2008 at €145 million, but 2010 data indicate a 13.4 per cent fall (€20 million) to €125 million.
- Expenditure in the field of engineering and technology continues to increase, standing at €163 million in 2010 (a 14.1 per cent increase on 2008), making it the second-largest beneficiary of funding by field of science.
- The field of medical and health sciences was €122 million funding in 2010, a substantial decline (13.9 per cent) on 2008.
- Funding for the humanities fell proportionately the greatest in 2010. The survey findings indicate a €24 million fall to €32 million in 2010 which represents a 44.1 per cent cut compared to 2008.
- The agricultural sciences also saw their funding fall in 2010 to €16 million, a 29.4 per cent decline on the 2008 figure.

Chapter 1: General trends in higher education R&D expenditure

The following information on research and development spending by higher education institutions was collected from the accounts and research departments of all higher education institutions engaged in R&D. The survey was carried out under the statistical rules and international definitions as outlined in the OECD Frascati Manual[1].

The period 2008-2010 saw a decline in expenditure on research and development (R&D) by third level institutes in Ireland. In 2010 higher education expenditure on R&D fell to €708 million, a decrease of 5.5 per cent in current terms.

Figure 4: Trend in HERD expenditure, 2000-2010, in current prices, (€ million)



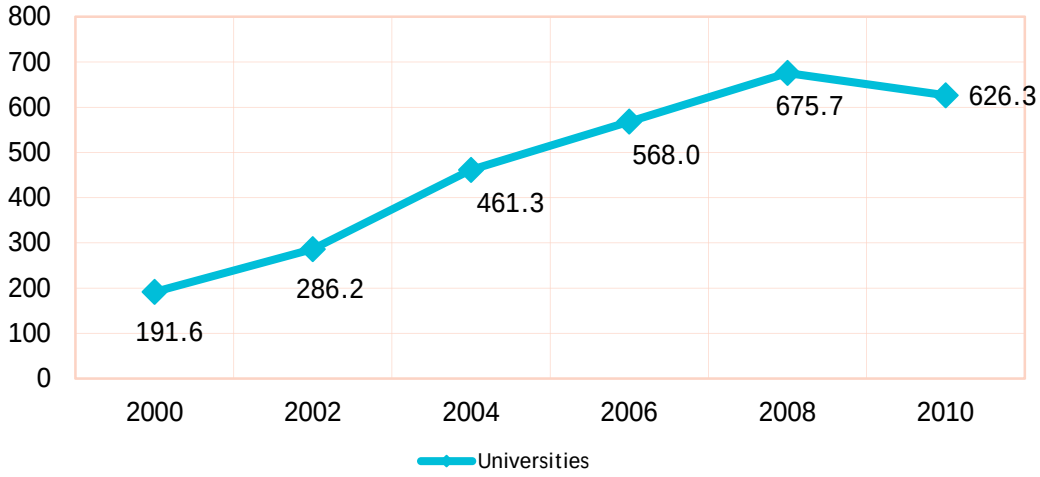
Source: Forfás HERD data

Higher education expenditure on R&D for the past 10 years is shown in Figures 5a and 5b by type of institute, i.e. universities, institutes of technology and other higher education institutes performing R&D. Appendix 1 contains a full list of the institutions covered in the survey.

Universities continued to dominate the funding allocated for R&D in this sector in the academic year 2010/2011, accounting for 88 per cent of total expenditure. In 2010, R&D spending by universities rose to €626.3 million from €191.6 million recorded ten years ago (more than a threefold increase), but fell by 7.3 per cent since 2008 (Fig. 2a)

1 Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development - OECD, 2002.

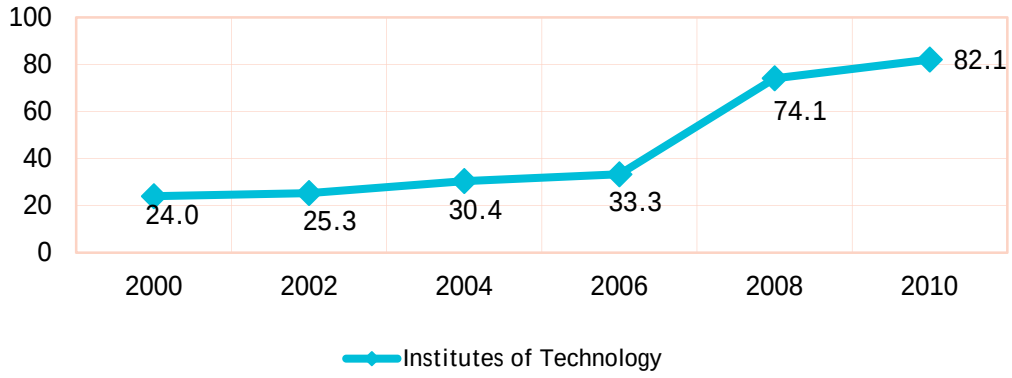
Figure 5a: Research expenditure by universities 2000-2010 (€ millions), in current prices



Source: Forfás HERD data

As can be seen in Figure 5b below, R&D spending by the Institutes of Technology (IoTs) remained fairly stagnant between 2000 and 2006 with only modest increases. In 2008, R&D spending by IoTs more than doubled over 2006, with expenditure rising from €33.3 million to €74.1 million. In 2010, R&D spending increased to €82.1 million, a further 10.8 per cent since 2008 in the IoT sector. However, the total R&D spend in the IoTs remains a small fraction of that performed in the Universities (approximately 13 per cent).

Figure 5b: Research expenditure by Institutes of Technology 2000-2010 (€ millions), in current prices.

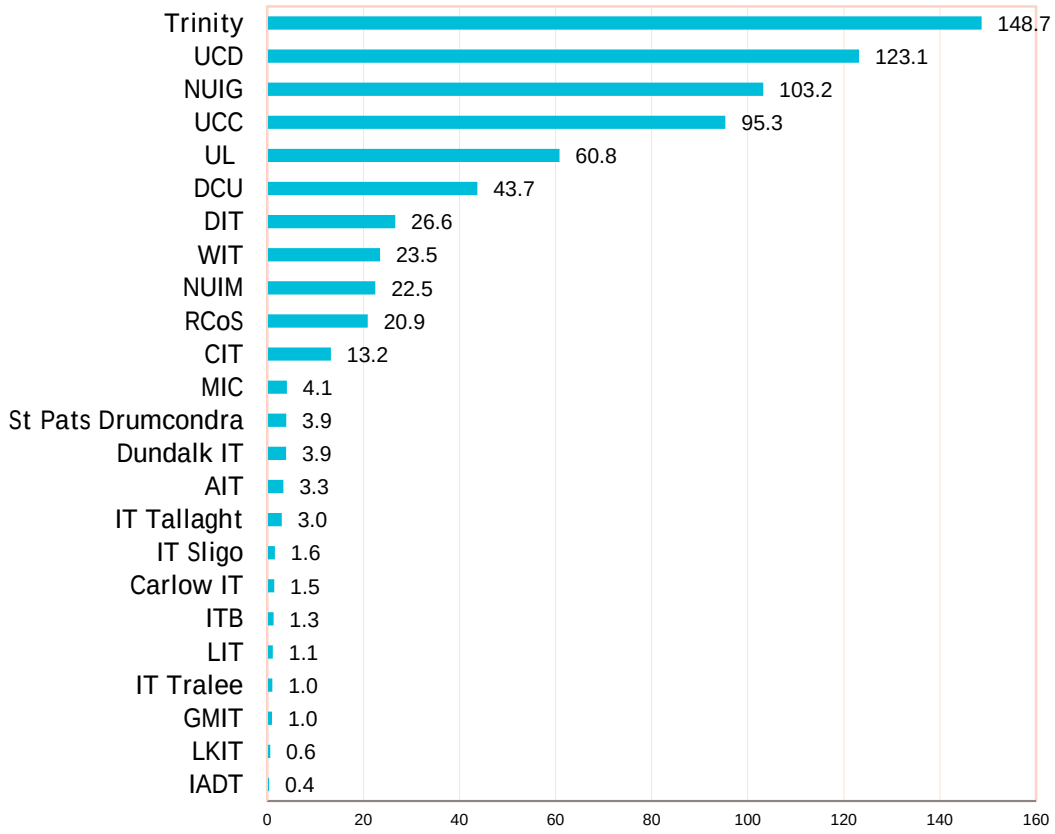


Source: Forfás HERD data

Figure 6 below shows expenditure on R&D by Institute in 2010. Of the universities, Trinity spent €148.7 million on R&D in 2010, followed by UCD and NUIG with expenditures of €123.1 million and 103.2 million respectively. UCC spent €95.3 million on R&D in 2010. These four universities account for two thirds of the total HERD spend.

In the IOT sector, the highest spenders on R&D were DIT and Waterford IT which amounted to €26.6 million and €23.5 million respectively.

Figure 6: Research expenditure by Universities and Institutes of Technology 2010, (€ millions), in current prices

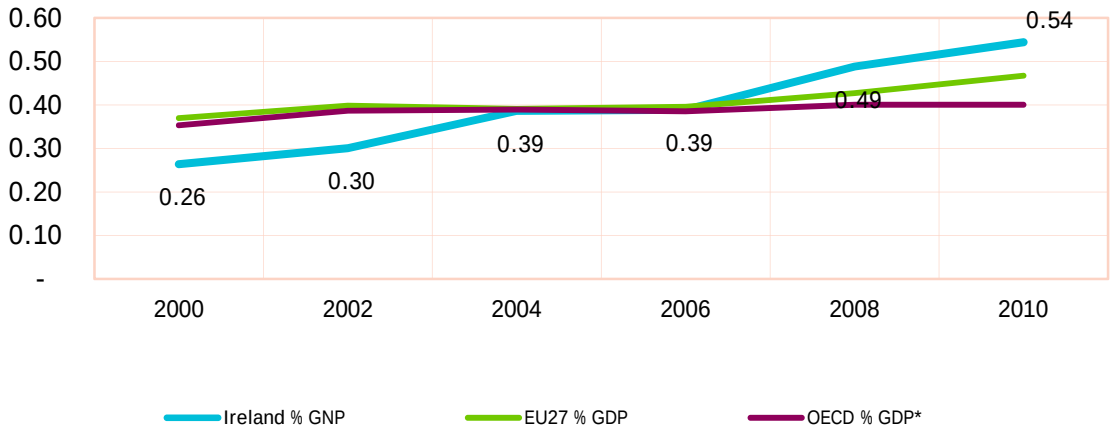


Source: Forfás HERD data

R&D expenditure by the higher education sector in Ireland, as a percentage of economic activity, is compared in Figure 7 below, with the performance of this sector across the EU27 and OECD countries. In Ireland, Gross National Product (GNP) is more commonly used to measure economic activity as opposed to Gross Domestic Product (GDP) which may be overestimated. Figure 4 shows HERD as a percentage of economic activity over the 10 year period from 2000 to 2010. Caution should be used when observing these ratios due to the rapid swings in nominal economic activity over the last decade.

From 2000 to 2002, Ireland's HERD intensity ratio remained below the EU27 and OECD averages. Increased spending on R&D by the higher education sector between 2002 and 2004 brought Ireland's ratio to 0.39 per cent of GNP, on a par with the EU27 and OECD averages. In 2008, HERD as a percentage of economic activity in Ireland at 0.49 per cent surpassed both the EU27 and OECD averages of 0.43 per cent and 0.40 per cent respectively due to a 25 per cent increase in R&D expenditure between 2006 and 2008. In 2010, Ireland's HERD intensity increased to 0.54 per cent above both the EU27 and OECD averages of 0.47 and 0.40 per cent respectively. The HERD intensity increased in 2010 although expenditure on R&D fell by 5.5 per cent in the same period. The increase is explained by a 15 per cent fall in GNP since 2008.

Figure 7: HERD as a percentage of economic activity, 2000-2010, Ireland, OECD and the EU27

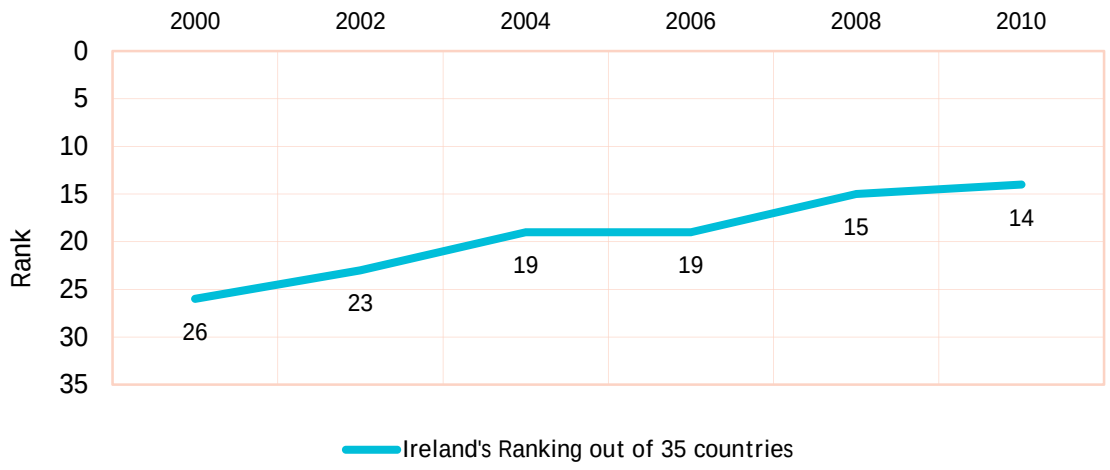


Source: OECD, Main Science and Technology Indicators, June 2012

Benchmarking Ireland's performance against other OECD states gives a clear picture of Ireland's progress in becoming a global centre of research excellence. Establishing Ireland's position with respect to other European countries is an important aspect of the HERD survey.

Figures 8 and 9 rank Ireland 14th out of 35 countries on HERD spending performance in 2010. Figure 7 shows clearly that Ireland has been making steady progress to reach its current 14th position out of 35 countries from 26th position in 2000.

Figure 8: HERD as a % of economic activity - Ireland's position in the OECD, 2000-2010

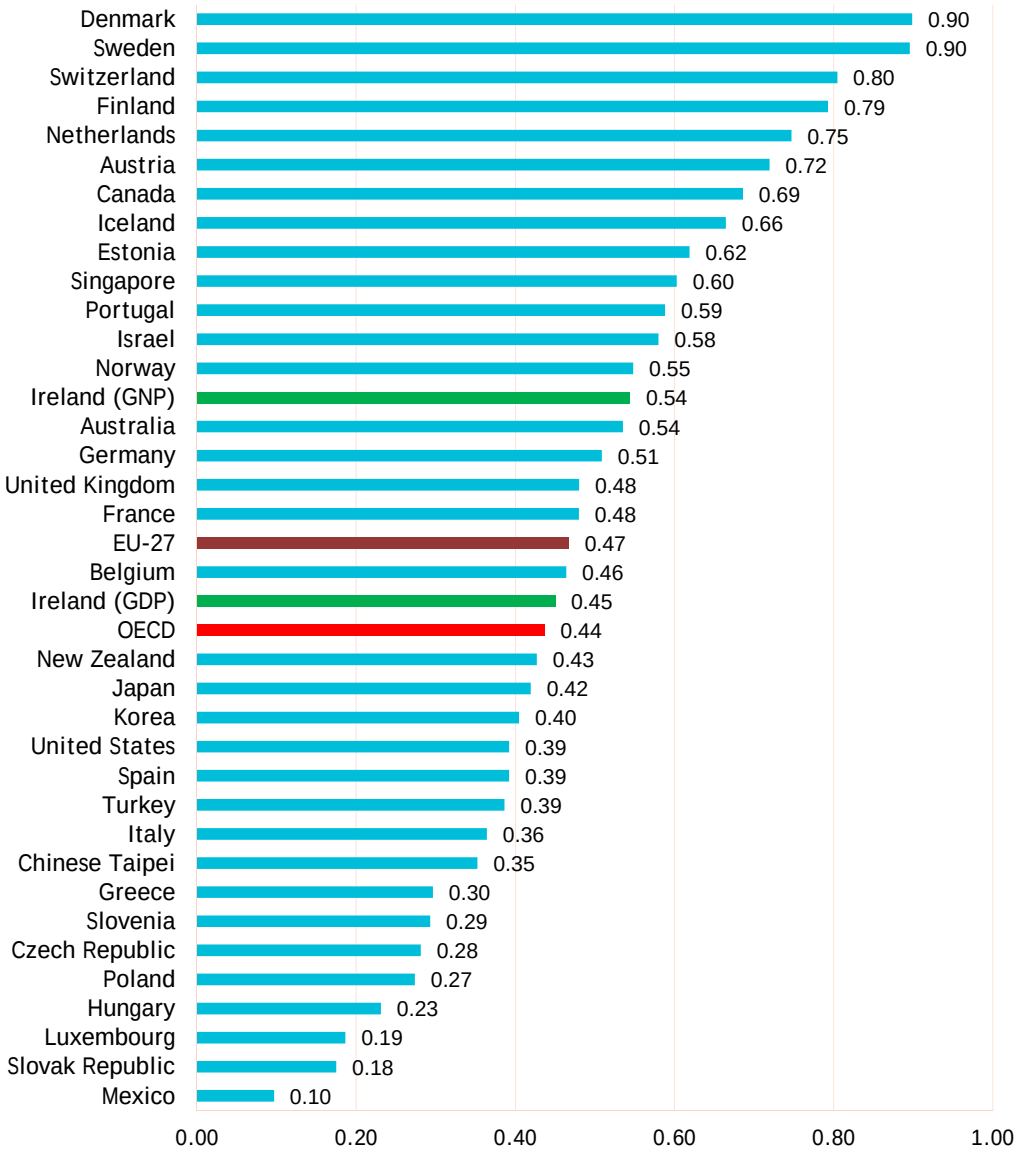


Source: OECD, Main Science and Technology Indicators, June 2012

In 2010, the top performers were Denmark and Sweden with higher education institutes spending 0.90 per cent of their respective GDPs on R&D, followed by Switzerland at 0.80 per cent. Ireland scores 14th place on this indicator in 2010, significantly above the EU27 and OECD averages at 19th and 21st positions respectively. Although there is substantial progress to

be made before reaching the top performers, many gains have been achieved which have helped Ireland close the research spending intensity gap when compared internationally.

Figure 9: HERD as a percentage of GDP (Ireland GNP) - 2010 or latest available data



Source: OECD, Main Science and Technology Indicators, June 2012

Chapter 2: Human resources allocated to higher education research

Improving Ireland's stock and flow of knowledge is one of the key challenges in completing the transition to a true knowledge economy, as outlined in the Government's Science Strategy[2] published in 2006 and the Report of the National Research Prioritisation exercise. Specifically, there is a need to increase the number of researchers and research personnel employed in the higher education sector, while also promoting the development of a strong and relevant learning platform for researchers at student level. The HERD survey gathers information on the numbers and type of personnel involved in R&D within Ireland's third level sector.

The number of researchers by total headcount is shown in Table 2a below. This includes academic staff, post-doctoral fellows, contract lecturers and research assistants engaged in R&D. The survey also requested data on research support staff including technicians, administrative/clerical and other support staff. The total number of researchers (headcount) reported for 2010 has decreased by 4.8 per cent over 2008, falling from 11,610 to 11,058. The headcount of research personnel, including research support staff, has increased by 6 per cent to 16,414 over the 2008 figure of 15,487. Caution should be exercised when comparing 2008 figures by personnel type with previous years due to the introduction of the Principal Investigators category for the 2008 survey. This has resulted in some post-doctoral fellows, contract lecturers or contract researchers being re-allocated to the new category resulting in a reduction in the other categories for 2008.

Table 2a: Total researchers by performer, 2010 (headcount)

Sector	Academic Staff	Principal Investigators	Post-doctoral Fellows	Contract Lecturers	Contract Researchers	Total Researchers
	A	B	C	D	E	(A+B+C+D+E)
Institutes of Technology	2,768	140	99	85	182	3,274
Universities	3,387	811	1,672	698	1,216	7,784
Total - 2010	6,155	951	1,771	783	1,398	11,058
Total - 2009	6,294	952	1,891	756	1,460	11,354
Total - 2008	5,994	1,032	2,278	1,396	911	11,610

Source: HERD survey 2010/2011

2 Strategy for Science, Technology and Innovation, 2006-2013.

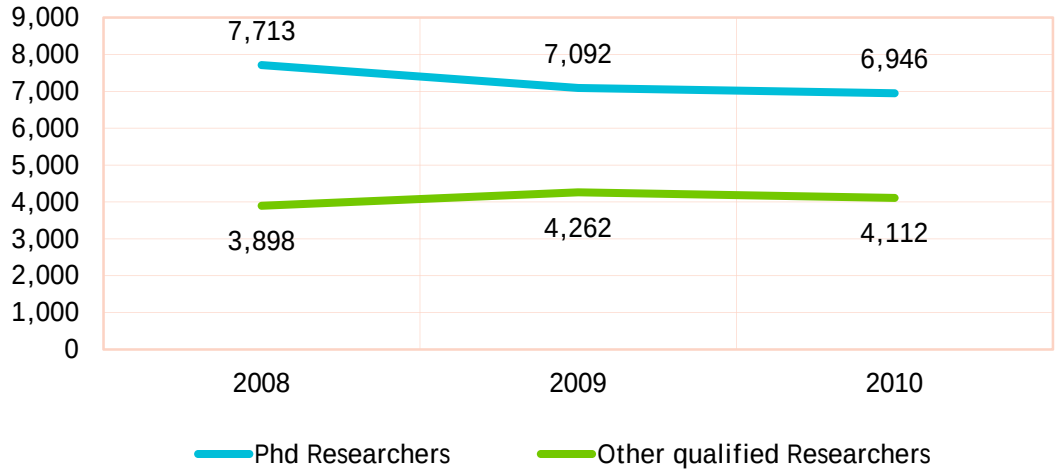
Table 2b: Total research personnel analysed by performer, 2010 (headcount)

Sector	Total Researchers	Technicians	Admin Staff	Other staff	Total Research Personnel
	F	G	H	I	(F+G+H+I)
Institutes of Technology	3,274	106	220	27	3,626
Universities	7,784	1,010	2,788	1,206	12,788
Total - 2010	11,058	1,115	3,007	1,233	16,414
Total - 2009	11,354	1,156	3,083	1,306	16,899
Total - 2008	11,610	1,079	2,242	556	15,487

Source: HERD survey 2010/2011

The total number of research personnel including technicians and other team members employed in the Higher Education Institutes (HEIs) increased by 927 since 2008. The number of researchers employed in the HEIs has declined by 552 since 2008. Figure 10 below shows that there were 7,713 PhD researchers in the sector in 2008 and by 2010 there was a net fall of almost 10 per cent or 767 PhD researchers. There were 3,898 other researchers employed in the sector in 2008 and this increased by 214 to 4,112 other researchers employed in 2010.

Figure 10: Researchers by qualification, 2008-2010 (headcount)



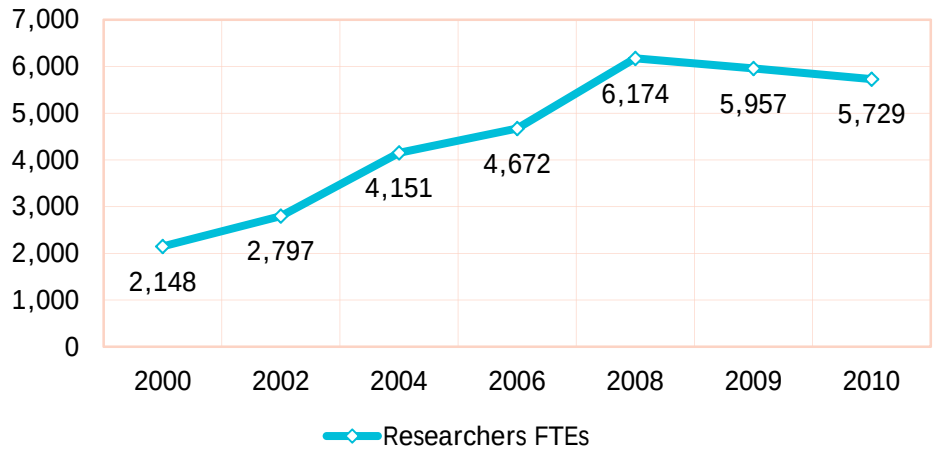
Source: Forfás Data

To obtain a clearer picture of the amount of time devoted to research as opposed to other work the higher education institutes were asked to estimate the actual amount of time spent on research. This estimate enables the headcount figure to be converted to a full-time equivalent figure (FTE) which more accurately describes the time allocated to research in the

various institutes. If a single researcher is counted as 1 in headcount terms, and they spend 40 per cent of their total work time on research activities then they are counted as 0.4 FTEs.

Figure 11 below shows that the number of researchers in FTE terms increased almost threefold in the period 2000 to 2008, growing from 2,148 to 6,174. Between 2008 and 2010 the number of researchers in FTEs declined by 7.2 per cent from 6,174 to 5,729. This decline is somewhat higher than the 5.5 per cent decline in HERD and the 4.8 per cent decline in the number of researchers employed over the same period, indicating a possible reduction in the research intensity (i.e. the proportion of time spent engaged on research) of researchers.

Figure 11: Total researchers in the higher education sector, 2000-2010 (FTE)



Source: Forfás HERD Data

When the FTE numbers of researchers and research support staff for 2010 is examined by field of science, as in Table 3 below, the following can be noted:

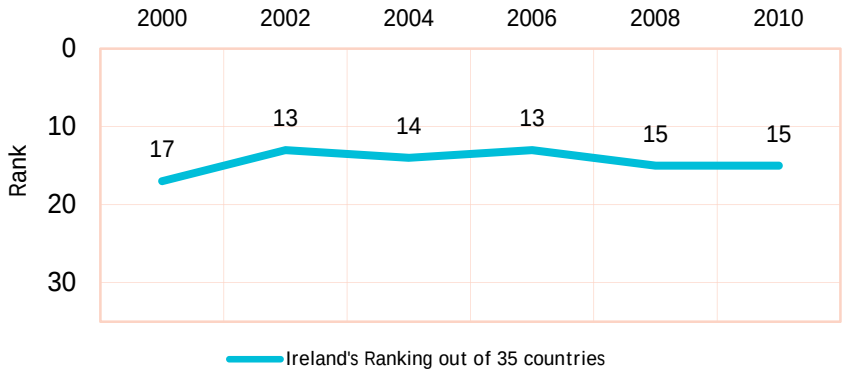
- the total number of FTE research personnel rose from 2,148 in 2000 to 5,729 in 2010, peaking in 2008 with 6,174 FTE researchers employed in the sector.
- the majority of researchers are employed in the field of natural sciences in 2010 with a FTE figure of 1,915, a decrease of 26, from 1,941 in 2008.
- after natural sciences, the number of researchers are greatest in the fields of medical and health sciences (1,168) and engineering and technology (1,124).
- FTE researchers in the social sciences, humanities and agricultural sciences accounted for 16 per cent, 9 per cent and 2 per cent of total FTE researchers, respectively, in 2010.
- apart from social science, most research support was provided in the fields of natural sciences (174 FTE) and the fields of engineering and technology (161 FTE) and medical and health sciences (148 FTE).

Table 3: Researchers by occupation and field of science in the higher education sector, FTEs, 2010

Sector	Total Researchers	Total Support Staff	Total Research Personnel
Natural Sciences	1,915	174	2,088
Engineering and Technology	1,124	161	1,285
Medical and Health Science	1,168	148	1,316
Agricultural Sciences	104	0	104
Social Sciences	910	247	1,157
Humanities	508	41	549
Total - 2010	**5,729**	**771**	**6,500**
Total - 2009	5,957	762	6,718
Total - 2008	6,174	967	7,141

Source: Forfás HERD Data

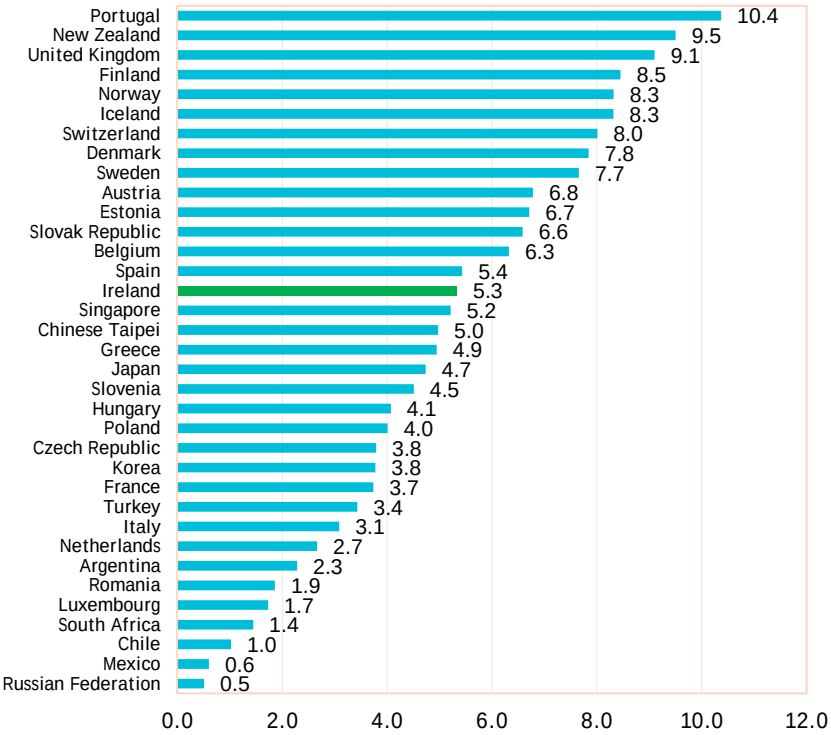
Figure 12: Ireland's ranking, higher education researchers per 1,000 of the labour force (2010 or latest available data)



Source: OECD, Main Science and Technology Indicators, June 2012

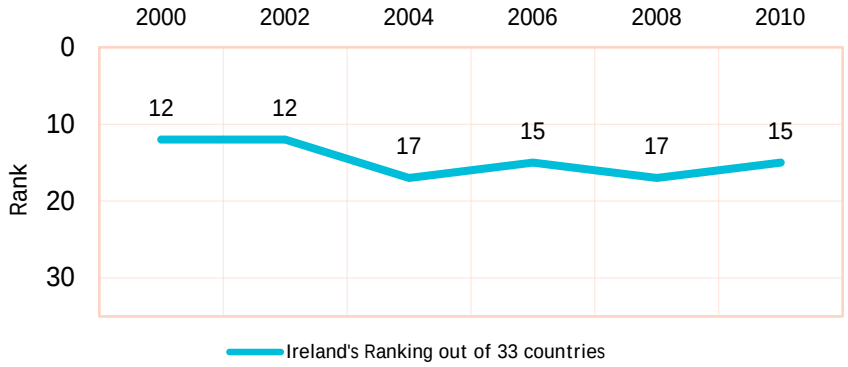
Figure 12 and 13 illustrates Ireland's ranking against other OECD countries when comparing the number of higher education researchers per 1000 of the labour force. In 2000, Ireland was ranked 17th of 35 states. Over the decade Ireland moved up to 15th place out of 35 countries, having peaked in 2006 at 13th place, with Portugal reporting the highest number of researchers per thousand labour force at 10.4.

Figure 13: Higher education researchers (headcount) per 1,000 of labour force (2010 or latest available data)



Source: OECD, Main Science and Technology Indicators, June 2012

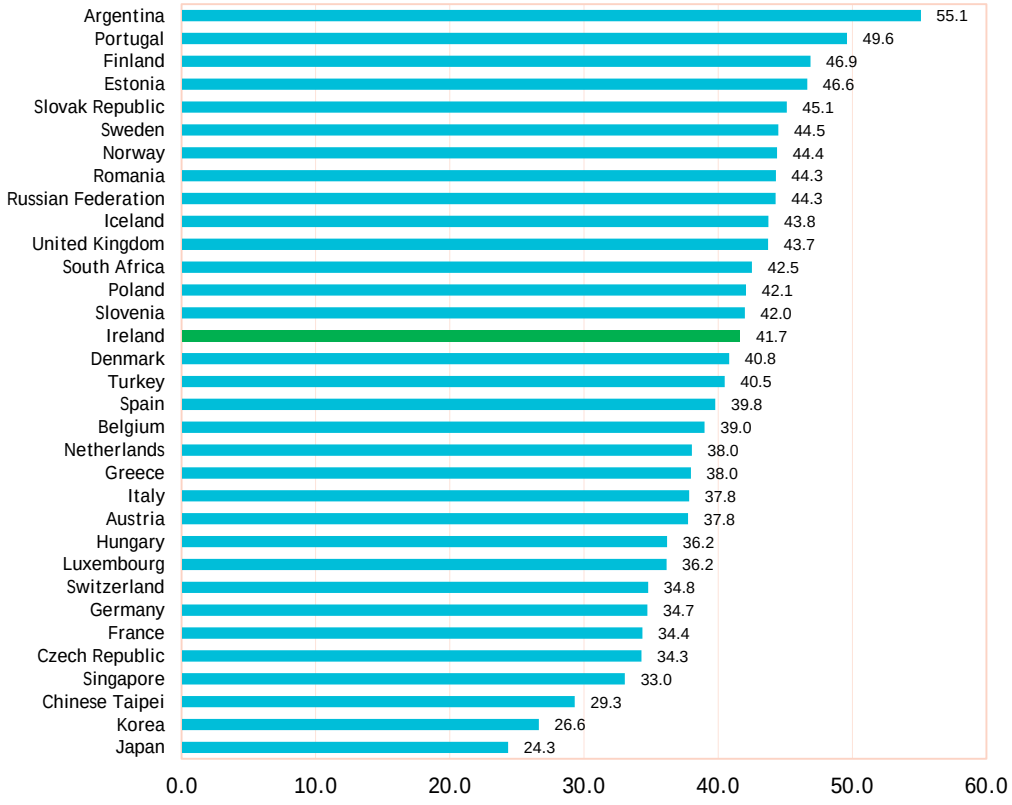
Figure 14: Ireland's ranking, Higher education female researchers as a % of total researchers (2010 or latest available data)



Source: OECD, Main Science and Technology Indicators, June 2012

When the number of female researchers as a percentage of total researchers is compared internationally (Figures 14 and 15), Ireland performs well, ranking 15th out of 33 countries in this indicator. Some 41.7 per cent of all researchers in Ireland are female. Argentina and Portugal are the current leaders with female researchers accounting for 55.1 per cent and 49.6 per cent of all researchers in 2010 respectively.

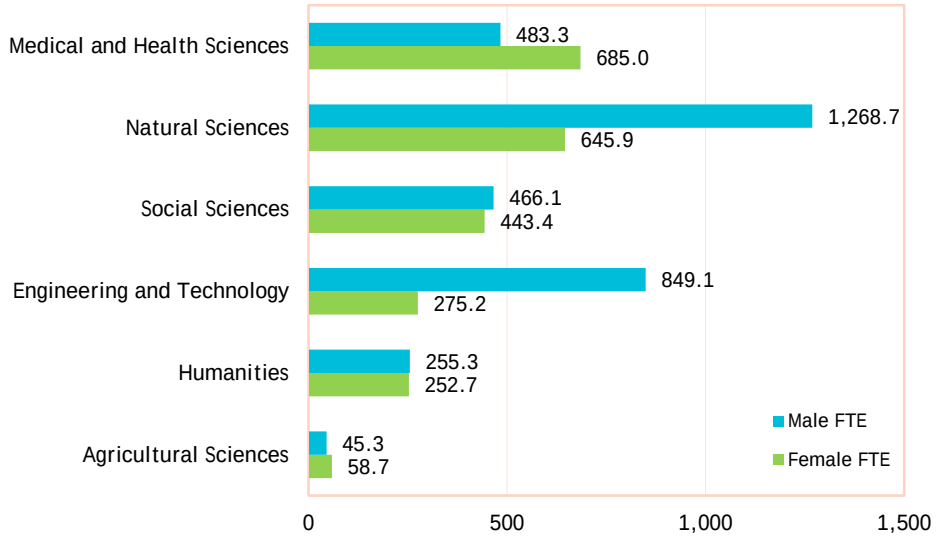
Figure 15: Higher education female researchers as a % of total researchers (2010 or latest available data)



Source: OECD, Main Science and Technology Indicators, June 2012

Figure 16 below shows the number of FTE male and female researchers by field of science in 2010. In the field of medical and health sciences, female researchers account for 59 per cent of total researchers contrasting with the field of engineering and technology where male researchers account for 76 per cent of total researchers.

Figure 16: Female and male FTE researchers, 2010



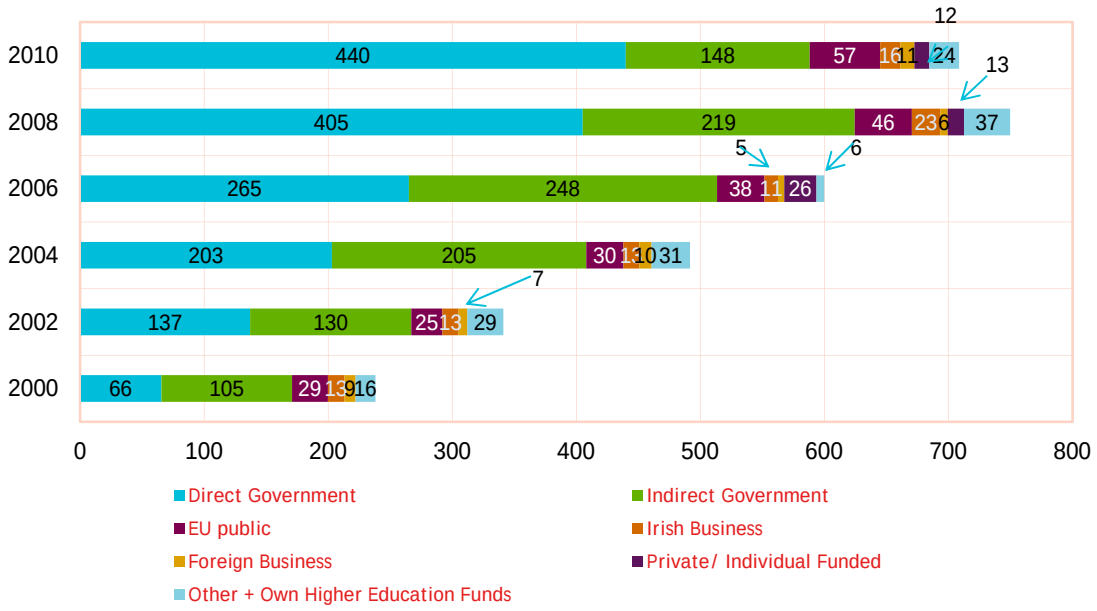
Source: Forfás Data

Chapter 3: Source of funding of HERD expenditure

This chapter examines the main sources of funding for higher education R&D. Funding for research in higher education institutes is provided by a number of different sources. The main sources of funding come from three distinct areas: direct government, indirect government and other sources such as Irish industry, foreign industry and EU funding programmes, including the Framework Programmes, and also some funding from private individuals.

Direct funding includes funding from the HEA's Programme for Research in Third level Institutions (PRTLI) fund, SFI's Research Frontiers Programme, SFI US-Ireland R&D Partnership Programme, SFI Principal Investigator Programme and other programmes. Indirect funding sources include funding from the HEA via the annual "block grant" to universities.

Figure 17: Sources of research funding, 2000-2010, in current prices (€ millions)



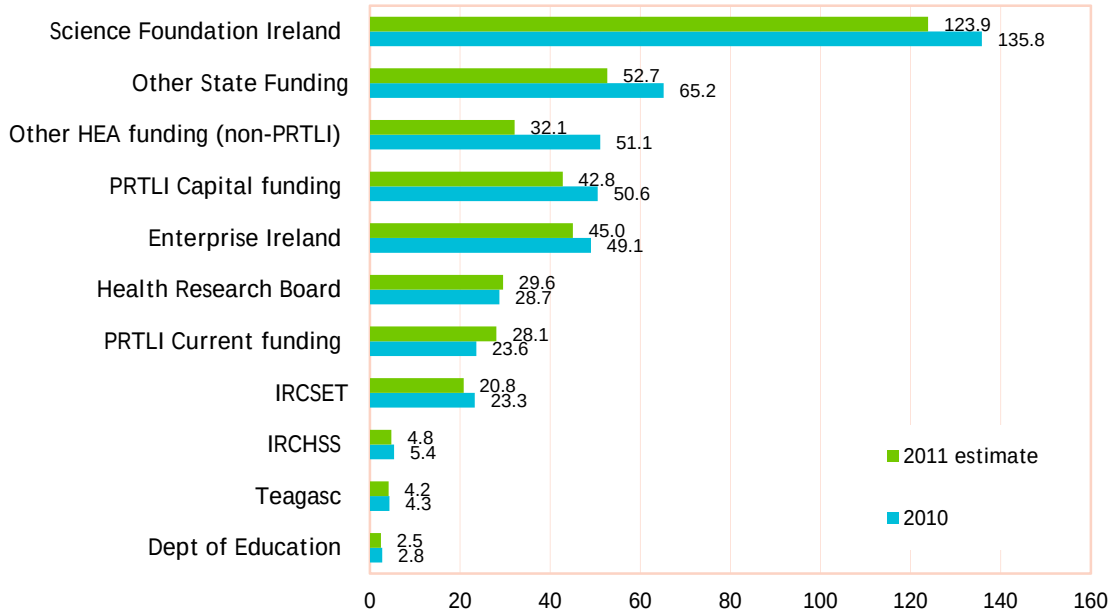
Source: Forfás Data

Figure 17 above illustrates the level of funding provided by government and other sources for 2000 to 2010. With the exception of 2004 direct government has been the main source of research funding in the higher education sector. Indirect government funding marginally outstripped direct funding in 2004. While funding directly from government increased substantially between 2006 and 2010, indirect funding decreased by 40 per cent over the same period. Total government funding, (both direct and indirect) accounted for 83.1 per cent of all research income in the higher education sector in 2010.

Direct government funding comes from the Irish exchequer via various government departments and agencies in order to fund research projects that are performed in the higher education sector. In 2010, direct government funding of higher education R&D rose to €440

million, an 8.6 per cent increase on the amount allocated to research and development activities in the higher education sector in 2008. Government agencies providing funding for research and development activities in the higher education sector in 2008 included: Science Foundation Ireland (SFI); the HEA, through its Programme for Research in Third Level Institutions (PRTLI); Enterprise Ireland, the Health Research Board, IRCSET and the Dept. of Agriculture, Fisheries & Food etc. A large contribution also came from "Other" sources, which encompasses various government departments, Bord Fáilte, National Digital Research Centre, OPW, HSE and County Councils etc.

Figure 18: Sources of direct government research funding (€ millions) 2010/2011 estimate



Source: Forfás Data

Figure 18 shows the breakdown of direct government funding by its main sources for the academic years 2010 and estimates for 2011. As already mentioned the largest amount of funding for research in the third-level sector comes from SFI. Funding from SFI accounted for 30.9 per cent of the total direct government research funding in 2010. PRTLI funding (both current and capital) amounted to €70.9 million (16.9 per cent of the total) and EI's funding in 2010 amounted to €45 million (11.2 per cent of the total). Research in the areas of health science, engineering and technology, social science and agriculture account for the remainder of the direct government research funding.

Indirect government funding is distributed by the HEA to the universities in the form of an annual "block grant". The allocation of this funding to the universities is for a variety of purposes on behalf of the Department of Education and Science. The size of the R&D component of the academic part of the block grant is decided upon by measuring the amount of time spent on research at the institution by academic staff, and apportioning that part of

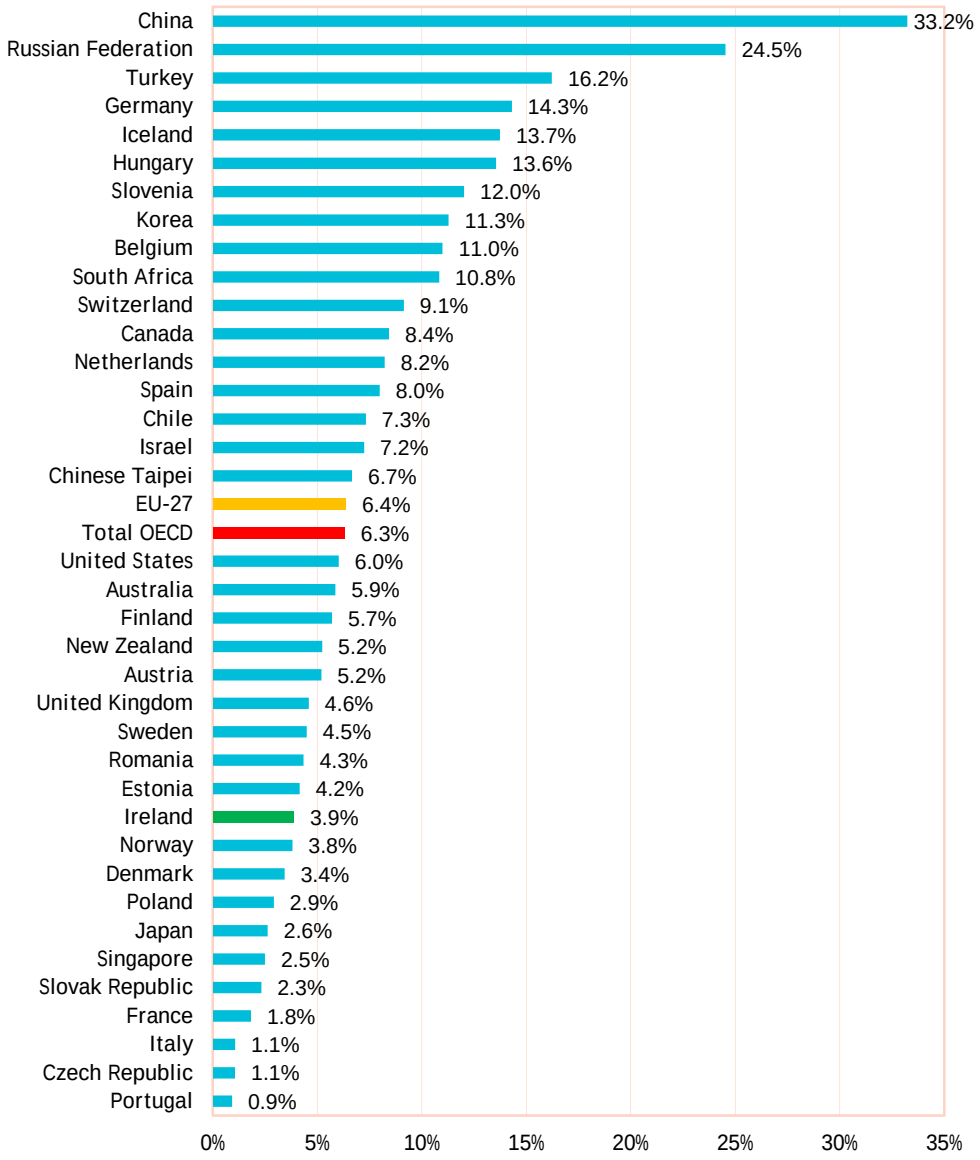
overall funding to departmental R&D activities. This is standard practice in all OECD countries that operate a dual system of higher education funding – direct and indirect (General University Funding). This system follows the guidelines set out in the OECD's Frascati manual. In 2010, the R&D element of the HEA block grant fell to €148 million from the €219 million recorded in 2008.

Since 2002 the EU contribution has more than doubled from €25 million in 2002 to €57 million in 2010, mainly through its Framework Programmes. Irish industry's contribution rose considerably between 2006 and 2008 increasing from €11 million to €23 million and declined to €16 million in 2010. In 2010 industry's share accounted for 3.9 per cent of total funding. The contribution from private individuals and philanthropists, who donate to higher education institutions to further research, which was measured for the first time in 2006, dropped from €26 million then to only €12 million in 2010 (1.7 per cent of the total).

Figure 19 overleaf, shows the percentage of higher education R&D that is financed by industry in 35 countries. Ireland's contribution of 3.9 per cent ranks well below the leaders China (with a contribution of 33.2 per cent) followed by Russian Federation at 24.5 per cent followed by Turkey and Germany with contributions of 16.2 per cent and 14.3 per cent respectively. Ireland is also below the total OECD contribution of 6.3 per cent and the EU-27 contribution of 6.4 per cent.

Total funding of R&D in the higher education sector amounted to €708.5 million in 2010 and total expenditure amounted to €708.3 million due to an underspend of €0.2 million by one of the higher education institutes. Table 4 below illustrates the breakdown of research funding in the higher education sector by areas of research or fields of science. Slight differences can be noted by field of science between funding and expenditure totals. This could be explained by inter departmental loans in the institutes to cover shortfalls in funding which is later repaid when funding comes through. This breakdown can be used to examine and compare the areas of research receiving most funding and those areas that attract smaller amounts of funding.

Figure 19: Percentage of HERD financed by industry, (2010 or latest available data)



Source: OECD, Main Science and Technology Indicators, June 2012

- 73.5 per cent of research funding for natural sciences was received through direct government funding. Indirect funding accounted for 11.7 per cent, while Irish and foreign business and other sources provided 5.5 per cent and the EU 9.3 per cent.
- The engineering and technology research areas received 76.4 per cent of their HE funding directly from government. Only 6.9 per cent came from indirect sources, while 16.7 per cent came via the EU, industry and other sources of funding.
- Direct government funded 56.3 per cent of research in the medical and health sciences fields of science. 22.6 per cent of funding is provided via the HEA's block grant while

the remaining 21.0 per cent is sourced through business and other sources and the EU respectively.

- The majority of funding for agricultural science research (61.4 per cent) is provided directly by the government. 31.5 per cent comes from the block grant while the EU funds 5.4 per cent and the remaining 1.8 per cent is provided by Irish and foreign business and other sources.
- The social sciences obtain 36.9 per cent of their funding from direct government sources and 42 per cent from indirect government sources. Industry and other sources provide 13.6 per cent while the 7.4 per cent is funded by EU programmes.
- As with social sciences the majority of funding for the humanities comes from the HEA with the block grant accounting for 61.8 per cent of funding. By contrast with the other fields of science, direct government funding only accounted for 31.1 per cent of research funding in the humanities research area. Industry and other sources provided 5 per cent of funding in 2010 and the EU 2.1 per cent.

Table 4: Sources of research funding by Field of Science (€ millions), 2010

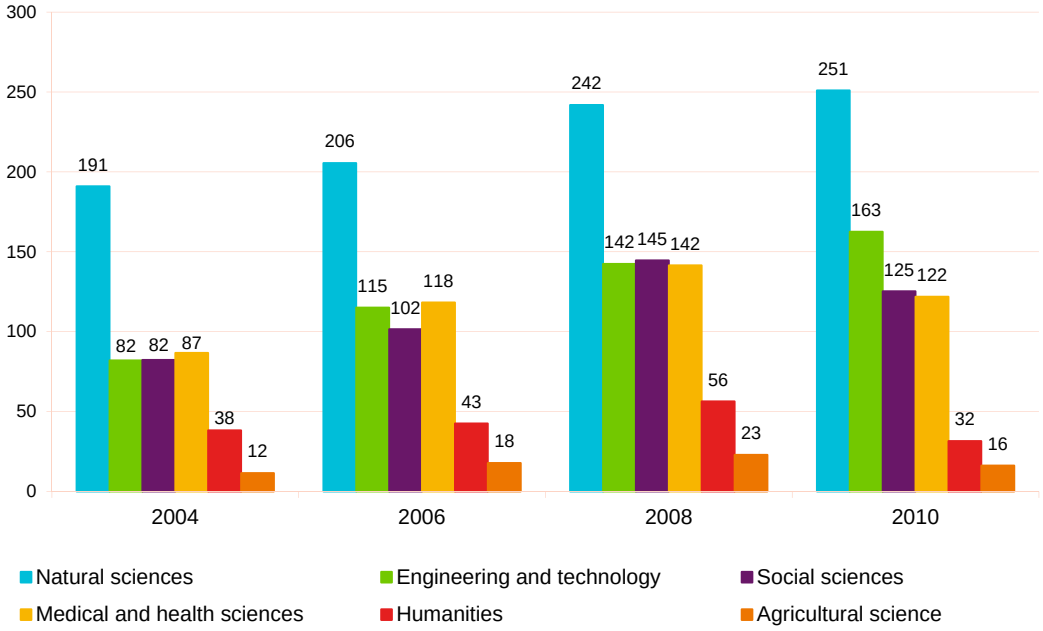
Field of Science	Direct Sources of Funds			Indirect Government	Total
	Irish Public Research	EU	Industry and Other		
Natural Sciences	181.1	23.0	13.6	28.8	246.5
Engineering and Technology	120.4	16.3	10.0	10.8	157.5
Medical and Health Sciences	69.4	6.0	19.9	27.9	123.2
Agricultural Sciences	9.9	0.9	0.3	5.1	16.2
Social Sciences	49.3	9.9	18.2	56.2	133.6
Humanities	9.8	0.7	1.6	19.5	31.6
Total	439.9	56.8	63.6	148.3	708.5

Source: Forfás Data

Chapter 4: HERD Expenditure by Field of Science

This chapter examines R&D expenditure in the higher education sector more closely by breaking the expenditure down by fields of science. Fields of science classifications are produced by the OECD to be used by member countries for international comparison purposes. The major OECD fields of science include: natural sciences; engineering and technology; medical and health sciences; agricultural sciences; social sciences and humanities. The fields of science were revised in 2006 to reflect changes in science and technology such as the emergence of technology fields such as ICT, biotechnology and nanotechnology. While the fields of science allow us to follow trends in key research areas the production of the new classification in 2006 doesn't allow for comparison with previous HERD surveys. Consequently the old field of science classifications are used in this chapter to allow for an examination of meaningful trends over time.

Figure 20: Higher education expenditure on R&D by Field of Science in current prices (€millions), 2004-2010

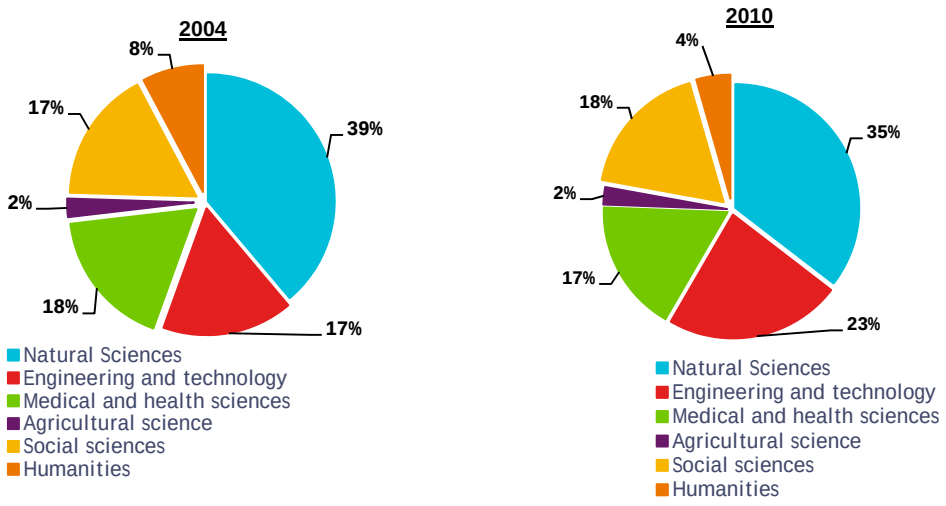


Source: Forfás Data

- Figure 20 shows that the largest proportion of R&D expenditure was in the field of natural sciences in 2004, 2006, 2008 and again in 2010. In 2010 R&D expenditure in the field of natural sciences amounted to €251 million an increase of 3.8 per cent over 2008, which in turn had increased by 17.7 per cent since 2006. In 2010, R&D expenditure in the field of natural science was 54.5 per cent higher than R&D expenditure in the field of engineering and technology, the field of science with the next largest R&D expenditure.

- In turn R&D expenditure in 2010 on social sciences decreased by 13.4 per cent over the 2008 figure of €145 million to €122 million in 2010.
- Expenditure in the fields of engineering & technology and medical & health sciences amounted to approximately €163 million and €122 million respectively in 2010. R&D expenditure in the field of engineering and technology increased over the two-year period between 2008 and 2010 by €21 million, while R&D expenditure in the field of medical & health sciences decreased by €20 million. Engineering & technology increased R&D funding by €81 million over the 4 year period since 2004.
- Funding for the humanities decreased by 44.1 per cent between 2008 and 2010.
- The agricultural sciences recorded a decline of €7 million in research funding from 2008 to 2010 with the total amount of R&D funding allocated within this field of science reducing to €16 million in 2010.

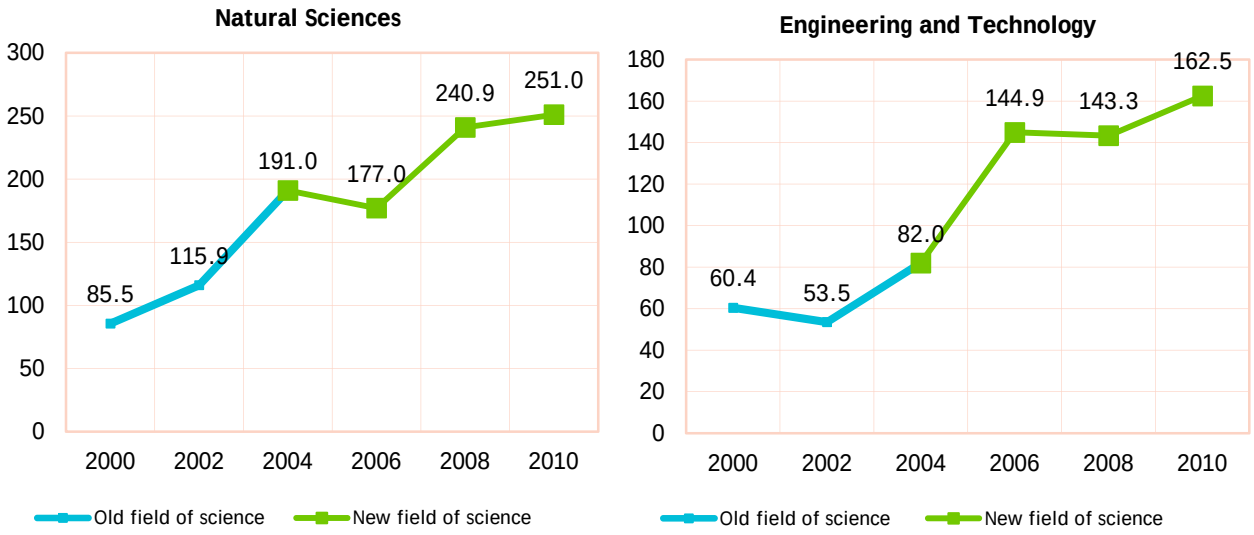
Figure 21: Share of total R&D expenditure by field of science, 2004 and 2010



Source: Forfás Data

Figure 21 above compares the percentage share of total R&D expenditure by the various fields of science in 2010 with the percentage share six years ago. Most fields of science increased their funding over the last 6 years. However, when comparing 2004 with 2010 percentage shares of the different fields of science have changed somewhat. The natural sciences shares have dropped from 39 per cent to 35 per cent and humanities have dropped from 8 per cent to 4 per cent in 2010 respectively. Engineering & technology academic departments have increased their share from 17 per cent in 2004 to 23 per cent in 2010. Social Science has had a slight increase from 17 per cent in 2004 to 18 per cent in 2010. The share of total R&D expenditure for the field of medical and health sciences dropped slightly from 18 per cent to 17 per cent and for agricultural sciences remained stable at 2 per cent between 2004 and 2010.

Figure 22: HERD expenditure on natural sciences and engineering & technology in current prices 2000 to 2010, (€ millions)



Note: In 2006 the Fields of Science categories were revised by the OECD and new sub-categories added to the original six main fields of science. This resulted in a re-allocation of expenditure between the main fields of science. Consequently, care should be taken when comparing Old and New Fields of Science since 2006.

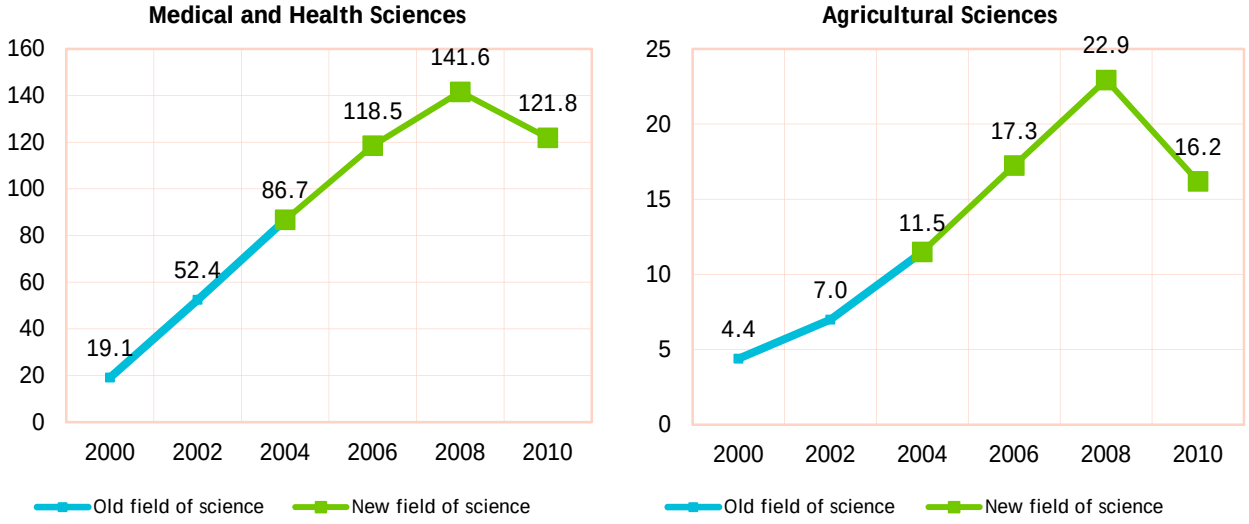
Source: Forfás Data

Natural sciences: The new revised fields of science classifications came into effect in 2006 and the chart above shows the difference in HERD expenditure in the natural sciences area from 2000 to 2010. Expenditure rose from €85.5 million in 2000 to €251 in 2010. The largest increase in expenditure was between 2002 and 2004 when there was an increase of 65 per cent in funding in the area. Using the new field of science classification HERD expenditure in this research area rose by 4.1 per cent between 2008 and 2010 following an increase of 36 per cent from 2006 to 2008. Breaking down the field of science to the next sub-category (see Appendix 3) shows that the sub-category of computer and information sciences at 35.5 per cent account for the largest portion of the HERD spend in this category, with biological sciences accounting for 22 per cent of total funding, in 2010. Mathematics account for 5.7 per cent of total funding, chemical sciences and earth and related environmental sciences for 12 and 13 per cent of total funding respectively, with physical sciences and other natural sciences accounting for the remainder.

Engineering and technology: Research funding for the engineering & technology areas increased by 13.4 per cent between 2008 and 2010. Funding more than doubled between 2002 and 2006 in this area. The new classification of fields of science shows a very considerable rise of 77 per cent between 2004 and 2006 but a slight drop between 2006 and 2008 but once again rising in 2010. Under the new classification the engineering and technology research area has been expanded from three to eleven sub-categories, introducing new categories such as mechanical, chemical, materials, medical, and environmental engineering as well as environmental and industrial biotechnology and nanotechnology. This

re-classification means that while the sub-set of electrical, electronic and information engineering retains its 39 per cent share, the 65 per cent previously classified as "other engineering sciences" can now be re-classified more precisely under the new headings. Consequently the new classification of nanotechnology now accounts for 18.8 per cent of the total, with mechanical engineering and industrial biotechnology at 5.4 per cent and 7.2 per cent respectively. Environmental engineering and civil engineering receive 8 per cent and 7.6 per cent of the total and the rest is distributed between chemical, materials, medical, environmental and other engineering and technology areas.

Figure 23: HERD expenditure on medical and health sciences in current prices 2000 to 2010, (€ millions)



Source: Forfás Data

Medical and health sciences

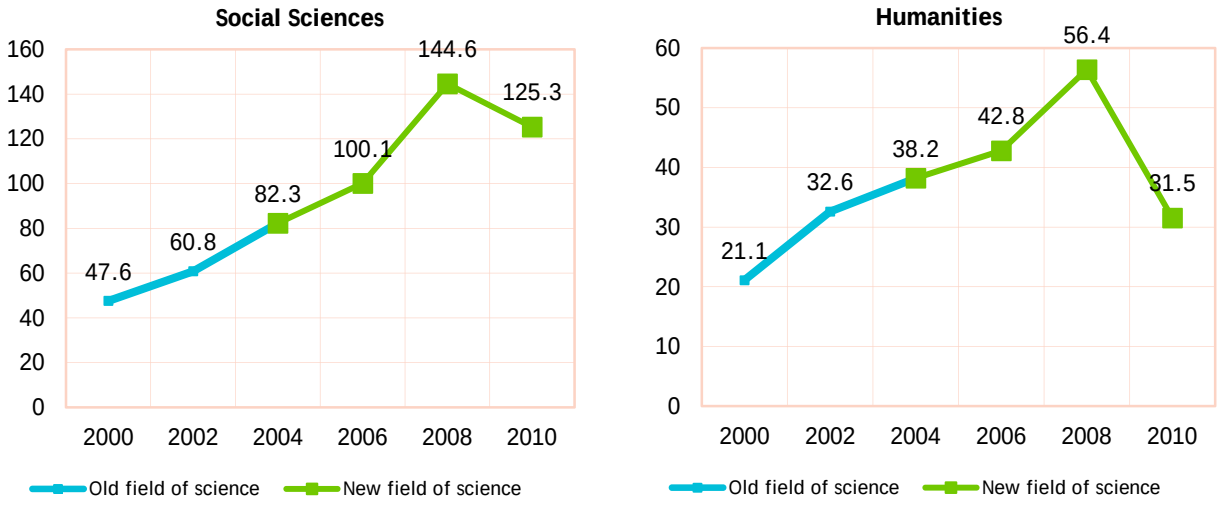
Funding for the medical and health research areas has increased steadily from €19.1 million in 2000 to €141.6 million in 2008. From 2008 to 2010 there was a decrease of €20 million. The sub-categories of health biotechnology and other medical sciences were the only additions in the new field of science re-classification in this area. Consequently, between 2006 and 2008 there was only a very small difference between the old classification and the current one. Funding almost tripled between 2000 and 2002 and continued rising with percentage increases of 66 per cent between 2002 and 2004 and 36.7 per cent between 2004 and 2006 and 19.4 per cent from 2006 to 2008. Over half of all research funding in the medical sciences area is performed by departments operating within the sub-category of basic medicine. Clinical medicine and health sciences account for 21.9 per cent and 20.4 per cent respectively with small amounts divided between health biotechnology and other medical sciences.

Agricultural sciences

Between 2000 and 2006 expenditure on research in agricultural science quadrupled from €4.4 million to €17.3 million respectively. In 2008 funding for agricultural science increased by a

further 33 per cent to reach €22.9 million by 2008. However, in 2010 funding decreased from €22.9 million to €16.2 million, a decline of 29.4 per cent. As with the medical and health sciences, the re-classification of the agricultural sciences sub-categories made little difference to the area. 97 per cent of total funding in 2010 in this area went to the sub-category of animal and dairy science and increase from 88 per cent in 2008, with agriculture, forestry and fisheries accounting for the remaining 3 per cent in 2010, down from 12 per cent in 2008.

Figure 24: HERD expenditure on social sciences and humanities in current prices 2000 to 2010, (€ millions)



Source: Forfás Data

Social sciences

Expenditure in this field of science has increased steadily since 2000 with the largest increase occurring between 2006 and 2008 when spending in the field increased by 44.4 per cent. In the two-year period between 2002 and 2004 funding in the social sciences area increased by 35 per cent**,** while increases between 2000-2002 and 2004-2006 were 28 per cent and 22 per cent respectively. However, in 2010 funding decreased from €145 million to €125 million, a decline of 13.4 per cent. Educational sciences and economics & business together account for 68 per cent of the R&D expenditure in the area of social sciences in 2010. The remaining 32 per cent is divided between other social science areas with the largest proportion being spent in the areas of social & economic geography, sociology and psychology.

Humanities

Spending on R&D more than doubled between 2000 and 2006, from €21.1 million to €42.8 million in the humanities field of science. Between 2006 and 2008 spending increased by 31.8 per cent to €56.4 million and in 2010 spending decreased to €32 million, down 44.1 per cent on 2008 expenditure. The languages and literature sub-category of the humanities field of science utilises 45 per cent of all R&D funding in this area. History and archaeology is the next largest area at 21 per cent, while philosophy, the arts and other humanities make up the remaining 34 per cent.

Chapter 5: Types of research

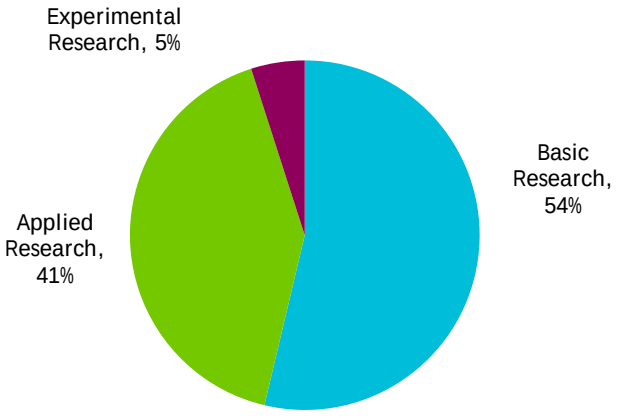
To ascertain the type of research undertaken by the universities and the institutes of technology, participants were asked to classify which type of research they were engaged in.

The three types of research as defined in the OECD's Frascati Manual are as follows:

- **Basic research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.
- **Applied research** is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or object.
- **Experimental development** is systematic work, drawing on knowledge gained from research and practical experience that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed."[3]

Figure 25 below divides expenditure on R&D in the higher education sector by research type for 2010. As in previous years, the type of research most commonly undertaken in this sector is basic research. Basic research accounted for 54 per cent of all research undertaken in 2010 mainly funded via SFI programmes. Universities and institutes of technology spent 41 per cent of the total HERD budget on applied research activities while experimental research accounted for 5 per cent of the budget.

Figure 25: Percentage of total HERD budget by research type, 2010 (Total = €708m)

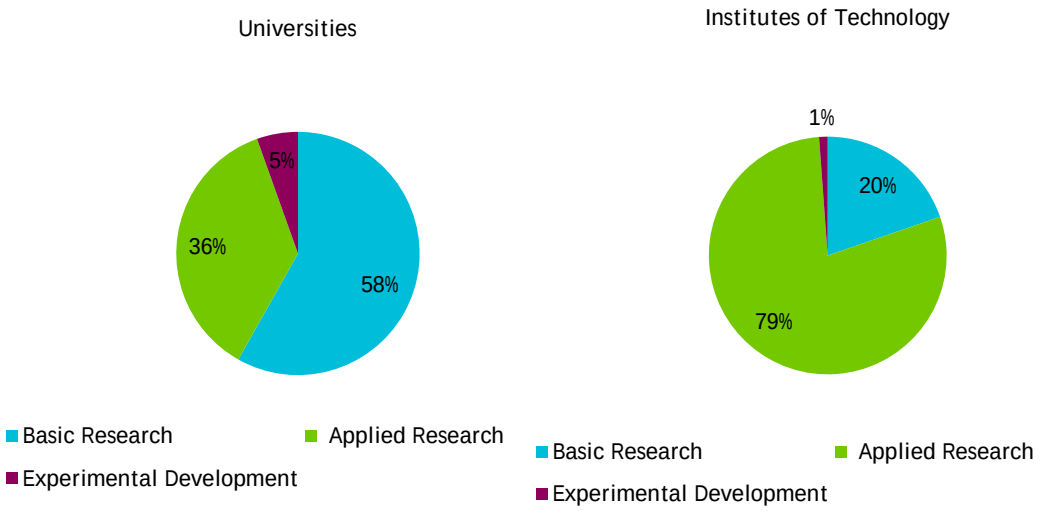


Source: Forfás Data

[3] Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development - OECD, 2002

Disaggregating research under the OECD's basic classifications is one approach to examining the distribution of R&D expenditure, which is self-reported by researchers. Forfás also undertook an analysis[4] based on the classification of funding by research funding agencies. The breakdown of funding for basic research within the Higher Education sector was in the range of 50 per cent-60 per cent and for applied research in the range of 32 per cent-50 per cent.

Figure 26: Type of research carried out by Field of Science, Universities and IoTs, 2010

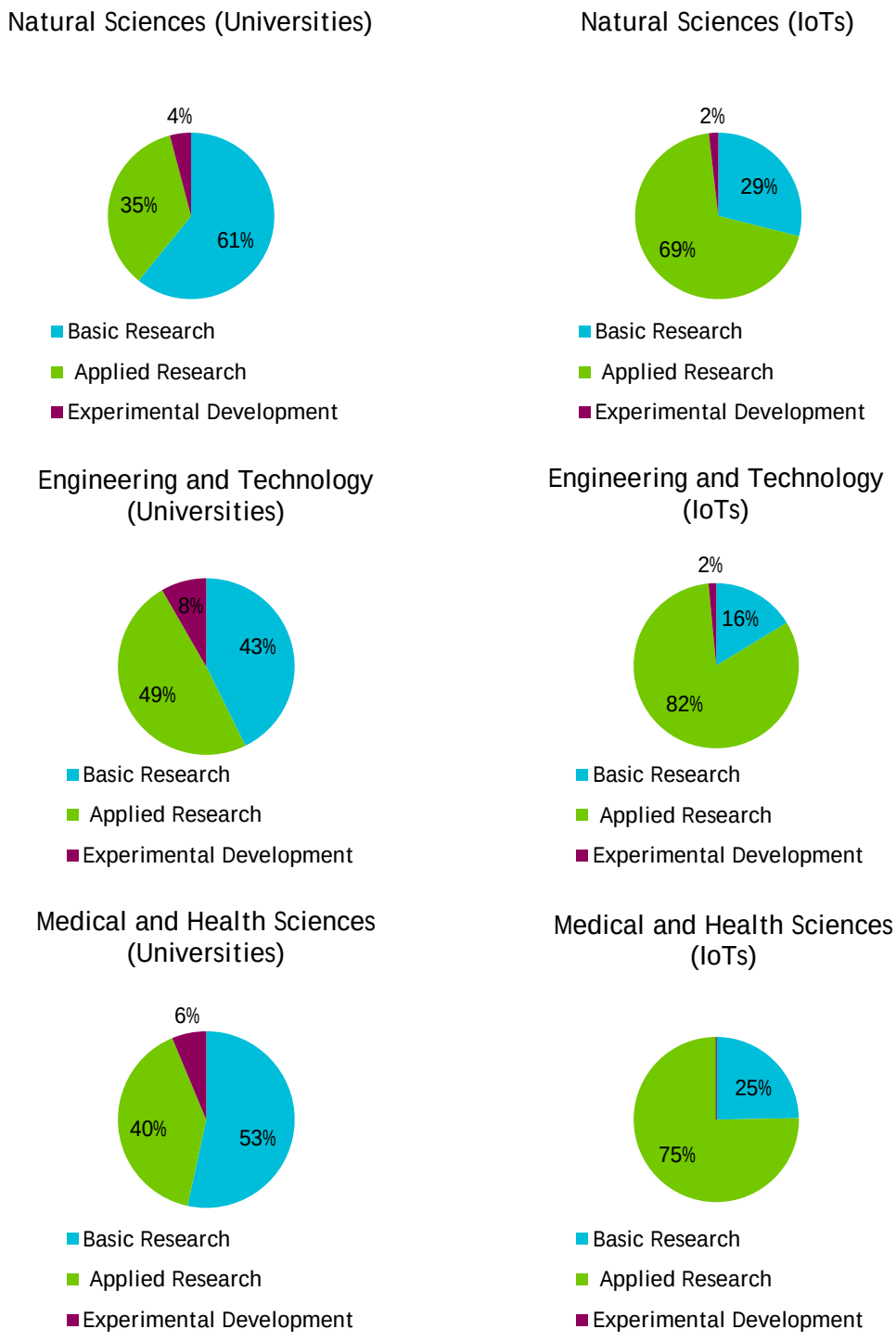


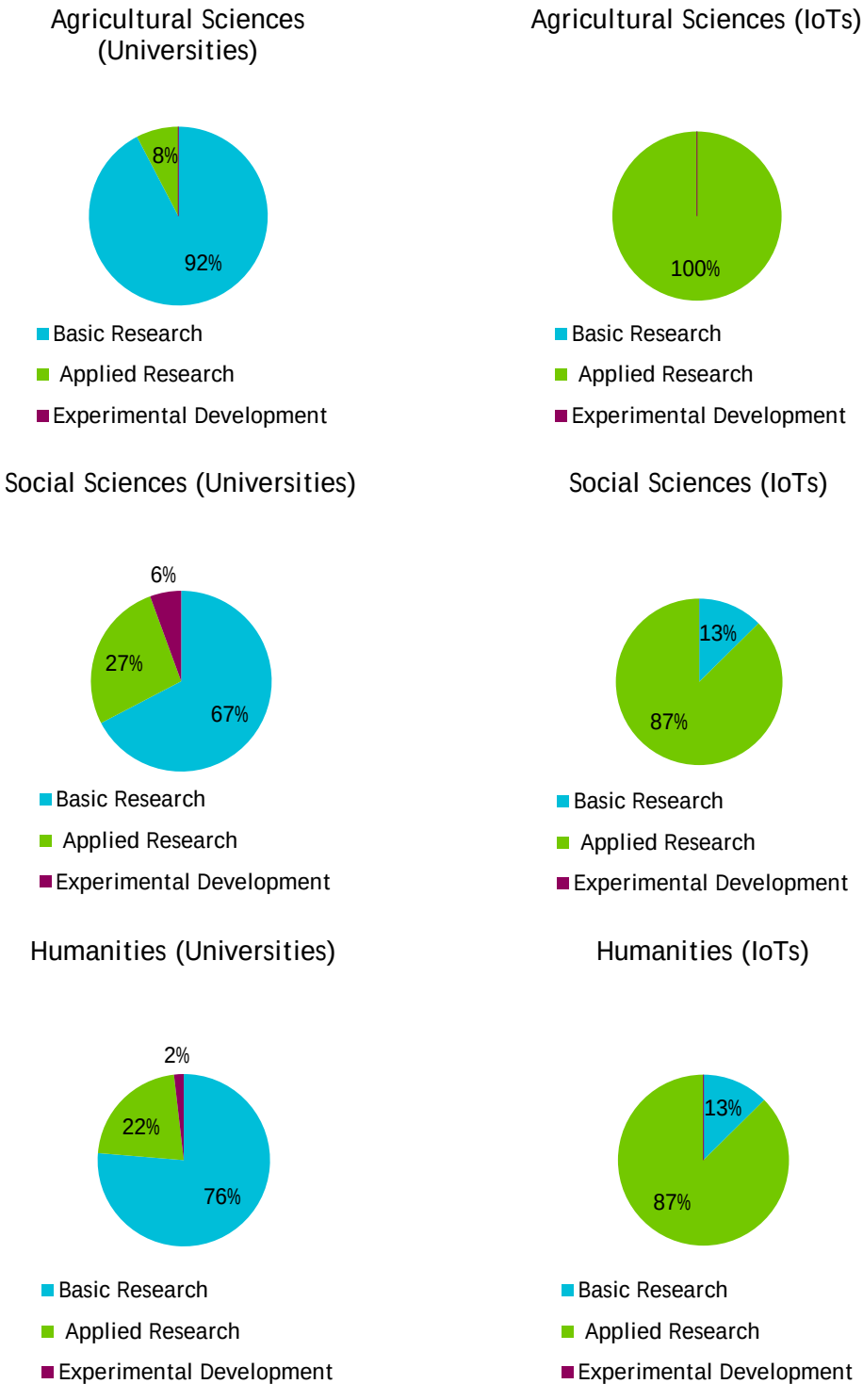
Source: Forfás HERD data

Figure 26 above clearly demonstrates the main focus of research for the universities is basic research (58 per cent) with the IoT's focusing on applied research (79 per cent). Both institutes allocated a small amount of funding for experimental development, with universities devoting 5 per cent and IoT's 1 per cent.

4 Categorisation of State Expenditure on R&D according to research type - Forfás

Figure 27: Type of research carried out by Field of Science, Universities and IoTs, 2010





Source: Forfás Data

Figure 24 above shows the percentage of the HERD budget by type of research and by field of science for universities and IoTs for 2010. Total HERD amounted to €626 million for the universities and the Royal College of Surgeons and to €82 million for the IOTs.

Basic research

Overall, the universities spent 58 percent of their R&D budget on basic research in 2010 and the equivalent figure was 20 per cent in the IoTs. In the universities all fields of science with the exception of engineering and technology allocated the majority (53 to 92 per cent) of the R&D budget to basic research in 2010.

- R&D spend on natural sciences in the universities amounted to €223 million in 2010 with €135 million (61 per cent) spent on basic research. In the IoTs the R&D spend amounted to €28 million with €8 million (29 per cent) spent on basic research
- R&D spend on social sciences in the universities amounted to €104 million with €70 million (67 per cent) spent on basic research. In the IoTs the R&D spend amounted to €22 million with €3 million (13 per cent) spent on basic research
- R&D spend on engineering and technology in the universities amounted to €134 million in 2010 with €57 million (43 per cent) spent on basic research. In the IoTs the R&D spend amounted to €29 million with €5 million (16 percent) spent on basic research

Applied research

The universities spent 36 percent of their R&D budget on applied research in 2010 compared with a 79 per cent share in the IoTs. In the IoTs all fields of science allocated the majority (69 to 100 per cent) of the R&D budget to applied research in 2010.

- For natural sciences, the R&D spend in the IoTs amounted to €28 million with €20 million (69 per cent) spent on applied research. In the universities the R&D spend amounted to €223 million in 2010 with €78 million (35 per cent) spent on applied research
- For engineering and technology, R&D spend in the IoTs amounted to €29 million with €24 million (82 per cent) spent on applied research. In the universities, R&D spend amounted to €134 million in 2010 with €65 million (49 per cent) spent on applied research
- For social sciences the R&D spend in the IoTs amounted to €22 million with €19 million (87 per cent) spent on applied research. R&D spend on social sciences in the universities amounted to €104 million in 2010 with €28 million (27 per cent) spent on applied research

Experimental research

Only small amounts of experimental research were undertaken by the universities (5 per cent) and less again in the Institutes of technology (1 per cent) with many fields not conducting any research in this area.

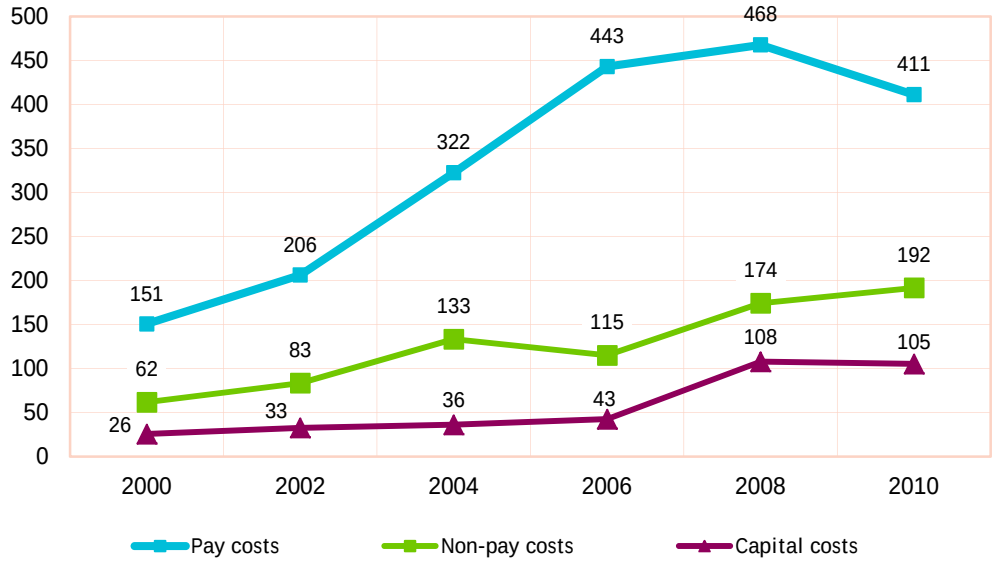
- In the universities, each field allocated a small amount of funding to experimental research in 2010, ranging from 8 per cent in engineering and technology to 2 per cent in the humanities in the universities
- In the IoTs only natural sciences and engineering and technology allocated 2 per cent of their respective budgets to experimental research

Chapter 6: Type of Costs

The type of research costs incurred by the universities and institutes of technology were examined in detail in the HERD survey. These research costs are broken into three types of costs as defined in the OECD Frascati Manual[5] as follows:

- Pay (or labour) costs ".. comprise annual wages and salaries and all associated costs or fringe benefits, such as bonus payments, holiday pay, contributions to pension funds and other social security payments, payroll taxes, etc."
- Non-pay (or other current) costs " ..comprise non-capital purchases of materials, supplies and equipment to support R&D performed by the statistical unit in a given year."
- "Capital expenditures are the annual gross expenditures on fixed assets used in the R&D programmes of statistical units." They are calculated by assessing how much of the capital asset is utilised for research purposes. For example, the institution will assess the percentage of a building's floor space utilised in undertaking research. If 10 per cent of the floor space is used for R&D, then 10 per cent of the building's value will be included in capital costs.

Figure 28: Distribution of research spend by type of costs, 2000-2010(€ million)



Source: Forfás Data

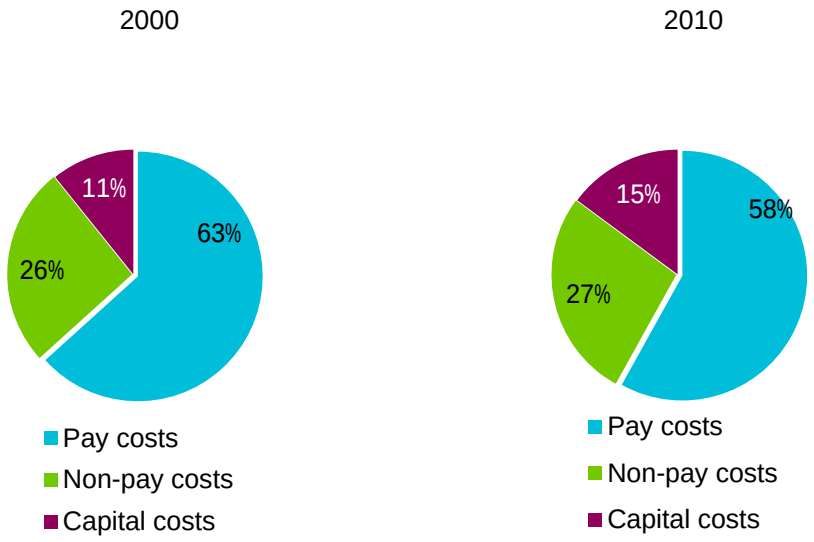
Figure 28 shows most R&D spending goes towards labour costs. In 2010 labour (or pay) costs amounted to €411 million, a decrease of 12 per cent over the 2008 figure of €468 million.

5 Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development - OECD 2002

Non-pay costs increased by 10 per cent from the 2008 figure of €174 million to €192 million in 2010. Non-pay costs have been increasing since 2006 rising from €115 million to €192 million in 2010.

Capital expenditure on R&D is usually focused on the acquisition of land, buildings and equipment. Capital expenditure has increased slowly year on year from a base of €26 million in 2000 to €43 million in 2006. Between 2006 and 2008 it more than doubled from €43 million to €108 million. In 2010 it decreased to €105 million, a small decrease of less than 3 per cent.

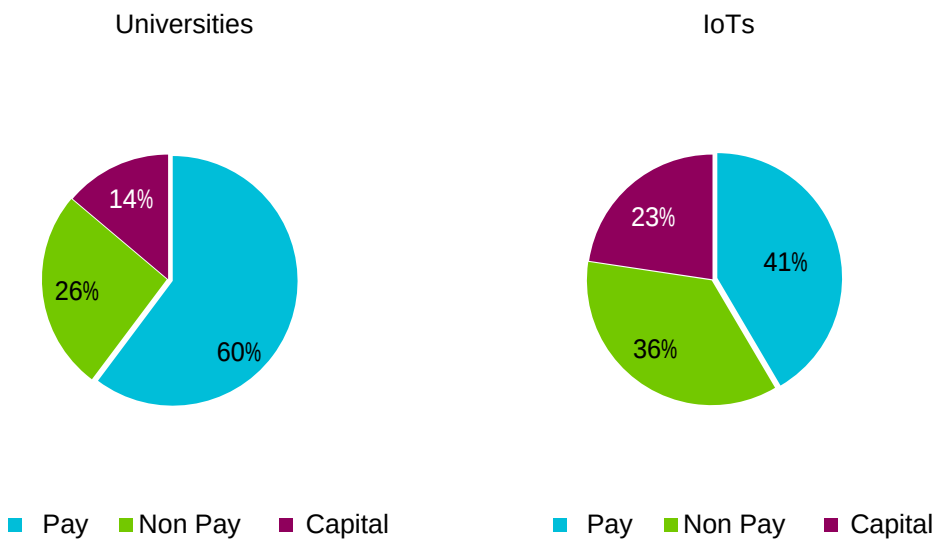
Figure 29: Percentage share of type of costs, 2000 and 2010



Source: Forfás Data

Figure 29 above shows the breakdown of expenditure by type of cost for 2000 and 2010. While pay costs account for the largest proportion of R&D expenditure by the universities and institutes of technology in both academic years, the proportions have shifted in the ten-year period. Pay costs have reduced from 63 per cent of the total in 2000 to 58 per cent of the total in 2010. Both non-pay and capital costs increased their percentage share from 26 per cent to 27 per cent for non-pay and from 11 per cent in 2006 to 15 per cent in 2010 for capital costs.

Figure 30: Percentage share of type of costs by Universities and IoTs, 2010



Source: Forfás Data

Figure 30 allows a more detailed examination of the three different types of costs broken down for universities and IoT's, with the universities spending a greater portion of their budget on pay (60 per cent) compared with 41 per cent for the IoT's

Table 5: Types of costs by new fields of science, 2010 (€ million)

	Pay Costs	% of Total	Non-pay Costs	% of Total	Capital Costs	% of Total	Total
Natural Sciences	132	53%	65	26%	54	21%	251
Engineering and Technology	84	52%	38	23%	41	25%	163
Medical and Health Sciences	76	63%	39	32%	6	5%	122
Agricultural Sciences	12	73%	4	25%	0	2%	16
Social Sciences	82	65%	40	32%	3	3%	125
Humanities	26	82%	5	16%	0	2%	31
Total	411	58%	192	27%	105	15%	708

Source: Forfás Data

As in previous years pay costs account not only for the largest proportion of the R&D costs generally, but within each field of science, without exception, pay costs account for the

largest percentage of the total R&D spend with percentages ranging from 82 per cent for humanities to 51 per cent for engineering and technology.

Pay costs in the field of natural sciences account for 53 per cent of total costs, non-pay costs account for 26 per cent and capital costs account for 21 per cent. The total costs in the field of engineering and technology can be divided between 51 per cent of the total for pay costs, 23 per cent for non-pay costs and 25 per cent for capital costs. Humanities pay costs account for 82 per cent of their total while non-pay costs and capital only account for 16 per cent and 2 per cent respectively of the total.

Agricultural science has the lowest expenditure on non-pay costs at €4 million, with no spending on capital costs in 2010. The total outlay accounts for €16 million or 2 per cent in total expenditure by field of science.

The fields of medical and health sciences spend 63 per cent of their total costs on pay, with 32 per cent on non-pay and 5 per cent on capital. Similarly a large proportion of expenditure in the social sciences area is taken up by pay costs (65 per cent), with non-pay costs accounting for 32 per cent of total social science expenditure and capital costs were 3 per cent.

Appendix 1: Methodology

The survey was carried out following the OECD Frascati Manual (2002) guidelines for estimating levels of research and development in the higher education sector and the results for Ireland are comparable to those from other OECD countries. Data captured in the survey relates to the 2008 academic year (Sep 2007 to Sep 2008).

There were two elements to this survey of research and development in higher education colleges:

1. An analysis of financial data from each institution;
2. An analysis of personnel data and time-use data based on the amount of research per person employed from each institution.

The coverage included all academic departments in seven universities*, fourteen institutes of technology** and the Royal College of Surgeons, Mary Immaculate College and St Patrick's College Drumcondra.

**Universities: Dublin City University, NUI Galway, NUI Maynooth, University College Cork, University College Dublin, University of Dublin (Trinity College) and University of Limerick.*

*** Institutes of Technology (IT): Athlone IT, Cork IT, Dublin IT, Dundalk IT, Dunlaoghaire Institute of Art, Design and Technology, Galway-Mayo IT, Letterkenny IT, Limerick IT, Waterford IT, IT Blanchardstown, IT Carlow, IT Sligo IT Tallaght and IT Tralee.*

Questionnaires were sent out at the end of October 2009 to the various colleges and institutes. There was intensive follow-up of non-respondents by telephone from mid-November 2009 until mid-February 2010 when final outstanding information was received. A full response rate was achieved for the financial and personnel parts of the survey.

Detailed departmental income and expenditure was obtained from the finance office in each university. Industrial liaison offices provided similar information for the institutes of technology.

This information comprised total capital and current expenditure from the colleges' block grant for all departments, from which a research proportion was derived, based on the amount of research-time reported by the respondents.

Research income for each department was provided by source of funds and types of costs.

Personnel Data

Detailed departmental headcounts were obtained from the personnel offices, categorised by research academic staff and research support staff. In order to calculate full-time equivalent totals the percentage of time spent on research was also obtained. In addition, the headcounts were split between male and female to allow gender comparisons.

Each academic department was also asked to estimate the time spent on research activities by each member of staff in his/her department. Strict guidelines and instructions were sent to each head of department outlining a single agreed methodology which identified comparable time spent on research activities. This methodology is as recommended by the international OECD Frascati Manual.

The following matrix was used to determine the percentage of time spent on research activities by people employed in the higher education sector.

The following activities are deemed as "research activities" for the purpose of this survey:	**The following activities are not deemed as "research activities" for the purpose of this survey:**
✓	X
Personal research	Teaching
Team research	General Admin
Writing research proposals	Supervision of non-PHD students
Writing research reports	Other non-research based activities
Supervision of PhD students	External activities
Other research based activities including admin and planning	

Appendix 2: Acronyms

EI	Enterprise Ireland
EU	European Union
FOS	Field of Science
FTE	Full-time equivalent (1 FTE = R&D 40 hours per week)
GDP	Gross Domestic Product
GNP	Gross National Product
HE	Higher Education
HEA	Higher Education Authority
HERD	Higher Education Expenditure on R&D
HRB	Health Research Board
IRCHSS	Irish Research Council for Humanities and Social Sciences
IRCSET	Irish Research Council for Science, Engineering and Technology
OECD	Organisation for Economic Co-operation and Development
PRTLI	Programme for Research in Third Level Institutes
R&D	Research and Development
SFI	Science Foundation Ireland

Appendix 3: Detailed Fields of Science Tables

Appendix table 1: Total HERD expenditure by old and new Fields of Science, 2010 (€ millions)

	New - Fields of Science	€m.
Natural Sciences	Mathematics	14.3
	Computer and information sciences	89.0
	Physical sciences	25.9
	Chemical sciences	30.0
	Earth and related environmental sciences	32.6
	Biological sciences	55.3
	Other natural sciences	3.9
		251.0
Engineering and Technology	Civil engineering	12.4
	Electrical, electronic and information engineering	63.5
	Mechanical engineering	8.7
	Chemical engineering	0.3
	Materials engineering	3.2
	Medical engineering	0.9
	Environmental engineering	12.9
	Environmental biotechnology	6.5
	Industrial biotechnology	11.7
	Nano-technology	30.6
	Other engineering and technologies	11.7
		162.5
Medical and Health Sciences	Basic medicine	63.5
	Clinical medicine	26.7

	Health sciences	24.9
	Health biotechnology	0.0
	Other medical sciences	6.8
		121.8
Agricultural Sciences	Agriculture, forestry and fisheries	0.5
	Animal and dairy science	15.7
	Veterinary science	
	Agricultural biotechnology	
	Other agricultural sciences	0.0
		16.2
Social Sciences	Psychology	7.9
	Economics and business	31.6
	Educational sciences	54.1
	Sociology	7.6
	Law	6.4
	Political science	4.8
	Social and economic geography	5.0
	Media and communications	4.2
	Other social sciences	3.7
		125.3
Humanities	History and archaeology	6.5
	Languages and literature	14.1
	Philosophy, ethics and religion	2.3
	Art (arts, history of arts, performing arts, music)	5.1
	Other humanities	3.5
		31.5
HERD		**708.3**

Appendix 4: Forfás Board Members

Eoin O'Driscoll (Chairman) Chairman, Southwestern
Martin Shanahan Chief Executive, Forfás
Mark Ferguson Director General, Science Foundation Ireland
John Murphy Secretary General, Department of Jobs, Enterprise and Innovation
Barry O'Leary Chief Executive, IDA Ireland
Frank Ryan Chief Executive Officer, Enterprise Ireland
Michael O'Leary Secretary to the Board, Forfás

Appendix 5: Recent Forfás publications

Addressing Future Demand for High Level ICT Skills **EGFSN, Forfás**	November 2013
State Investment in Research and Development 2011-2012 **Forfás**	August 2013
Business Expenditure on Research and Development (BERD) 2011-2012 **Forfás, CSO**	August 2013
Social Enterprise in Ireland – Sectoral Opportunities and Policy Issues Forfás	July 2013
Ireland's Construction Sector – Outlook and Strategic Plan to 2015 Forfás	July 2013
Forfás Annual Report Forfás	July 2013
Research Prioritisation: Framework for Monitoring Public Investment in Science, Technology and Innovation and 14 Action Plans DJEI	July 2013
National Skills Bulletin 2013 EGFSN	July 2013
Monitoring Ireland's Skills Supply: Trends in Education and Training Outputs 2013 EGFSN	July 2013
Annual Business Survey of Economic Impact 2011 Forfás	July 2013
Global Entrepreneurship Monitor 2012 Global Entrepreneurship Monitor	July 2013
Annual Employment Survey Forfás	July 2013

Ireland's Competitiveness Performance 2013 Forfás	May 2013
Making It In Ireland: Manufacturing 2020 Forfás	April 2013
Future Skills Needs of the Manufacturing Sector to 2020 EGFSN	April 2013
Sectoral Regulation Forfás	April 2013
EGFSN Statement of Activity EGFSN	March 2013
Costs of Doing Business in Ireland 2012 Forfás	March 2013
Vacancy Overview 2012 EGFSN	February 2013
Action Plan for Jobs 2013 Forfás, DJEI	February 2013
A Review of the Equity Investment Landscape In Ireland Forfás	January 2013
Regional Labour Markets Bulletin 2012 EGFSN	January 2013
A Review and Audit of Licenses Across Key Sectors of the Irish Economy Forfás	December 2012
Global Entrepreneurship Monitor (GEM) 2011 Global Entrepreneurship Monitor	September 2012
Annual Employment Survey 2011 Forfás	August 2012
National Skills Bulletin 2012 NCC	July 2012

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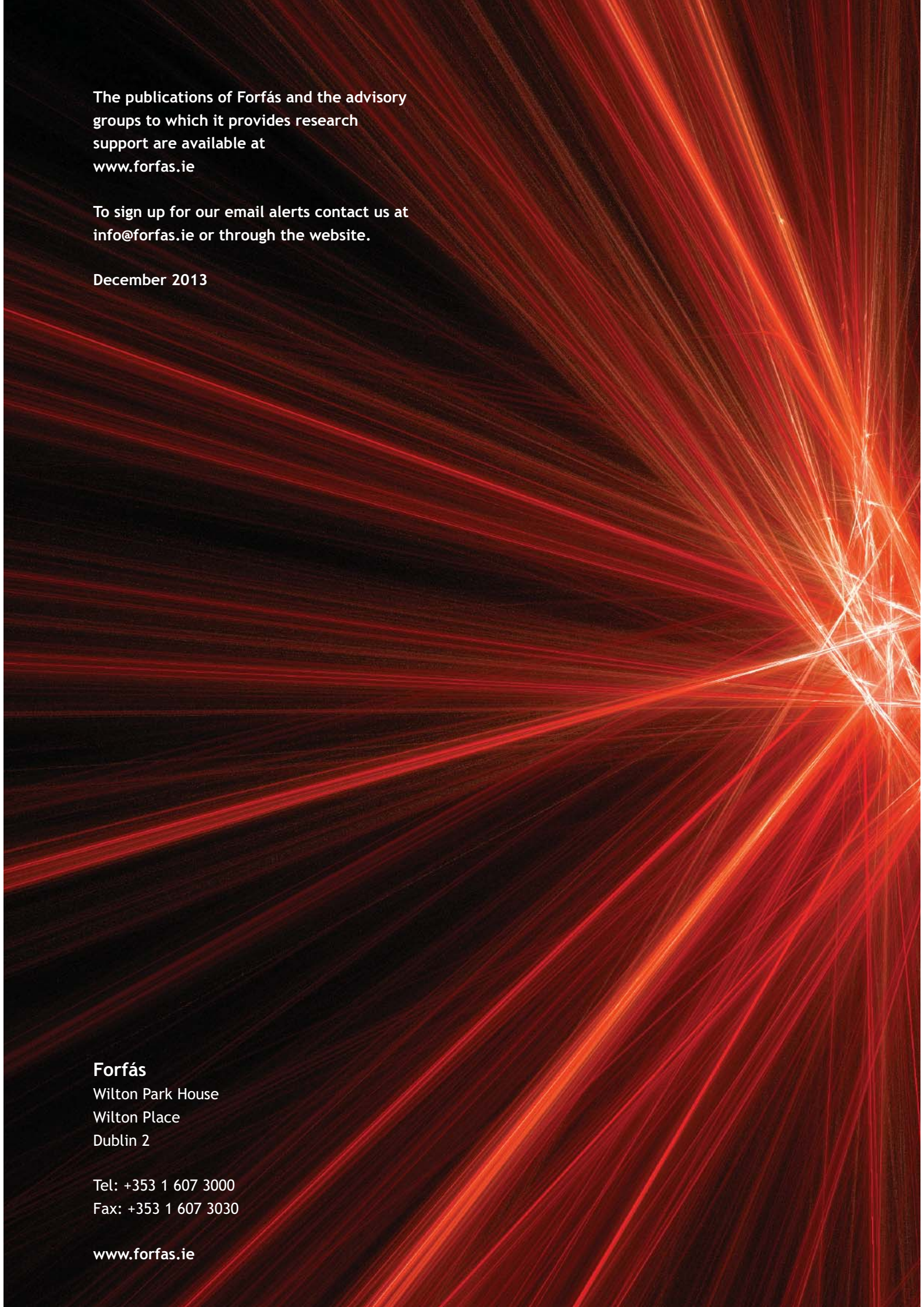

The publications of Forfás and the advisory groups to which it provides research support are available at www.forfas.ie

To sign up for our email alerts contact us at info@forfas.ie or through the website.

December 2013

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