Business Expenditure on Research and Development (BERD) 2011/2012

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Executive Summary

The biennial Business Expenditure on Research and Development (BERD) Survey 2011/2012 is jointly conducted by the Central Statistics Office (CSO) and Forfás and the most recent data was released by the CSO on 19 February 2013. This survey examines R&D activities performed across the business sector in 2011. The key findings include:

Aggregate levels of BERD (2011)

- Enterprises across all business sectors in Ireland spent €1.86 billion on in-house research and development (R&D) activities in 2011, a 1.3 per cent increase on 2010. Enterprises active in R&D in 2011 estimated an R&D spend of 1.96 billion in 2012, an increase of 5.5 per cent.
- Business R&D intensity (BERD as a percentage of GDP) reached 1.17 per cent in 2011 (1.46 per cent of GNP). Finland had the highest BERD intensity in the EU with 2.67 per cent of GDP.
- Foreign owned enterprises accounted for 71 per cent of the total business R&D spend in 2011.
- The vast majority of expenditure on R&D by businesses (86 per cent) in 2011 was current expenditure (wages of R&D staff etc.) and 14 per cent on capital expenditure (e.g. buildings, equipment, licence payments etc.)
- 61 per cent of BERD was generated in the services sector in 2011.
- Medium and large enterprises (more than 50 employees) accounted for almost three-quarters of BERD in 2011.
- 89 per cent of BERD funding was from company funds in 2011, down from 92 per cent in 2009.

Human resources in R&D (2011)

- There were over 19,000 research personnel in the business sector, a 21 per cent increase since 2009 and more than 14,000 full time equivalents (FTEs).
- More than half of R&D personnel (headcount) were employed in foreign owned firms.
- The majority of R&D personnel (63 per cent) were employed in the services sector.
- Medium to large companies employed two thirds of all research personnel.
- There were 10,618 researchers or 8,996 FTEs employed in the business sector.
- Of total researchers in the business sector, 22 per cent were female. Iceland had the highest proportion of female researchers in the business sector at 32 per cent.
- 15 per cent of all business sector researchers held a PhD qualification.

Number of R&D performing firms (2011)

- The number of R&D performing firms increased by 25 per cent from 2009 to 2011 to over 1,600 and almost three quarter were Irish owned.
- Of firms engaged in R&D activities, 58 per cent were in the services sector and 42 per cent in manufacturing.
- Small firms with less than 50 employees accounted for 69 per cent of all R&D active firms.
- More than 72 per cent of all R&D performing enterprises spent less than €500k on R&D activities and one in ten enterprises were engaged in large scale R&D activities (spending in excess of €2 million)
- Half of foreign-owned firms engaged in mid to large scale R&D (in excess of 500k) compared with 19 per cent of Irish firms
- Almost half of medium to large sized firms engaged in mid to large scale R&D activities compared with 18 per cent of small firms
- In both the manufacturing and services sectors, 27 per cent of firms were engaged in mid to large scale R&D activities

Type of research (2011)

- R&D expenditure was mostly concentrated in experimental development, accounting for 71 per cent of all expenditure.
- Nearly two-thirds of Irish enterprises were engaged in experimental development compared to three-quarters of foreign owned companies.
- Small enterprises were more likely to engage in applied research (28 per cent) than medium and large enterprises (23 per cent).

Collaboration

- Of all R&D performing firms, 35 per cent engaged in joint research projects with other parties in 2011.
- 40 per cent of medium to large firms engaged in collaborative research projects compared with 33 per cent of small firms. Of all collaboration partners, both small and medium/ large firms were most likely to collaborate with Higher Education Institutes (HEIs) in Ireland.
- Foreign owned firms were more likely than Irish firms to collaborate with research partners, with 44 per cent and 32 per cent respectively engaged. Foreign owned firms were most likely to collaborate with other firms outside Ireland, and Irish firms with HEIs in Ireland.
- The most likely collaboration partner for all firms was HEIs in Ireland, rather than HEIs outside of Ireland or collaborations with other firms either within or outside Ireland.

Caveats

- The survey of expenditure on research and development in the business sector (BERD) has been conducted by the CSO since 2007 and prior to that Forfás conducted the survey. Methodological changes were introduced in the BERD 2007/2008 survey and as a result comparisons between the Forfás and CSO surveys should be treated with caution, this is especially the case with detailed sectoral comparisons as there are sectoral differences in the CSO business register when compared with the Forfás business register.

- Another factor to allow for is when aggregating the subsectors up to total manufacturing and total services, pre 2007 Forfás included the following 2 sectors under manufacturing whereas the CSO include them under services:
  - Agriculture, Forestry, Fishing, Mining and Quarrying
  - Electricity, gas supply, water supply, sewerage, waste management and remediation; construction

- BERD 2009/2010 uses the NACE Rev. 2 classification and BERD 2003 - 2007 uses the NACE Rev 1.1 classification.

- The register of likely performers of research and development also changes between surveys.

- To differentiate between the surveys conducted by the CSO and those conducted by Forfás, Forfás survey data is represented in the following charts by a perforated line.

If you require further information about this survey please contact:

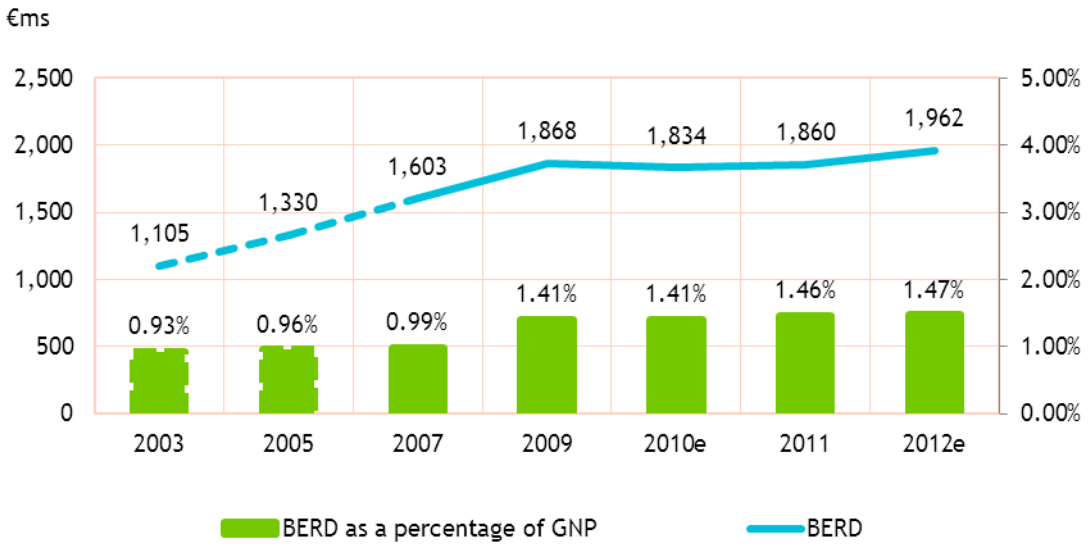
Helena Connellan
Survey Unit
Forfás
Wilton Park House
Wilton Place
Dublin 2
Ireland
Tel: +353-1-607 3018
www.forfas.ie

1. Business Expenditure on Research and Development, 2011/2012

Aggregate levels of BERD in Ireland, 2003-2011

Figure 1 presents details of aggregate levels of R&D expenditure by enterprises in Ireland between 2003 and 2011 and an estimate for 2012, 2010 is also an estimate as BERD is a biennial survey which collects the outturn for the odd year and an estimate for the even year. Enterprises in Ireland spent €1.86 billion on in-house research and development in 2011 and an estimated spend of €1.96 billion in 2012, a 5.5 per cent increase. BERD has remained static over the period 2009-2011 with an average annual growth rate -0.24 per cent compared with growth rate of 9.15 per cent per annum between 2003 and 2009.

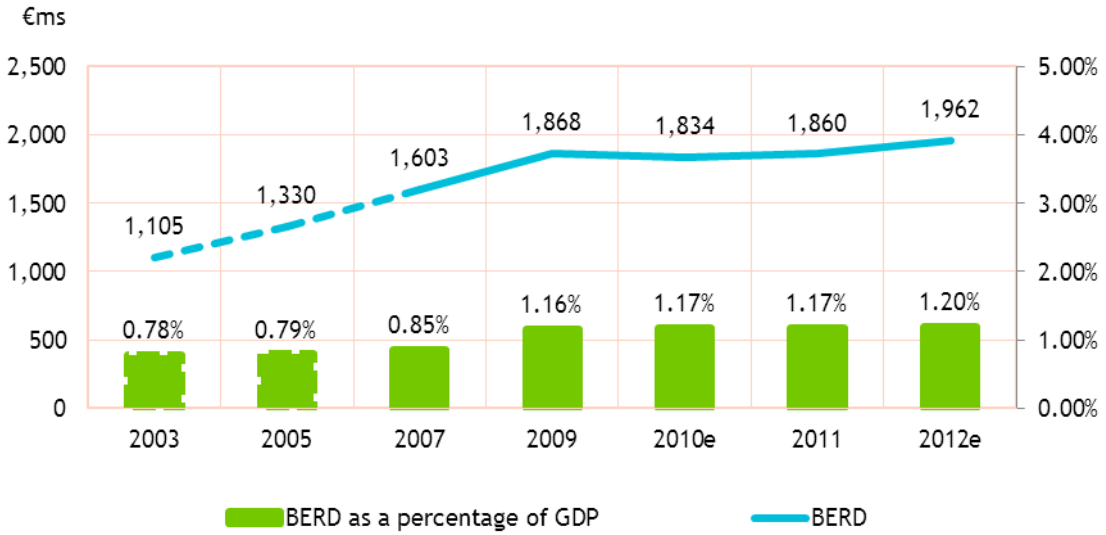
Figure 1: Trend in BERD and BERD as a percentage of GNP, 2003-2012



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 1 also details the BERD intensity or relative importance of BERD to the national economy between 2003 and 2012. For Ireland, two measures of economic activity are employed, GNP and GDP. GDP for Ireland is inflated by the inclusion of profits of inter-firm activities of multinational firms but GNP excludes these profits giving a truer measure of economic activity. BERD as a percentage of GNP has increased from 0.93 per cent in 2003 to 1.46 per cent in 2011 and is estimated to reach 1.47 per cent in 2012. The increase in BERD intensity from 2009 to 2011 is entirely due to a fall in GNP as BERD remained unchanged during that period.

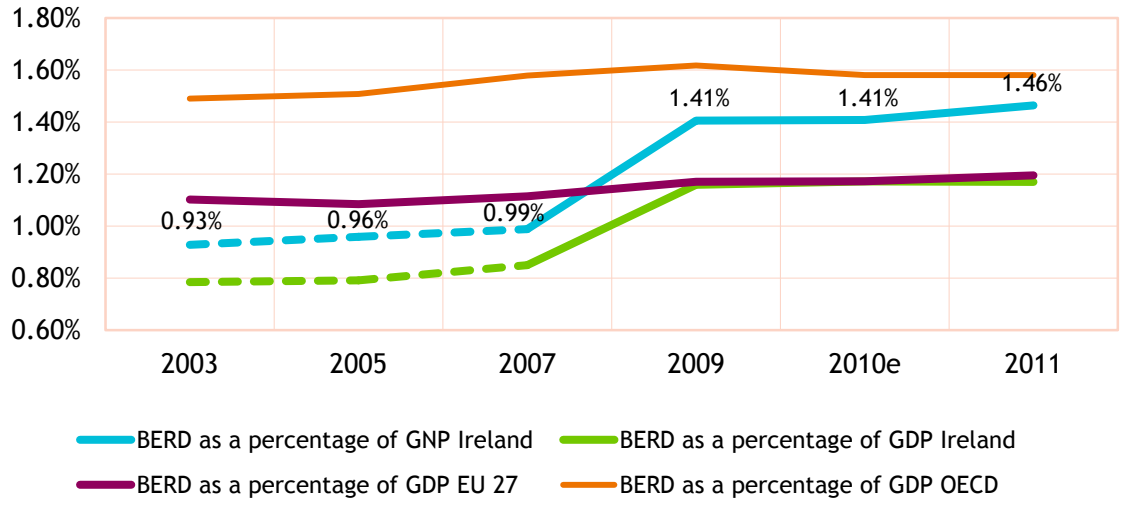
Figure 2: Trend in BERD and BERD as a percentage of GDP, 2003-2012



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 2 shows BERD intensity using GDP as the denominator. The higher GDP figure yields a lower BERD intensity which increased from 0.78 per cent in 2003 to an estimated 1.20 per cent in 2012.

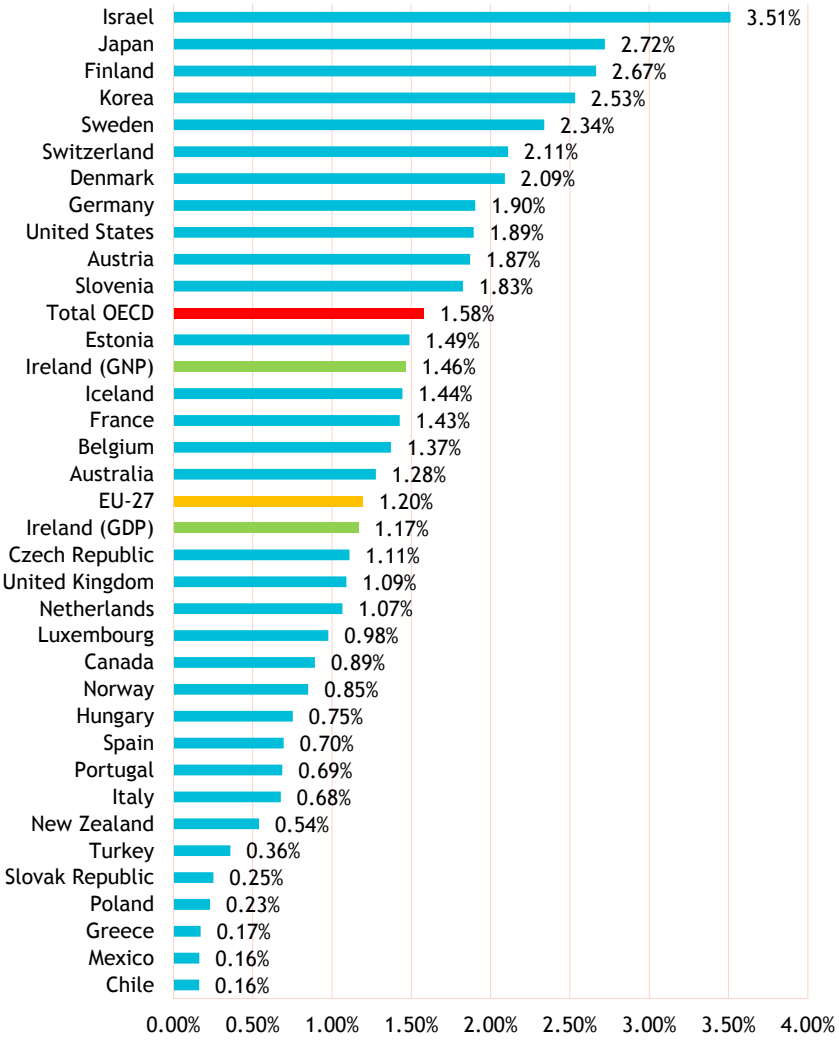
Figure 3: BERD intensity for Ireland, EU and OECD, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys, OECD MSTI 2012-2

Figure 3 shows Ireland's performance on BERD intensity relative to the EU 27 and OECD averages. In 2009, BERD as a percentage of GNP for Ireland at 1.41 per cent surpassed the EU 27 average of 1.17 per cent. In 2011, BERD as a percentage of GNP reached 1.46 per cent, above the EU 27 average of 1.2 per cent and below the OECD average of 1.58 per cent.

Figure 4: International comparisons of BERD intensity, 2011[1]

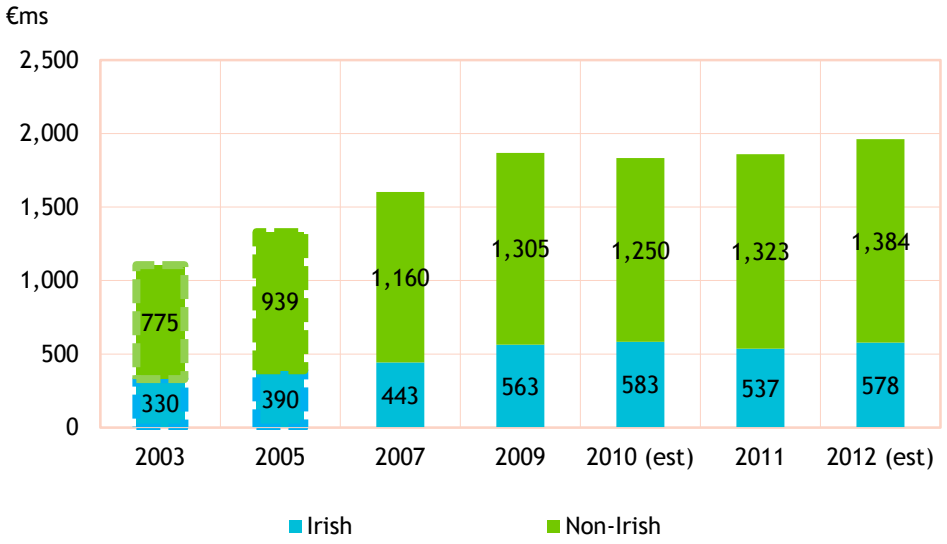


Source: CSO databank, OECD MSTI 2012-2

Figure 4 shows Ireland's BERD intensity performance relative to other OECD countries. Israel had the highest BERD intensity in 2011 at 3.51 per cent, followed by Japan at 2.72 per cent and Finland at 2.67 per cent. Ireland's BERD intensity (when taken as a percentage of GNP) at 1.46 per cent was significantly above the EU 27 average and below the OECD average of 1.58 per cent.

[1] Where data for 2011 was unavailable the next closest year was used

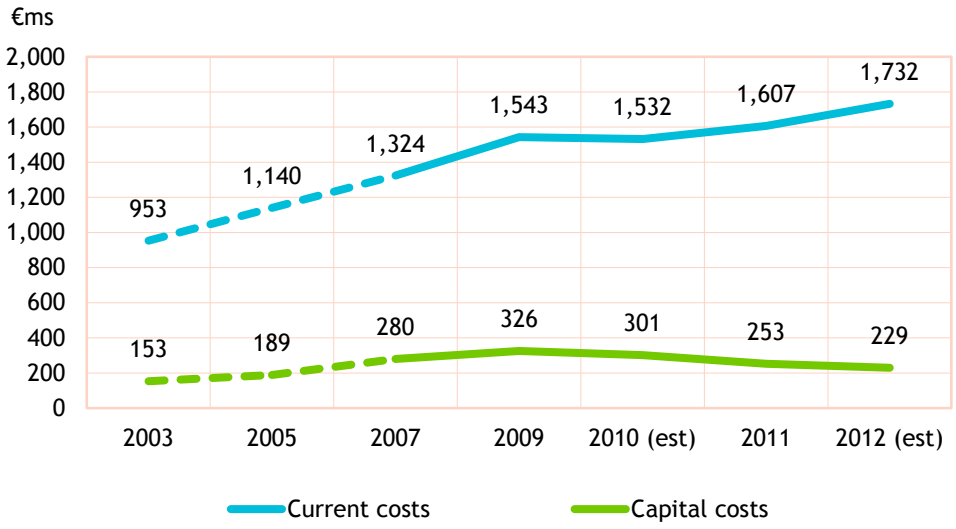
Figure 5: Irish and foreign BERD, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005

Figure 5 shows business spending on R&D by ownership between 2003 and 2011. Foreign companies account for the majority of total BERD with a fairly constant 70 per cent share over the period and reaching €1.32 billion in 2011. Irish BERD increased to €537 million in 2011 from €330 million in 2003, an increase of 75 per cent.

Figure 6: Current and capital expenditure on R&D, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Current expenditure on R&D amounted to €1.6 billion in 2011 accounting for 86 per cent of total BERD. Current expenditure increased by 5 per cent over 2010 and by 69 per cent since

2003 as shown in Figure 6. Capital BERD expenditure totalled €253 million in 2011 falling from a peak of €326 million in 2009 and is expected to decline to €229 million in 2012.

Table 1: Total BERD by NACE Industrial sector, 2009-2011

Sector	2009 (€m)	2011 (€m)
Agriculture, forestry, fishing mining and quarrying (A-B)	3.6	3.6
Manufacturing (C)	743.3	718.5
Electricity, gas supply Water supply, sewerage, waste management and remediation Construction (D-F)	4.6	19.0
Wholesale and retail trade repair of motor vehicles and motorcycles transport and storage (G - H)	166.6	178.6
All other service activities (I, O - U)	7.9	9.6
Information and communication services (J)	487.9	571.2
Financial and insurance activities (K)	157.5	47.6
Real estate Professional, scientific and technical activities (L - M)	291.0	292.5
Administrative and support service activities (N)	6.0	19.0
Total BERD (05 to 99)	1,868.5	1,859.6

Source: CSO databank

Table 1 shows the breakdown of expenditure on R&D performed in the business sector in 2009 and 2011. Expenditure on R&D in the manufacturing sector decreased by €24.8 million (-3.3 per cent) in 2011.

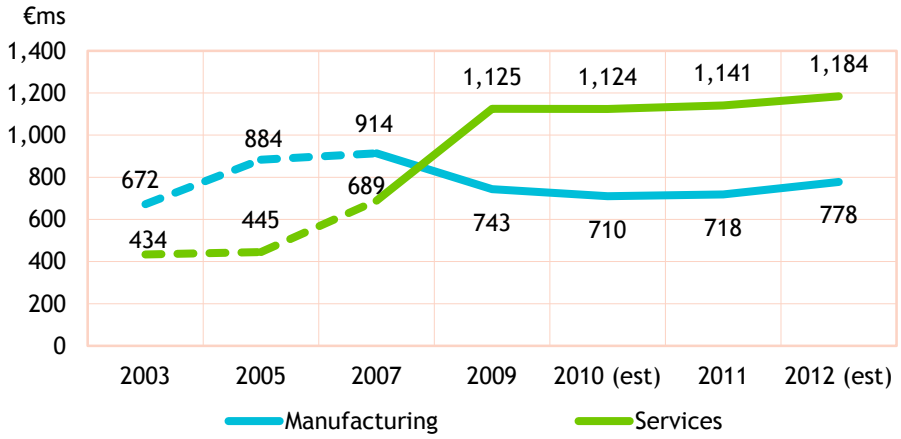
Electricity, gas supply, water supply, sewerage, waste management and remediation and construction increased expenditure by €14.5 million, more than quadrupling the spending on R&D since 2009.

R&D expenditure in the services sector increased by 15.9 million (1.4 per cent) over 2009. The following sectors had significant increases in R&D expenditure in 2011:

- Information and communication services - €83.3 million (17.1 per cent)
- Administrative and support service activities had an increased spend of €13 million, tripling the R&D spend in the sector since 2009

Offsetting these increases in R&D expenditure was a significant decrease of €110 million (-70 per cent) in the Financial Services sector in 2011.

Figure 7: Manufacturing and Services BERD, 2003-2011

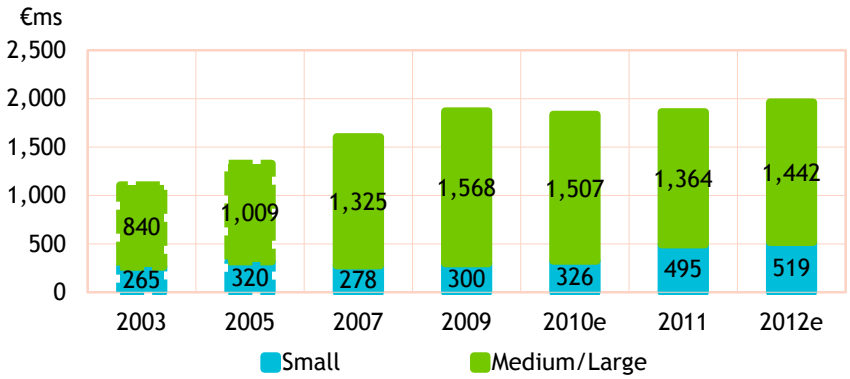


Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 7 highlights the shift from a manufacturing to service economy between 2003 and 2011 in expenditure on R&D. Expenditure on R&D in services increased from €434 million in 2003 to €1.14 billion in 2011, an increase of 163 per cent compared with a 7 per cent increase in manufacturing over the period. Of total BERD in 2011, 61 per cent was generated in the services sector, a complete reversal since 2003 when 61 per cent of BERD was generated in the manufacturing sector. Methodological changes were introduced in the BERD 2007/2008 survey and as a result comparisons between the Forfás and CSO surveys should be treated with caution, this is especially the case with detailed sectoral comparisons as there are sectoral differences in the CSO business register when compared with the Forfás business register. Also, when aggregating the subsectors up to total manufacturing and total services, pre 2007 Forfás included the following 2 sectors under manufacturing whereas the CSO include them under services:

- Agriculture, Forestry, Fishing, Mining and Quarrying; and
- Electricity, gas supply, water supply, sewerage, waste management and remediation,construction.

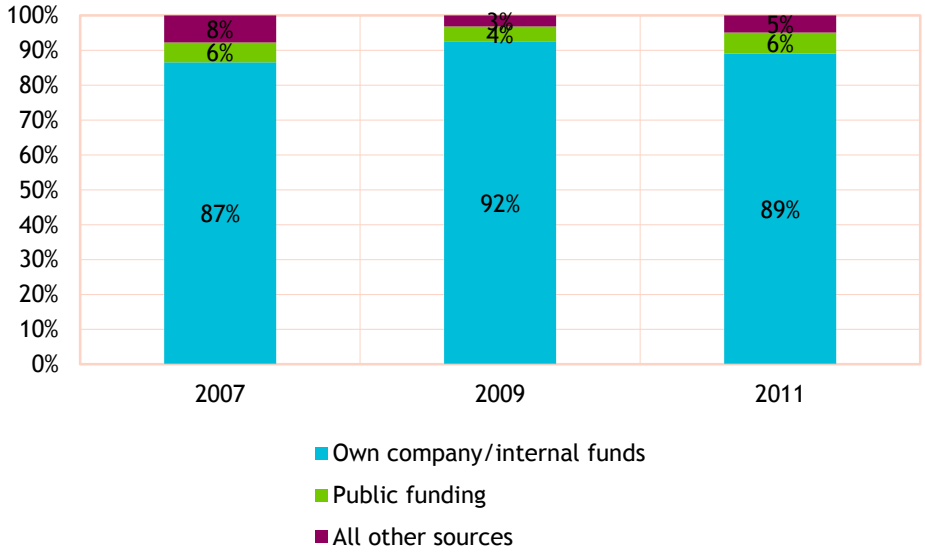
Figure 8: BERD by firm size, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 8 shows BERD by size of firm, with medium/large firms with 50+ employees holding the majority share between 2003 and 2011. Medium/large firms made up almost three quarters of BERD at €1.4 billion in 2011. However, the share of total BERD accounted for by small firms (less than 50 employees) increased from 24 per cent in 2003 to 27 per cent in 2011. Small firms almost doubled BERD expenditure between 2007 and 2011, from €278 million to €519 million.

Figure 9: BERD by funding sources, 2007-2011



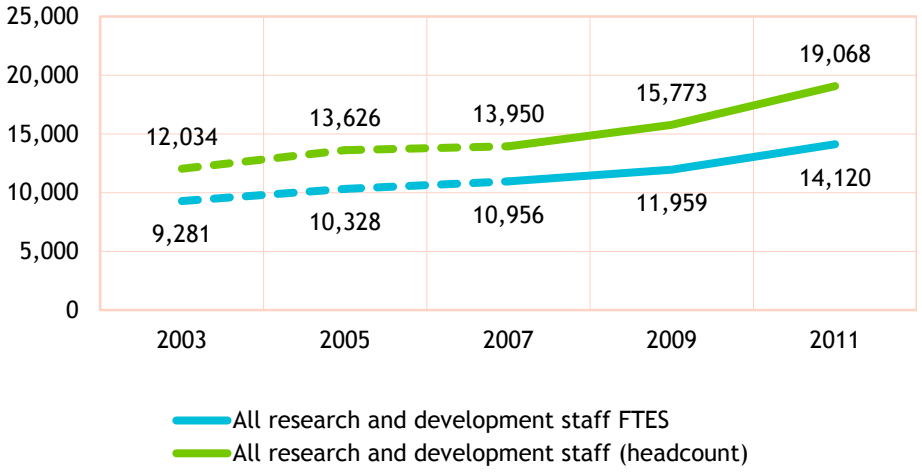
Source: CSO databank

Figure 9 shows that the bulk of funding for R&D performed in the business sector comes from company funds accounting for 89 per cent of total BERD in 2011 and down from a 92 per cent share in 2009. The residual share of funding comes from public funds, funding from higher education institutes, private non-profit institutes and other sources.

2. Human Resources in Research & Development

This section focuses on personnel in R&D in the business sector between 2003 and 2011. R&D personnel includes researchers (PhD qualified and other) technicians and all other R&D support staff.

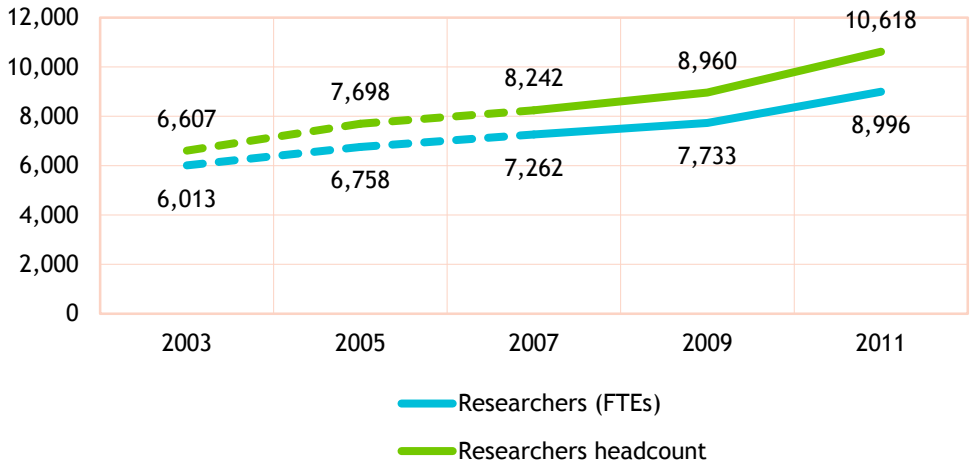
Figure 10: Total research personnel (headcount and FTEs), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 10 shows that over 19,000 employees or 14,000 on a full time equivalent (FTE) basis were engaged in R&D in 2011. Personnel engaged in R&D increased by 3,295 (a 21 per cent increase) since 2009 and by 7,034 employees over the decade.

Figure 11: Total researchers (headcount and FTEs), 2003-2011



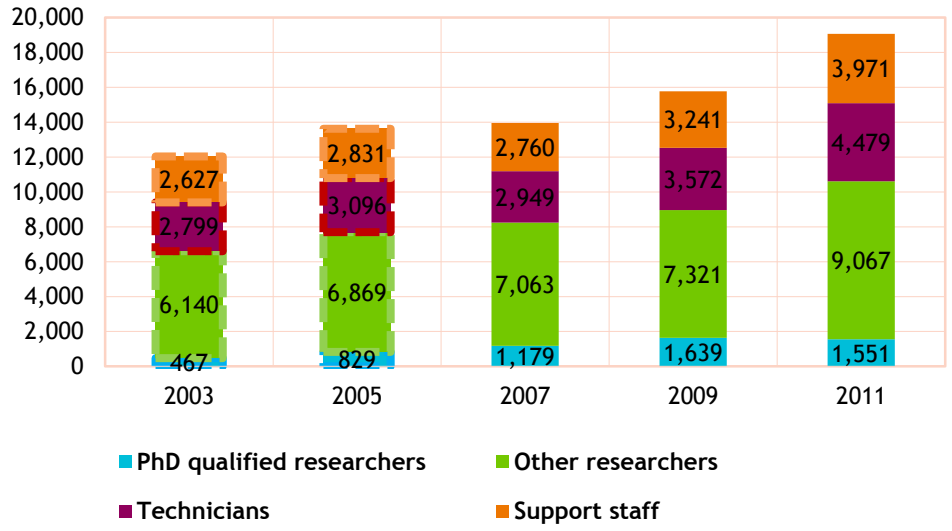
Source: CSO databank, Forfás BERD 2003 and 2005 surveys

The number of researchers employed in businesses in Ireland increased from 8,960 in 2009 to 10,618 in 2011. Since 2003 an extra 4,011 researchers were employed in the business sector. There were 8,996 FTEs employed in the business sector in 2011, an increase of 50 per cent since 2003.

Figure 12 shows research personnel in the business sector by occupation. The following staff increases were observed between 2003 and 2011:

- the number of PhD qualified researchers increased more than threefold from 467 to 1,551
- other researchers increased from 6,140 to 9,067, a 48 per cent increase
- the number of research technicians employed increased by 60 per cent from 2,799 to 4,479
- R&D support staff increased by 51 per cent from 2,627 to 3,971 in 2011

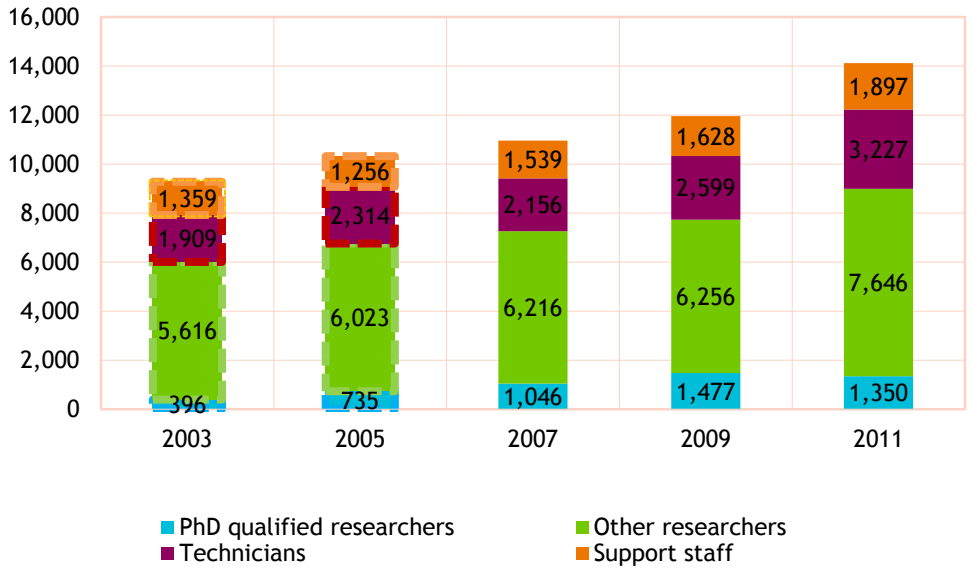
Figure 12: Research personnel by occupation (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 13 shows the same classification as above in FTE terms. Comparing 2011 data from Figure 12 and 13 shows the occupations spending most of their time on R&D (as determined by FTEs divided by headcount) are PhD researchers (87 per cent), other researchers (84 per cent), technicians (72 per cent) and support staff (48 per cent)

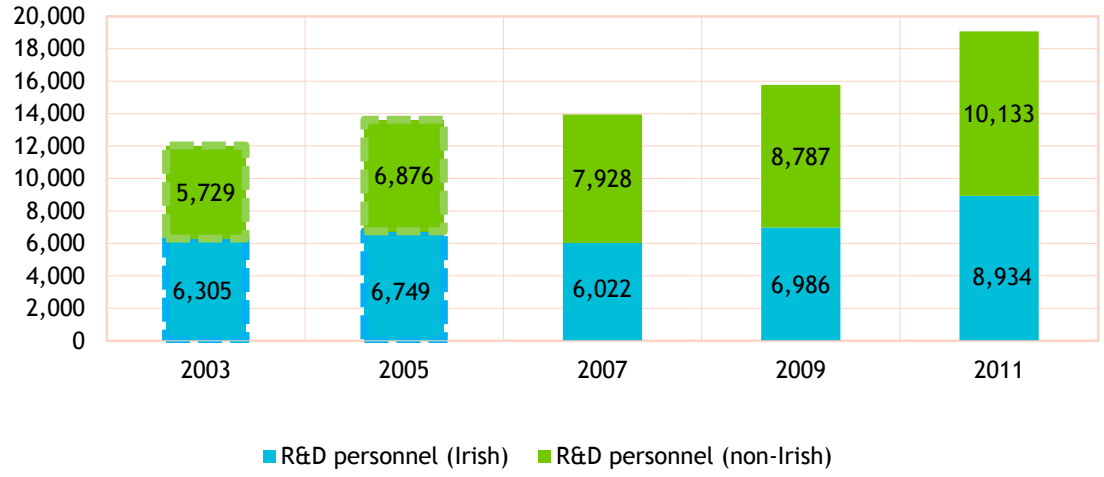
Figure 13: Research personnel by occupation (FTEs), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

More than half (53 per cent) of R&D personnel were employed in foreign owned firms in 2011, a reversal of the situation in 2003 when 52 per cent were employed in Irish firms as shown in figure 14 below. Research personnel in foreign firms increased from 5,729 in 2003 to 10,133 in 2011, a 77 per cent increase and Irish firms saw an increase of 42 per cent, from 6,305 to 8,934 research personnel respectively.

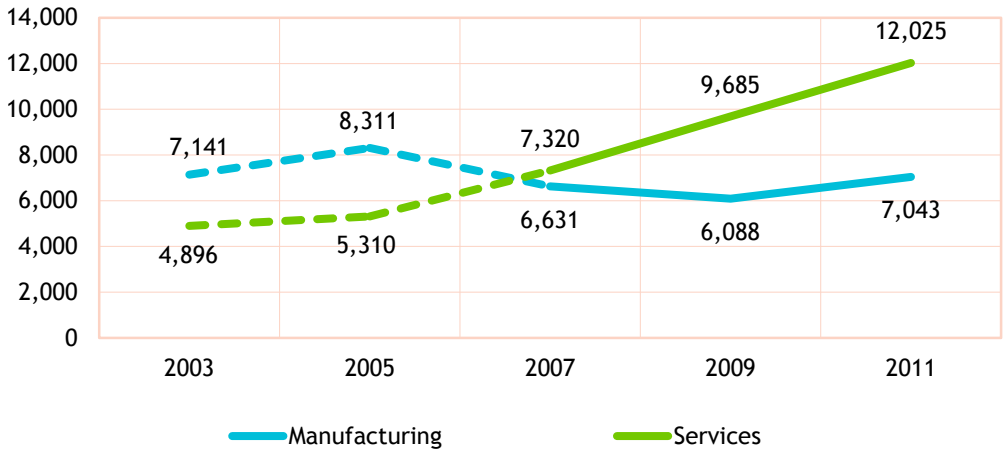
Figure 14: Research personnel by ownership (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 15 below mirrors figure 7 which related to R&D expenditure by sector. As with R&D expenditure, the majority (63 per cent) of R&D personnel resides in the services sector in 2011, a complete turnaround from the situation in 2003 when 59 per cent of R&D personnel were employed in manufacturing. As detailed in the caveats section, sectoral comparisons between pre-2007 and post-2007 surveys should be treated with caution due to methodological changes that were introduced in 2007.

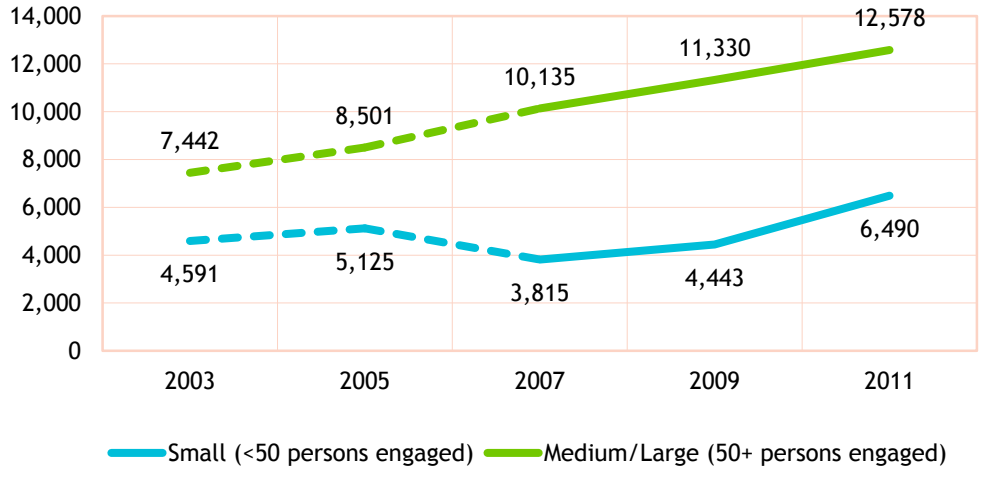
Figure 15: Research personnel employed by sector (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

As with expenditure, medium/large firms employ the majority of R&D personnel, accounting for two thirds of all R&D personnel in 2011 and up from a 62 per cent share in 2003 as shown in Figure 16.

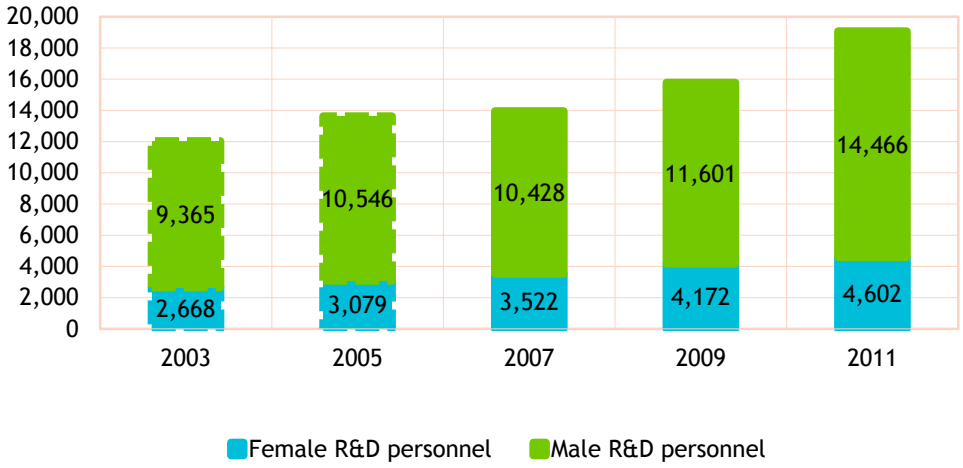
Figure 16: Research personnel employed by firm size (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 17 shows R&D personnel over the decade classified by gender. Over three-quarters of all R&D staff were male in 2011. Female R&D personnel accounted for 22 per cent of the total in 2003 and the proportion had slightly increased to 24 per cent in 2011. In absolute terms, there was an increase of 1,934 female R&D personnel since 2003 compared with an increase of 5,101 male personnel over the period.

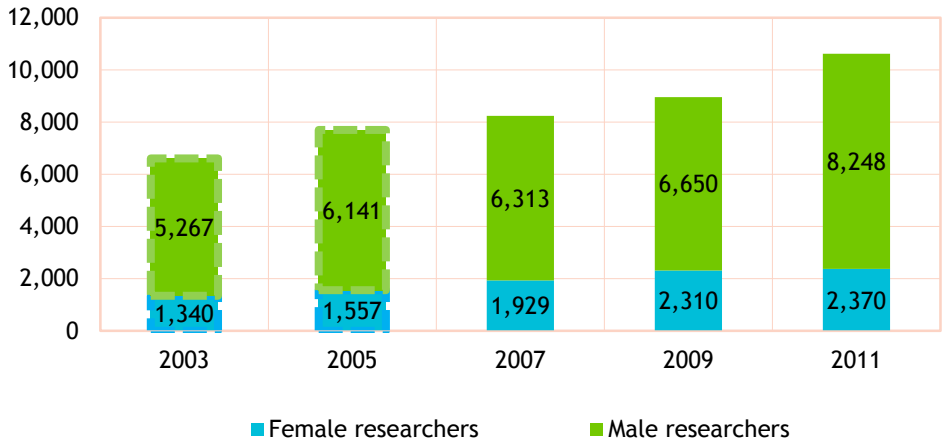
Figure 17: Research personnel employed by gender (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 18 shows researchers in the business sector categorised by gender. An additional 1,030 female researchers are employed in the sector since 2003. In 2011, 2,370 female researchers were employed accounting for 22.3 per cent of total researchers in the business sector. This compares with 1,340 female researchers in 2003, a 20.3 per cent share.

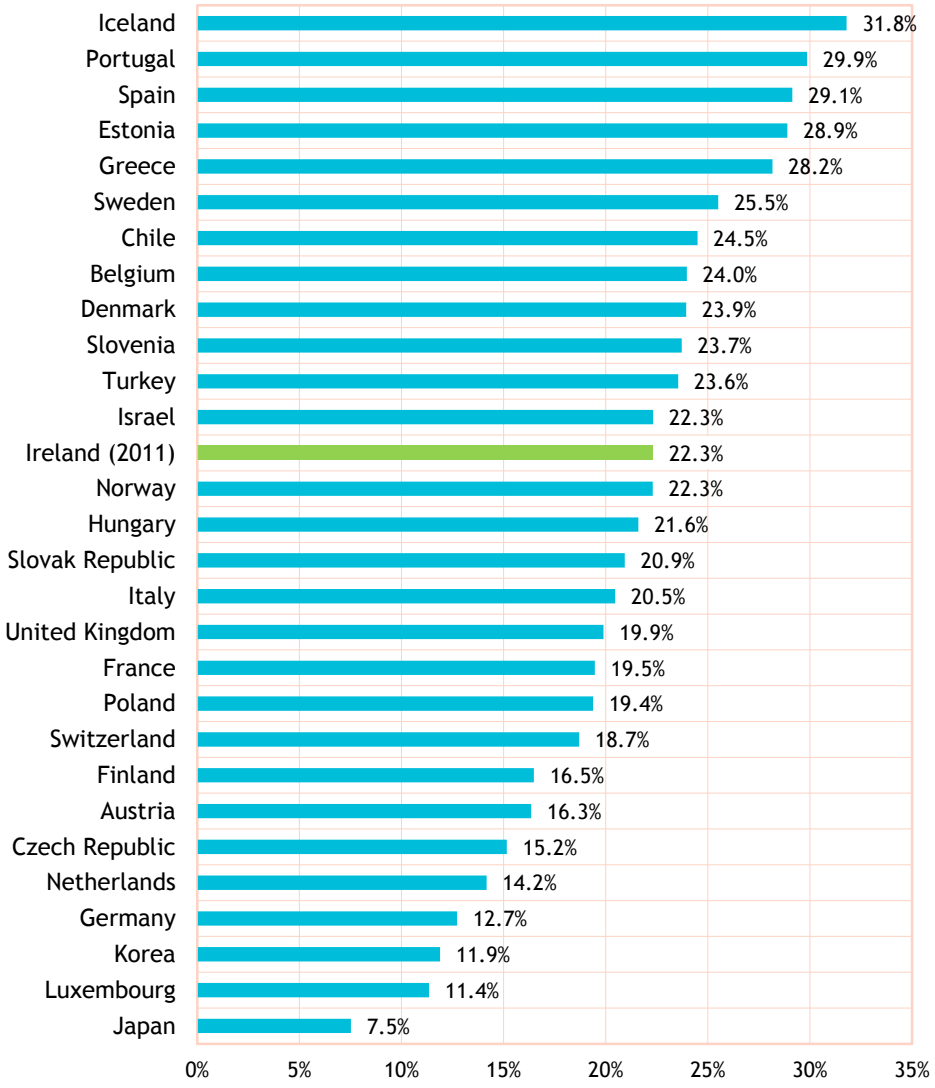
Figure 18: Researchers employed by gender (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 19 shows how Ireland compares internationally in terms of the share of female researchers employed in the business sector. Iceland had the highest share of female researchers at 31.8 per cent.

Figure 19: International comparison of female researchers as a percentage of total researchers in the business sector, 2010



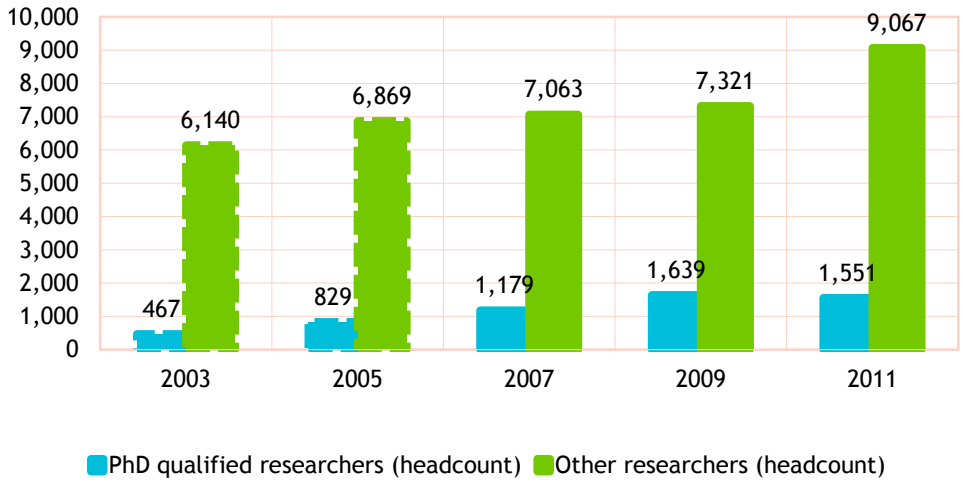
Source: CSO databank, OECD MSTI 2012-2

Researchers by qualification

Figure 20 shows researchers with a PhD qualification and other researchers.

- Researchers employed in the business sector with a PhD qualification almost quadrupled between 2003 and 2009, from 467 to 1,639.
- All other researchers increased by 19 per cent between 2003 and 2009 from 6,140 to 7,321.
- The number of PhD researchers declined in 2011 to 1,551, a fall of 5 per cent.
- All other researchers increased in 2011 to 9,067, a 24 per cent increase or additional 1,746 researchers.

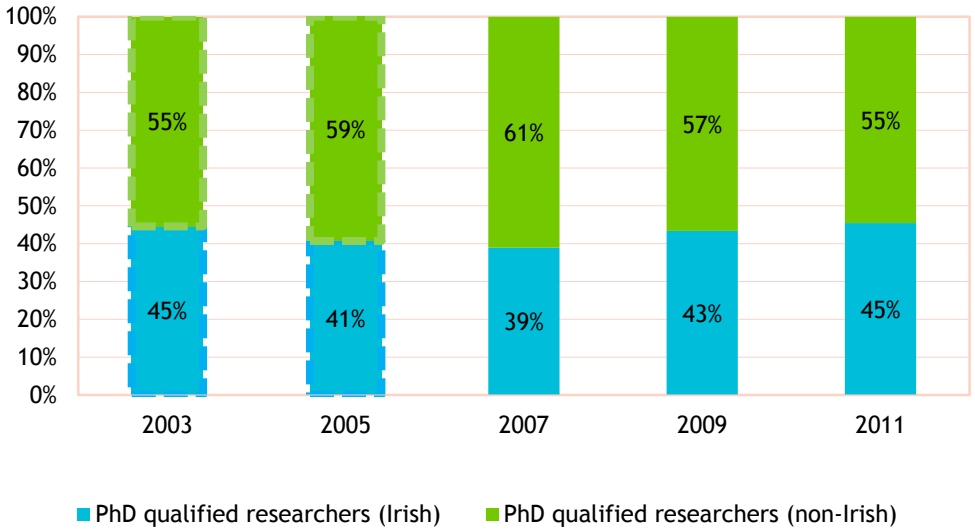
Figure 20: Total researchers (PhDs and other) headcount, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

In 2011, 15 per cent of all researchers in businesses held a PhD qualification down from 18 per cent in 2009. However, the share of researchers with a PhD qualification in the business sector more than doubled since 2003 from 7 per cent to 15 per cent in 2011.

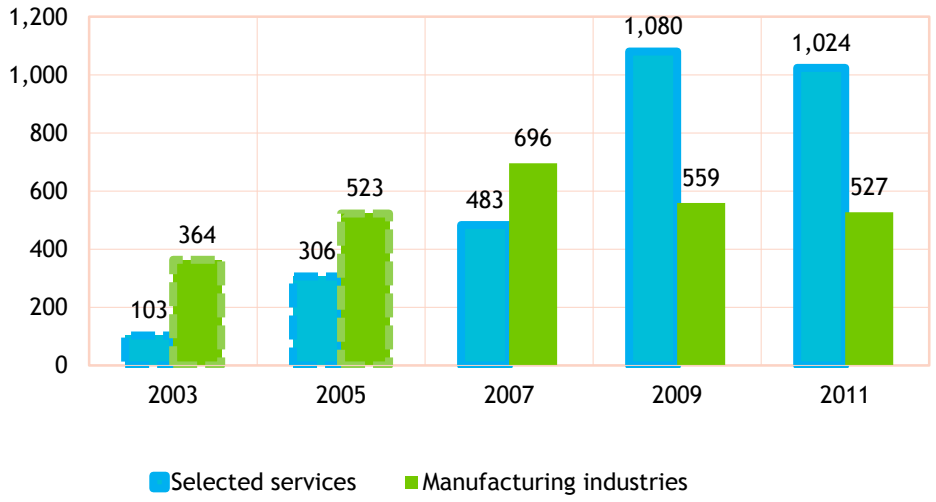
Figure 21: PhD researchers by firm ownership (headcount), 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Researchers with a PhD qualification are fairly evenly dispersed in Irish and foreign firms with 45 per cent employed in Irish firms and 55 per cent in foreign firms in 2011, the same shares as in 2003 as shown in figure 21.

Figure 22: PhD researchers by sector, 2003-2011

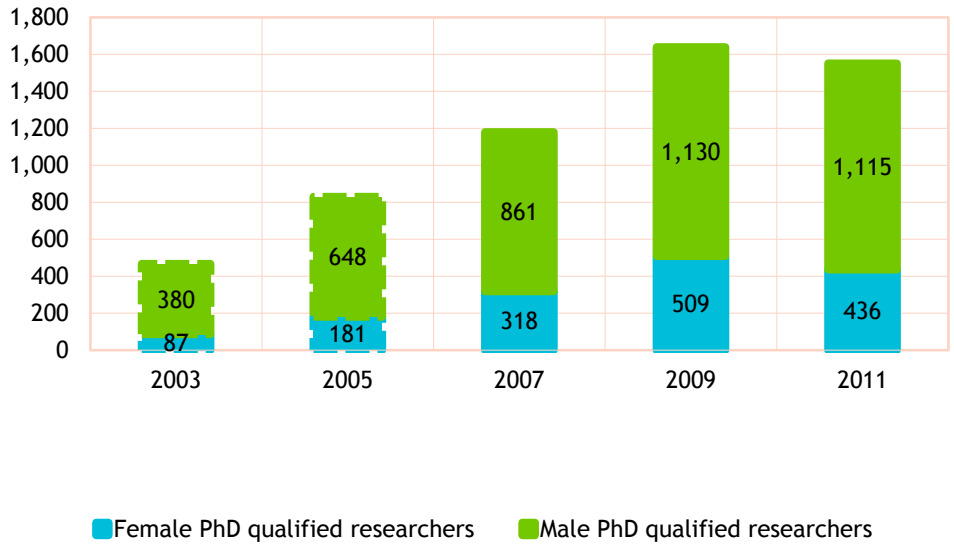


Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 22 shows PhD researchers are more concentrated in the services sector since 2009, with the sector accounting for two thirds of all PhD researchers employed in the business

sector. This contrasts with the profile in 2003 when only 22 per cent of all PhD researchers were working in services. PhD researchers in both sectors have declined slightly since 2009.

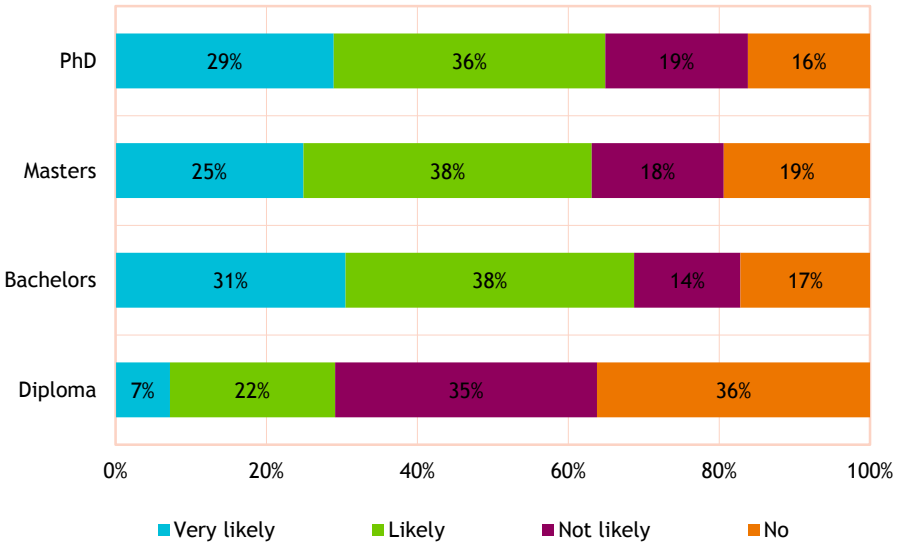
Figure 23: PhD researchers by gender, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 23 shows the gender breakdown of PhD researchers over the decade with female PhD researchers increasing their share of the total cohort from 19 per cent in 2003 to 28 per cent in 2011.

Figure 24: Level of qualification at which firms are likely to employ researchers between 2012 and 2017



Source: CSO databank

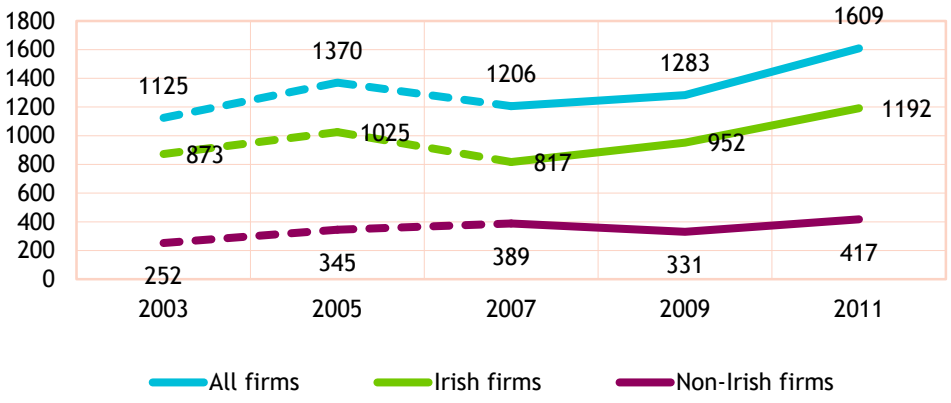
Firms were asked at what level of qualification they were likely to recruit more researchers. The results in figure 24 show that:

- 69 per cent of firms were very likely or likely to recruit to researchers at Bachelor's degree level (down from 74 per cent in 2009)
- 65 per cent were very likely or likely to recruit at PhD degree level (up from 64 per cent in 2009)
- 63 per cent were very likely or likely recruit at Master's degree level (down from 68 per cent in 2009)
- only 29 per cent were very likely or likely to recruit at Diploma level (down from 38 per cent in 2009)

3. Number of R&D-performing firms

In this section data gathered on the number of R&D-active companies and the levels of R&D expenditure by ownership and sector and firm size is examined.

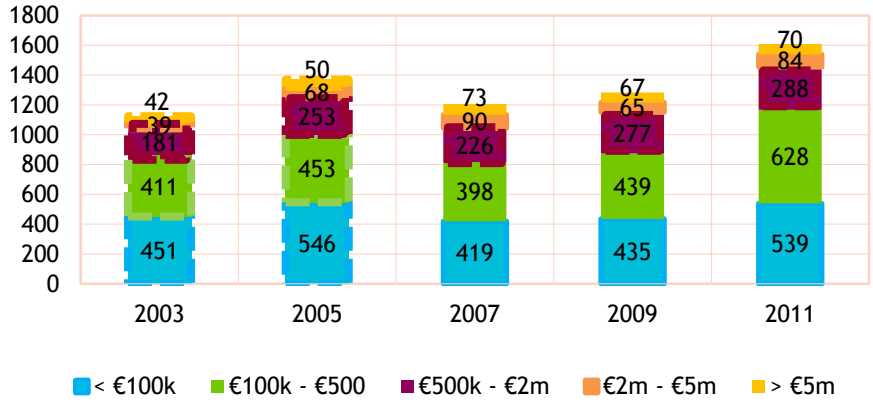
Figure 25: Number of R&D active firms by ownership, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 25 shows the total number of firms engaged in R&D activities between 2003 and 2010. More than 1,600 firms were R&D active in 2011, of which 74 per cent were Irish owned and 26 per cent foreign-owned. An additional 484 firms are performing R&D since 2003; Irish-owned R&D performers grew by 37 per cent over the period and foreign-owned by 65 per cent.

Figure 26: All R&D active firms by expenditure ranges, 2003 - 2011

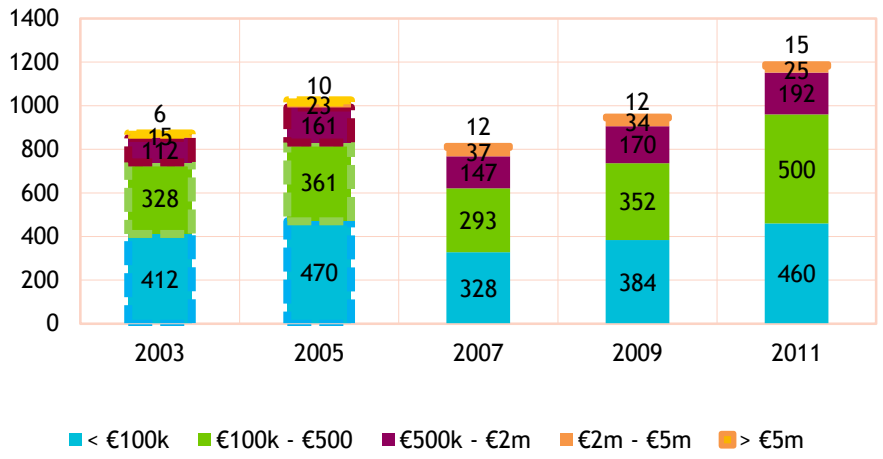


Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 26 examines the number of firms in each R&D expenditure category. In 2011, 73 per cent of all enterprises spent less than €500,000 on R&D activities compared with 77 per cent in 2003 accounting for an additional 305 firms in this expenditure range over the period. One

in ten enterprises spent in excess of €2 million in 2011 up from 7 per cent of R&D-active firms in 2003, but accounting for an additional 73 firms in this expenditure range since 2003.

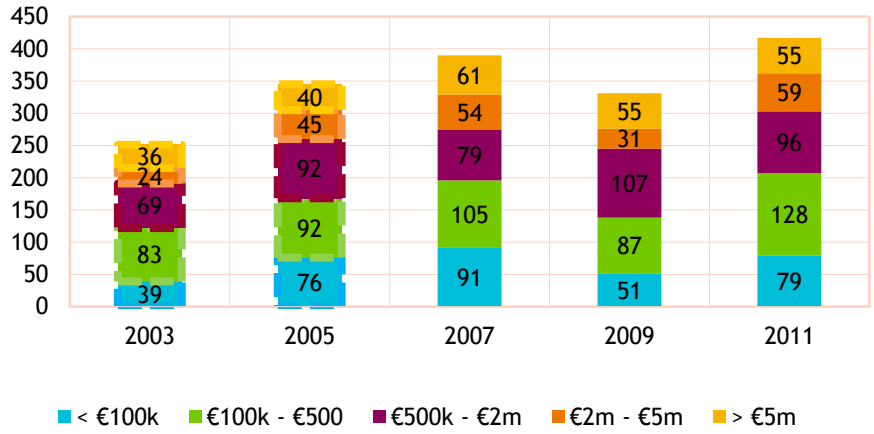
Figure 27: Number of Irish firms by R&D expenditure ranges, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 27 examines the number of Irish firms in each R&D expenditure category. In 2011, firms spending less than €500k on R&D activities accounted for 81 per cent of all enterprises down from an 85 per cent share in 2003. In absolute terms there was an additional 220 firms in this expenditure range over the period. 3 per cent of firms spent in excess of €2 million in 2011 up from 2 per cent in 2003, accounting for an extra 19 firms in this spend category since 2003.

Figure 28: Number of foreign firms by R&D expenditure ranges, 2003-2011

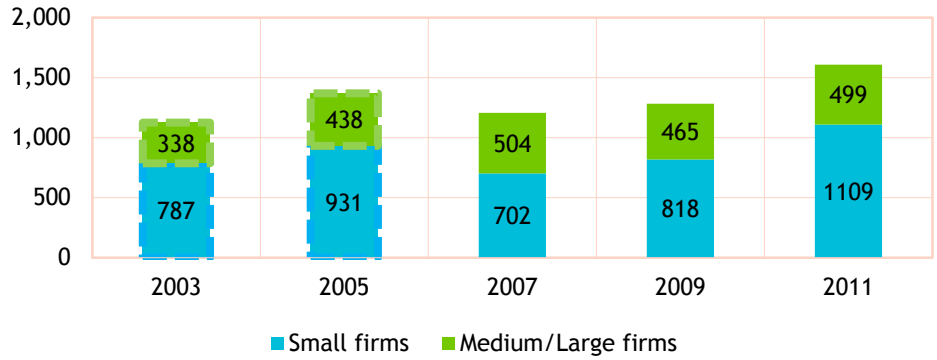


Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 28 shows the number of foreign firms in each R&D expenditure category between 2003 and 2011. In 2011, firms spending less than €500k on R&D activities made up 50 per cent of all

enterprises up from a 48 per cent share in 2003. In absolute terms, this accounts for a further 85 firms in this expenditure category over the period. In 2011, 27 per cent of foreign firms spent in excess of €2 million up from a 24 per cent share of R&D-active firms in 2003 and accounting for 54 extra firms in this spend category since 2003.

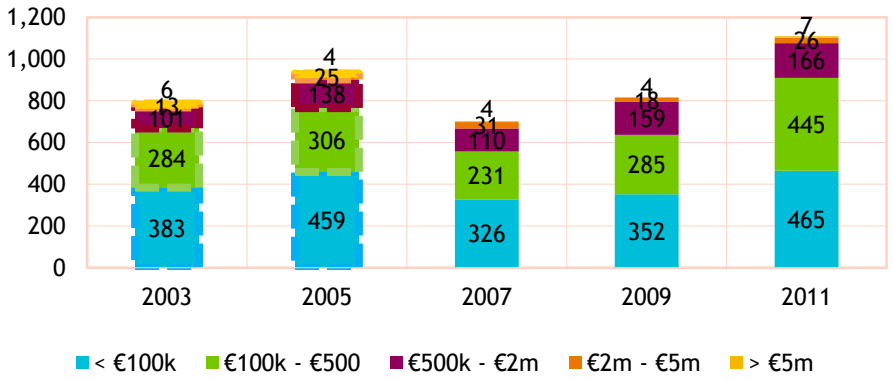
Figure 29: All R&D active firms by firm size, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 29 shows the total number of R&D active firms by firm size. Overall the number of R&D performers has increased by 43 per cent from 1,125 in 2003 to 1,608 in 2011. Small R&D firms (less than 50 employees) increased by 41 per cent since 2003, from 757 firms to 1,109 firms in 2011. Medium/large R&D performing firms (more than 50 employees) increased by 48 per cent since 2003 to 499 firms in 2011.

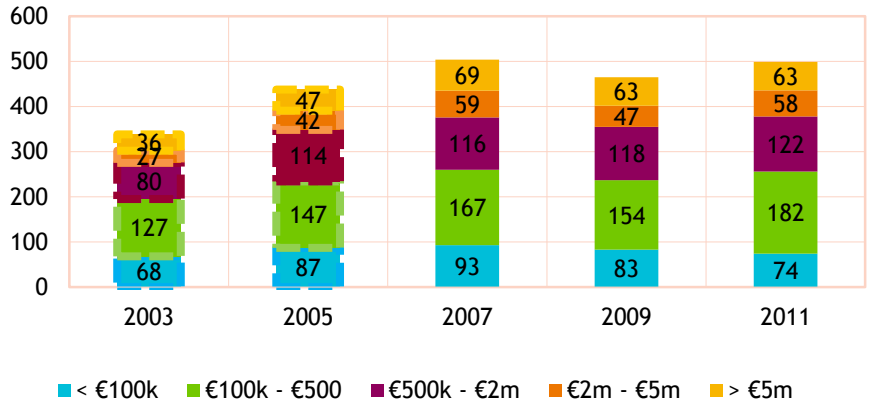
Figure 30: Small firms by R&D expenditure ranges, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 30 shows small firms' R&D expenditure categories from 2003 to 2011. In 2011, 910 firms spent less than €500K on R&D compared with 667 firms in 2003, a 36 per cent increase in small scale R&D activity over the period. In 2011, 33 firms spent in excess of €2 million on R&D, up from 19 firms in 2003, a 74 per cent increase.

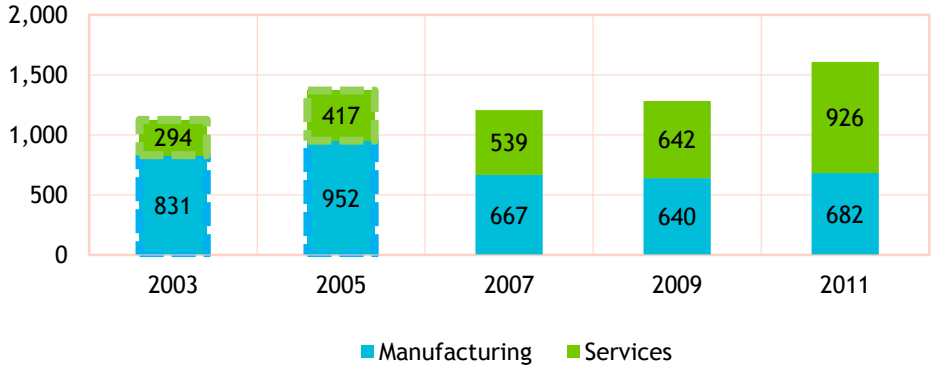
Figure 31: Medium/large firms by R&D expenditure ranges, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 31 shows the distribution of R&D expenditure for medium/large sized firms since 2003. In 2011, 121 firms invested over €2million in R&D, compared with 63 firms in 2003, a 92 per cent increase in large-scale R&D activity over the period. Enterprises investing between €500K and €2 million (mid-scale R&D activity) increased by 52 per cent from 80 firms in 2003 to 122 firms in 2011.

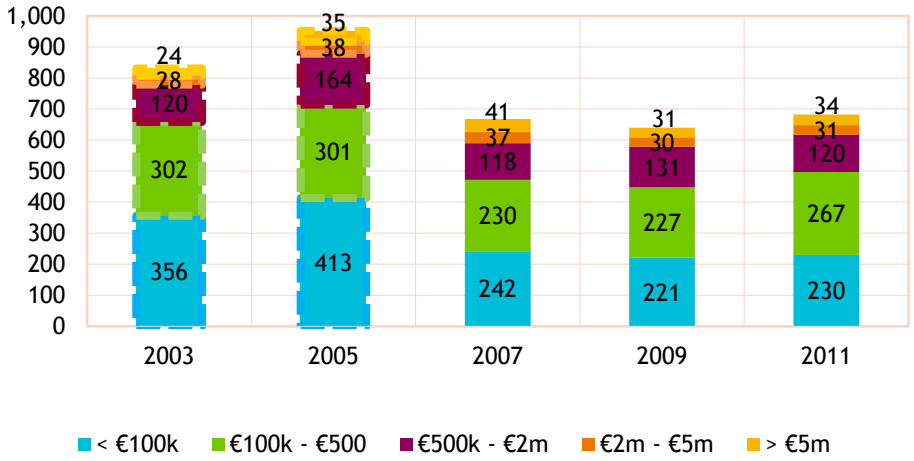
Figure 32: All firms by industrial sector, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Over 1,600 enterprises were engaged in R&D activities in 2011, of which 58 per cent were in the services sector and 42 per cent in manufacturing. This contrasts with 74 per cent of R&D-performing firms in the manufacturing sector in 2003 and 26 per cent in services (Figure 32).

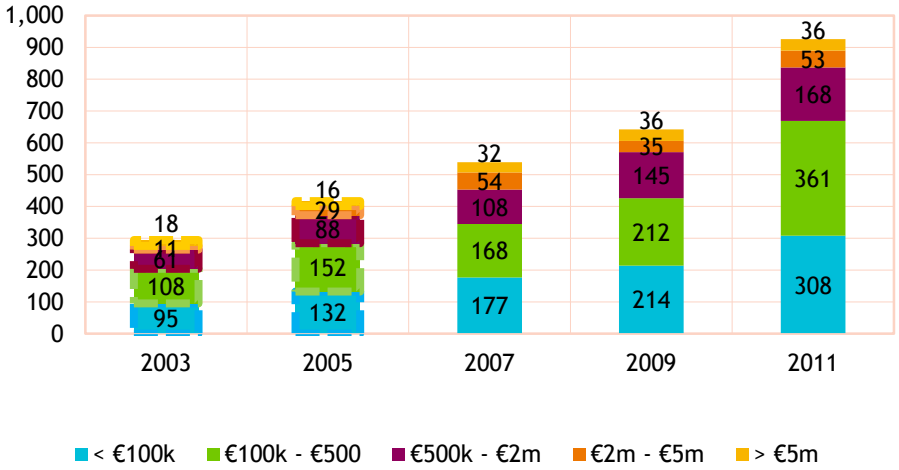
Figure 33: Manufacturing firms by R&D expenditure ranges, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 33 shows the distribution of R&D spending for manufacturing firms between 2003 and 2011. The total number of manufacturing firms engaged in R&D has fallen from 831 firms in 2003 to 682 in 2011. In 2011, 497 manufacturing firms spent less than €500K on R&D activities compared with 658 firms in 2003, a 25 per cent reduction in the number of firms engaged in small scale R&D activity. One in ten firms (65 firms) spent in excess of €2 million on R&D in 2011 compared with 52 firms in 2003, a 25 per cent increase in large scale R&D activity.

Figure 34: Services firms by R&D expenditure ranges, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 34 shows the R&D spend categories for services firms between 2003 and 2011. Services firms engaging in R&D have increased exponentially since 2003 from 294 firms to 926 firms in 2011. In 2011, 257 firms spent in excess of €500K on R&D activities compared with 91 firms in 2003.

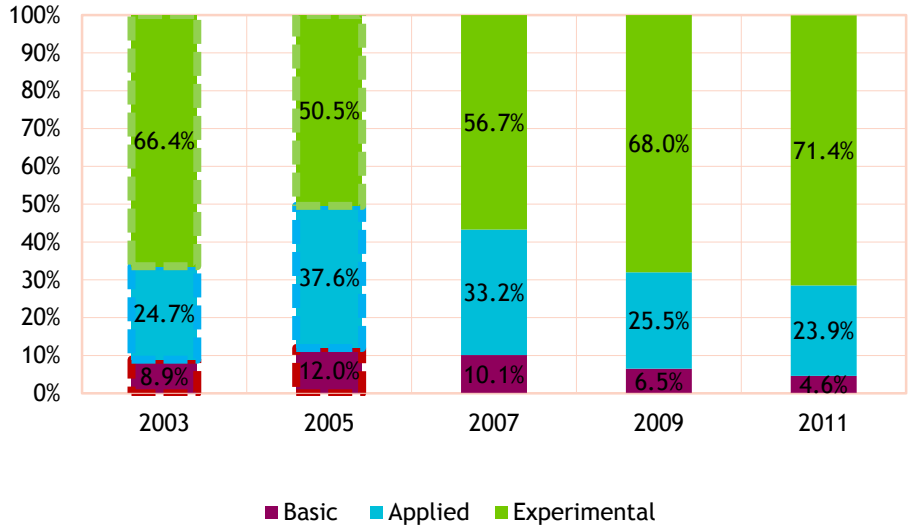
4. Types of Research and Development

R&D activity is categorised by the following three types of research:

1. Basic research (experimental or theoretical work undertaken primarily to acquire new knowledge, without any particular application or use in view)
2. Applied research (original investigation undertaken in order to acquire new knowledge , primarily directed towards a specific practicakl aim or objective)
3. Experimental development (systematic work, drawing on existing 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)

R&D expenditure in the business sector in Ireland has been mostly concentrated in experimental development projects ranging from 50.5 per cent of total BERD in 2005 to 71.4 per cent in 2011. The share of total R&D spending accounted for by basic research fell from 12 per cent in 2005 to 4.6 per cent in 2011. Similarly, the share of total R&D dedicated to applied research decreased from 37.6 per cent in 2005 to 23.9 per cent in 2011 as shown in figure 35 below.

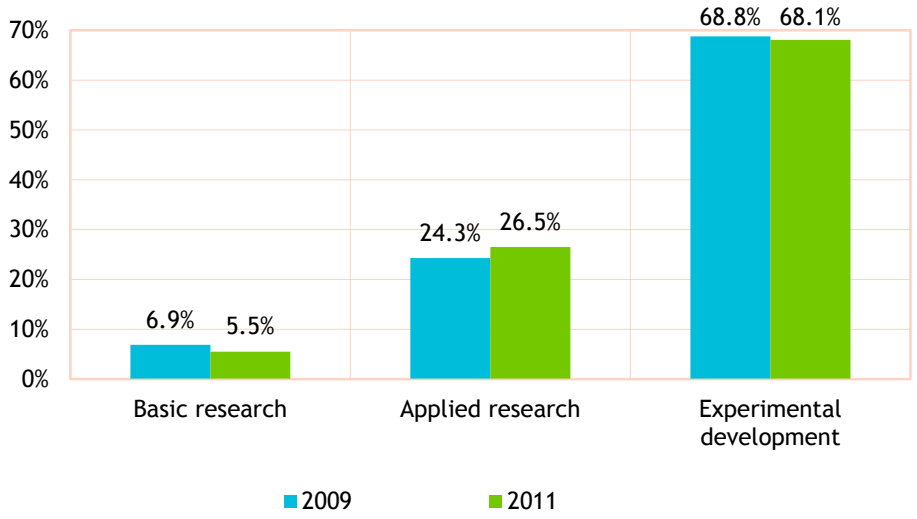
Figure 35: Types of R&D spending by all firms, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 36 shows the share of R&D expenditure in the manufacturing sector accounted for by applied research projects increased from 24.3 per cent in 2009 to 26.5 per cent in 2011. More than two thirds of research expenditure in the manufacturing sector was spent on experimental development projects in 2009 and 2011.

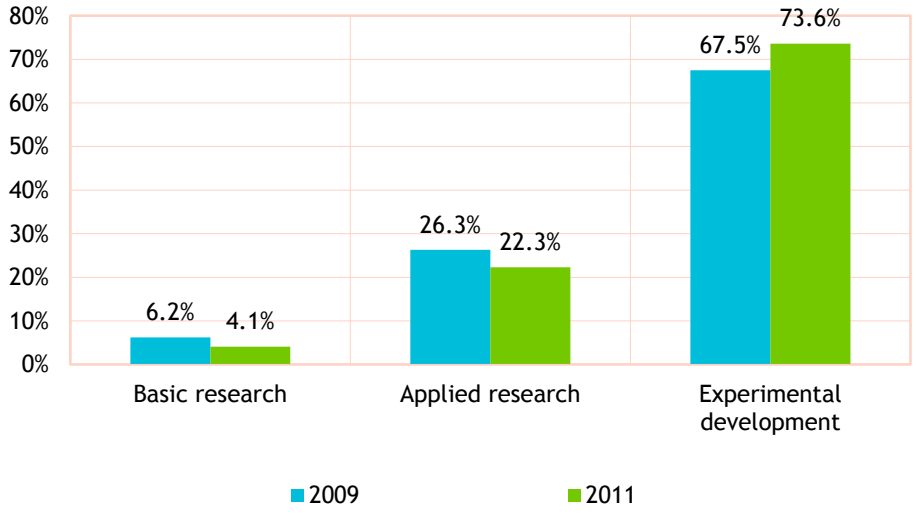
Figure 36: BERD in manufacturing firms by type of research, 2009-2011



Source: CSO databank

Figure 37 shows a strong focus on experimental development projects in the services sector making up almost three quarters of R&D expenditure. The services sector now holds the majority share of total BERD, driving the increased focus overall on experimental development projects over the decade.

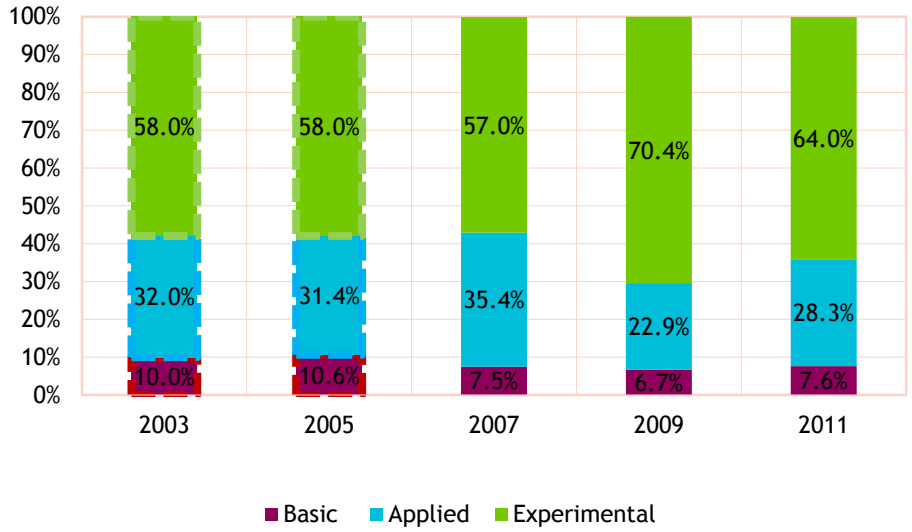
Figure 37: BERD in service firms by type of research, 2009-2011



Source: CSO databank

Figure 38 shows BERD spending by type of research in Irish owned firms. The majority of BERD spending is on experimental development projects and has increased from 58 per cent of total expenditure in 2003 to 64 per cent in 2011.

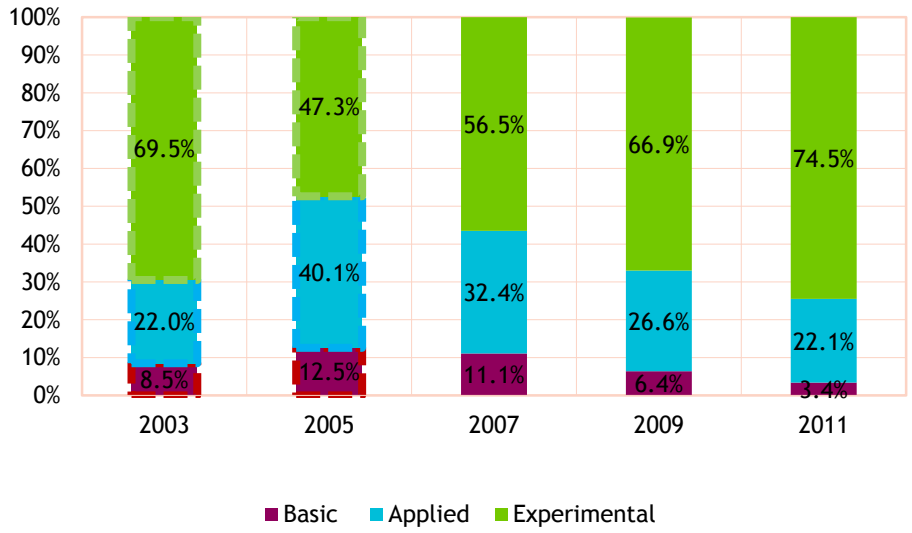
Figure 38: Types of R&D spending by Irish firms, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Nearly two-thirds of Irish enterprises were engaged in experimental development (figure 38) compared to three-quarters of foreign owned companies (figure 39) in 2011.The share of total expenditure accounted for by basic research projects fell from a 10 per cent share in 2003 to a 7.6 per cent share in 2011 but holds a higher share than non-Irish firms (3.4 per cent share in 2011) as shown in figure 39. Applied research projects accounted for a higher share of relative BERD in Irish firms (23.9 per cent in 2011) compared with a 22.1 per cent share in non-Irish firms. In absolute terms, however non-Irish companies spend significantly more on all types of research accounting for 70 per cent of total BERD.

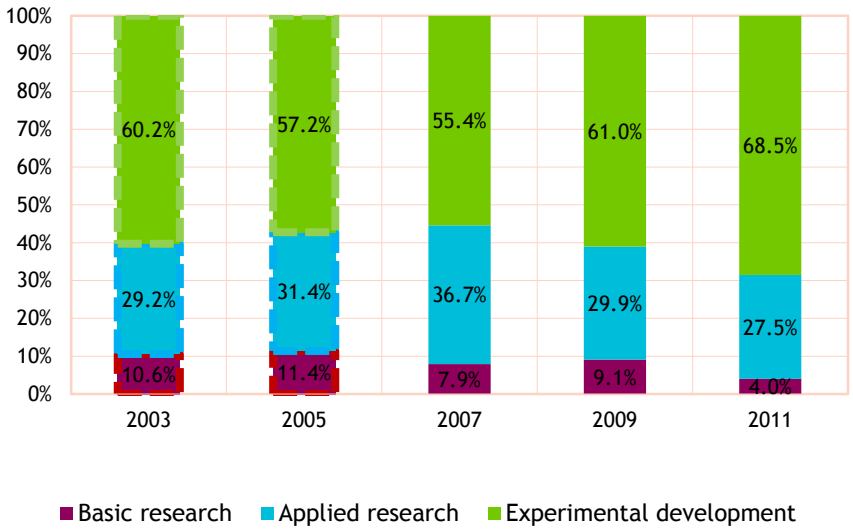
Figure 39: Types of R&D spending by non-Irish firms, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 40 below shows the trend in BERD by type of research for small firms and figure 41 for medium/large firms.

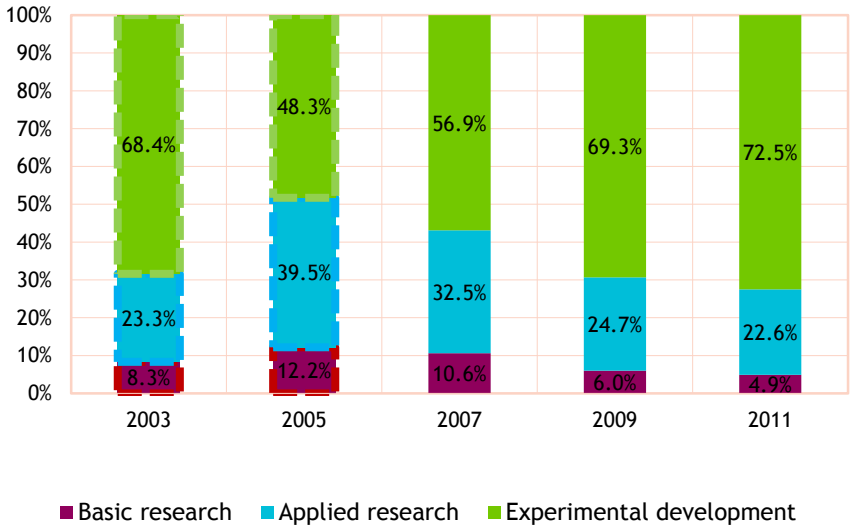
Figure 40: Types of R&D spending by small firms, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

With the exception of 2005 small enterprises were more likely to engage in applied research than medium and large enterprises.

Figure 41: Types of R&D spending by medium/large firms, 2003-2011

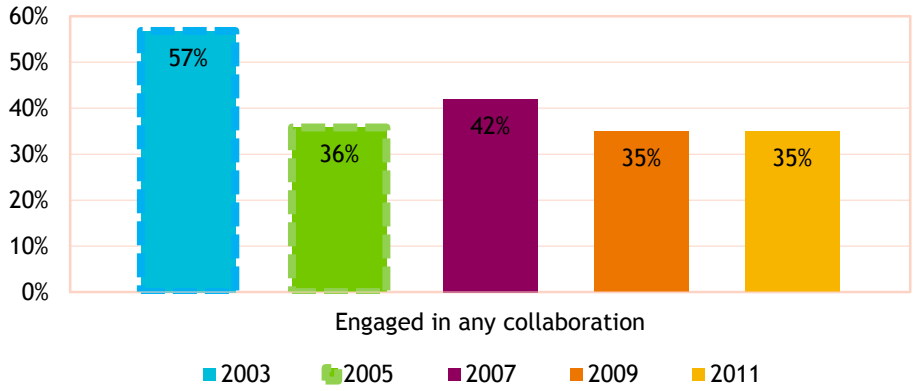


Source: CSO databank, Forfás BERD 2003 and 2005 surveys

5. Collaboration Activity

This section examines the extent to which firms in Ireland engage in joint research projects with other institutions or businesses.

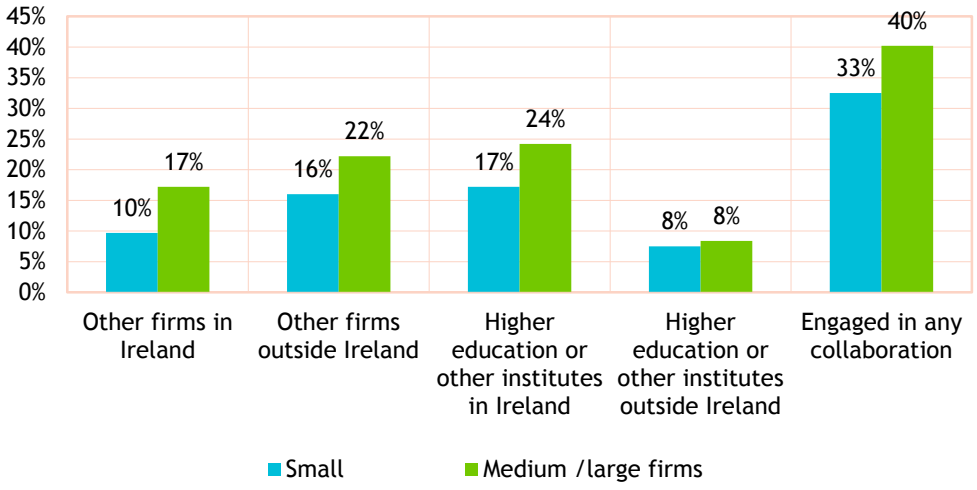
Figure 42: Percentage of firms engaged in any collaboration activities, 2003-2011



Source: CSO databank, Forfás BERD 2003 and 2005 surveys

Figure 42 shows the share of all R&D active firms engaged in joint research projects from 2003 to 2011. Collaboration rates decreased over the period remaining stable with 35 per cent of all firms engaged in joint research projects in 2009 and 2011.

Figure 43: Percentage of firms engaged in collaborative research, by firm size, 2011

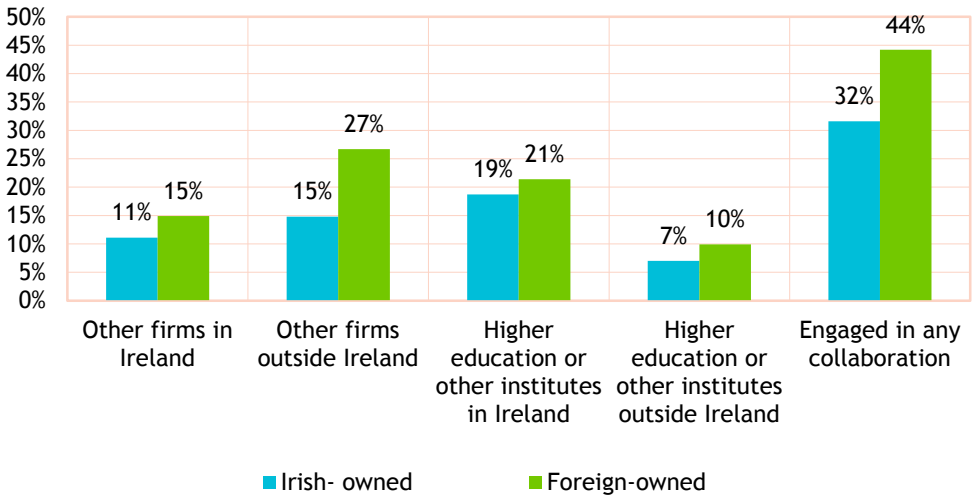


Source: CSO databank

Figure 43 shows collaboration rates for small and medium/large sized firms in 2011. Medium/large firms engaged in a higher share of collaborative research projects with any research partners, with 40 per cent engaged, while 33 per cent of small firms engaged in any R&D collaboration. Businesses mostly partnered with higher education institutes in Ireland,

with 17 per cent of small firms collaborating with HEIs and almost a quarter of medium /large firms.

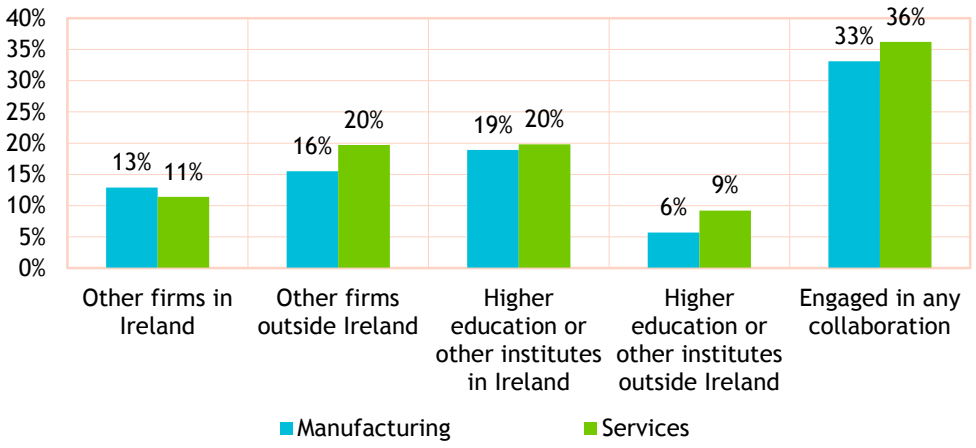
Figure 44: Percentage of firms engaged in collaborative research by ownership, 2011



Source: CSO databank

Figure 44 shows the share of Irish and foreign owned firms engaged in collaborative research projects in 2011. Foreign-owned firms showed higher rates of collaboration with all R&D partners in 2011. The highest rate of collaborative R&D activity for Irish firms at 19 per cent was with HEIs in Ireland. Foreign firms were more likely to collaborate with firms outside of Ireland with 27 per cent engaged in joint research projects.

Figure 45: Percentage of firms engaged in collaborative research by sector, 2011



Source: CSO databank

Figure 45 shows the share of manufacturing and services firms engaged in joint R&D projects in 2011. With the exception of collaborations with other firms in Ireland, services firms had higher collaboration rates with all other partners. Overall, 36 per cent of services firms engaged in collaborative R&D compared with a third of manufacturing firms.

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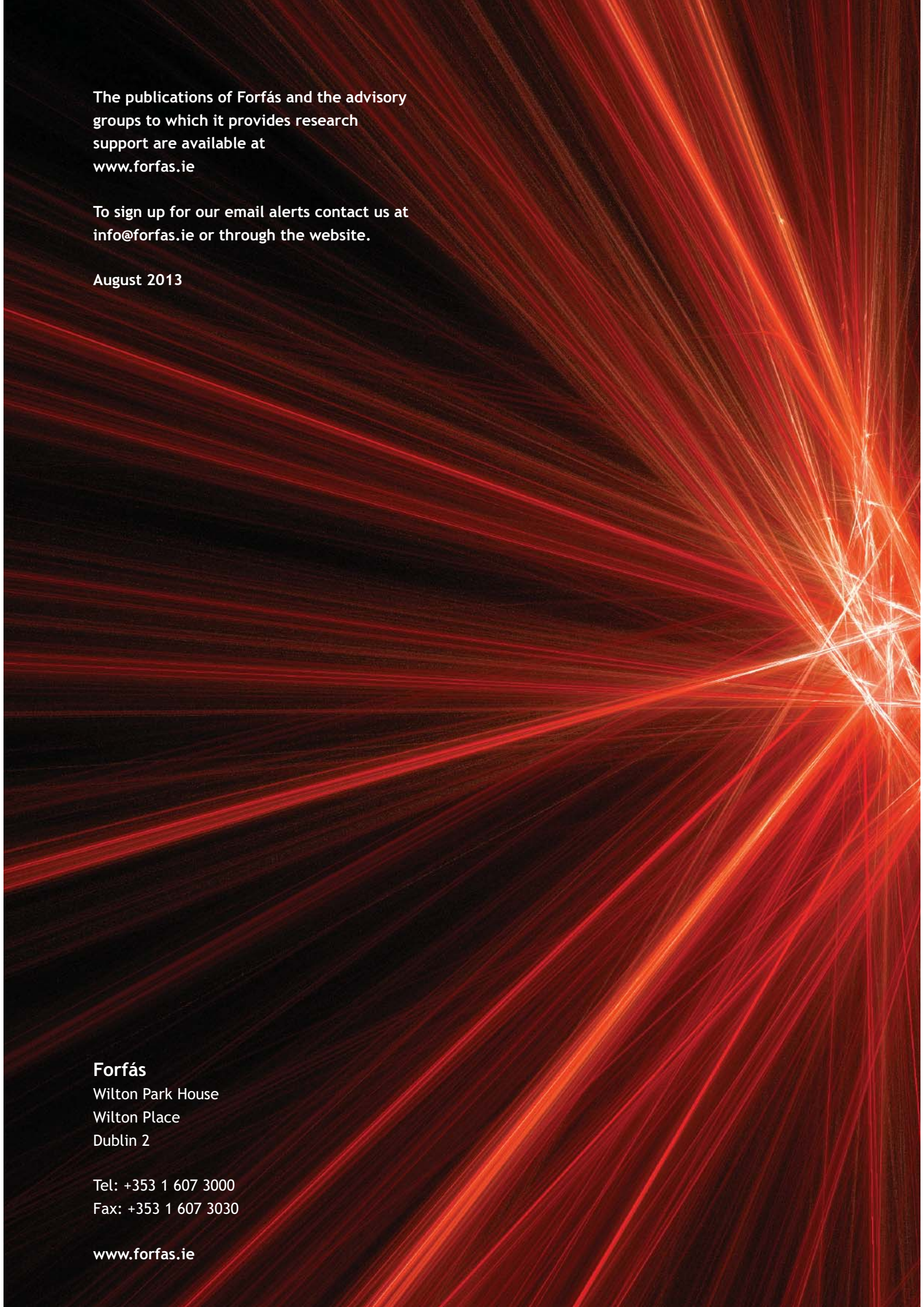

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Forfás
Wilton Park House
Wilton Place
Dublin 2

Tel: +353 1 607 3000
Fax: +353 1 607 3030

www.forfas.ie