

BUSINESS AND ENERGY

Business Enterprise Research and Development Scotland 2020

Release Date: 15 December 2021

Key Points

Business Enterprise Research and Development (BERD) expenditure in Scotland was £1.437 billion in 2020.

Between 2019 and 2020, BERD expenditure in Scotland decreased by 6.1% in real terms, this compares to a 3.0% decrease for the UK as a whole.

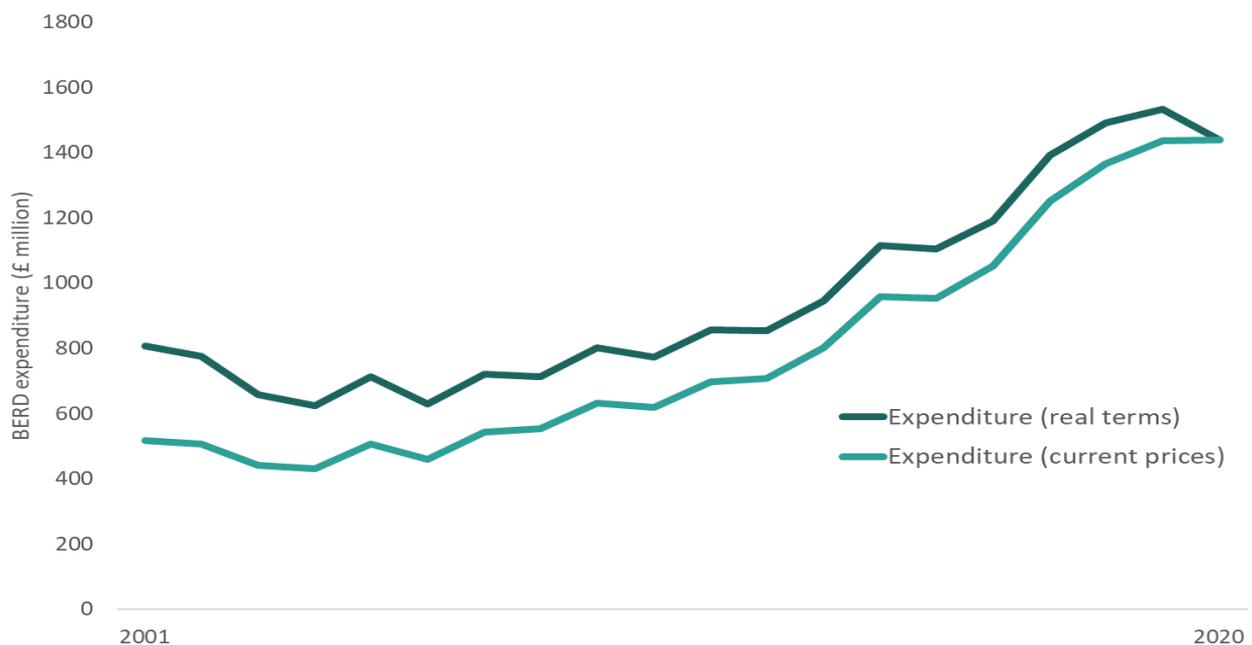
Since 2007, BERD expenditure in Scotland has increased by 99.5% in real terms, more than three times the rate of growth for the UK as whole (up 29.4% since 2007).

BERD expenditure represented 0.92% of Scottish GDP in 2020; the comparable figure was 1.26% for the UK.

Over the latest year, R&D spending on Manufacturing products decreased by 4.8%, and spending on Service products decreased by 9.5%. R&D spending on Other products increased by 13.5% over the year, in real terms.

In 2020, businesses in Scotland employed 16,208 R&D staff, 9.0% more than in 2019, which takes BERD jobs to the highest level in the series.

Figure 1. Between 2019 and 2020, BERD expenditure in Scotland decreased by 6.1% in real terms



About this publication

This publication presents estimates of business expenditure and employment relating to research and development (R&D) performed by businesses operating in Scotland in 2020, as well as revisions to previously published data for 2018 and 2019. The data in this release are sourced from the Business Enterprise Research and Development (BERD) survey conducted by the Office for National Statistics (ONS).

In this publication, BERD is measured by the expenditure on R&D carried out by the business. This is regarded as a more accurate measure of R&D than the funding received by a business for R&D work, as not all of these funds received may be used for R&D. This publication reports on R&D expenditure in businesses in Scotland irrespective of the country of residence of the ultimate owner or users of the R&D produced.

The BERD survey follows the definition of research and development proposed by the Organisation for Economic Cooperation and Development (OECD) and published in the ‘Frascati’ Manual. According to the manual, R&D is defined as:

“creative and systematic work undertaken in order to increase the stock of knowledge - including knowledge of humankind, culture and society - and to devise new applications of available knowledge”. R&D must contain an appreciable amount of novelty.

BERD contributes to Scotland’s Gross Expenditure on Research and Development (GERD), which forms the basis of the National Indicator: ‘Spend on Research and Development’. Gross Expenditure on Research and Development (GERD) comprises R&D undertaken by the Business Enterprise (BERD), Higher Education (HERD), Government (GoveRD) and Private-Non-Profit (PNP) sectors. The figures for GERD will become available in Spring 2022.¹

Coronavirus (COVID-19)

The response rate for the 2020 BERD survey in Great Britain was 54%, which was lower than usual because of the coronavirus (COVID-19) pandemic. This means that the estimates in this release are subject to more uncertainty than usual because of fewer responses on which to base the survey results.

Further information on Scottish R&D activity and the full set of tables are available at: <https://www.gov.scot/collections/business-and-innovation-statistics/>

Further details of definitions, coverage and methodology can be found in the [Background Notes](#)

¹ Information on the range of targets and indicators which comprise the National Performance Framework can be found on at: <https://nationalperformance.gov.scot>

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BERD expenditure decreased over the latest year

Business Enterprise Research and Development (BERD) expenditure in Scotland was £1.437 billion in 2020, down 6.1% (-£94 million) in real terms from 2019. Over the longer term, BERD expenditure in Scotland has increased by 99.5% in real terms since 2007.

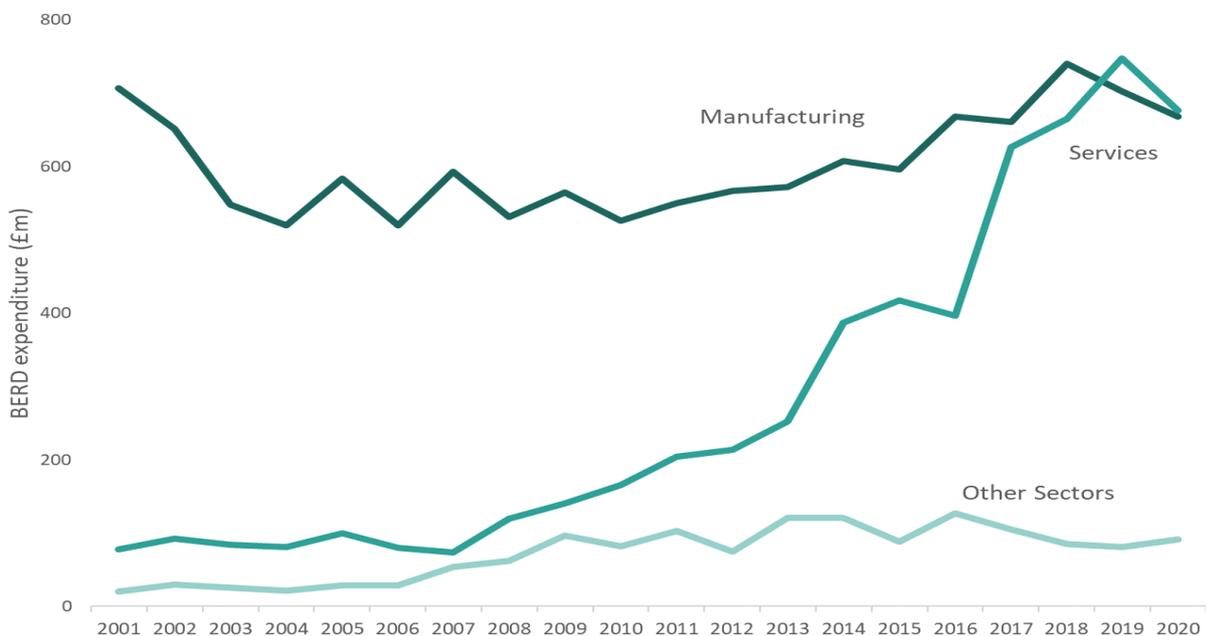
In 2020, BERD spending represented 0.92% of GDP in Scotland, which was an increase from 0.86% in 2019 and up from 0.45% in 2007. However, it is important to note that GDP was particularly low in 2020 as a result of the COVID-19 pandemic.

R&D spending in Scotland can fluctuate considerably year on year, especially given that it is concentrated in a small number of large businesses. In 2020, five businesses accounted for over a quarter of all Scottish BERD spending (29.4%). This is a sizeable share of the total R&D expenditure but is lower than in 2019 (36.4%) and represents a fall in dominance of the top businesses since 2001, when the top five businesses accounted for just over half of Scottish BERD expenditure.

BERD expenditure was highest on Services and Manufacturing products

In 2020, as in recent years, BERD expenditure in Scotland was split mainly between Services products (47.1%) and Manufacturing products (46.5%). Since 2007, R&D spending on Services products has increased rapidly, and in 2020 exceeded R&D expenditure on Manufacturing products for the second year in a row (Figure 2). Over the latest year, R&D spending on Manufacturing products decreased by 4.8% (-£34 million), and spending on Service product groups decreased by 9.5% (-£71 million), whereas for Other product groups, R&D spending increased by 13.5% (+£11 million) in real terms.

Figure 2. BERD spending on Service products exceeded spending on Manufacturing products in Scotland in 2020



Among Services products, ‘Miscellaneous business activities; Technical testing and analysis’ contributed considerably to the real terms decrease, with £94 million less being spent on R&D in 2020 than in 2019 (-23.5%).

The fall in spending on Manufacturing products was partly driven by reduced spending on ‘Chemicals’ (-£15 million) compared to 2019.

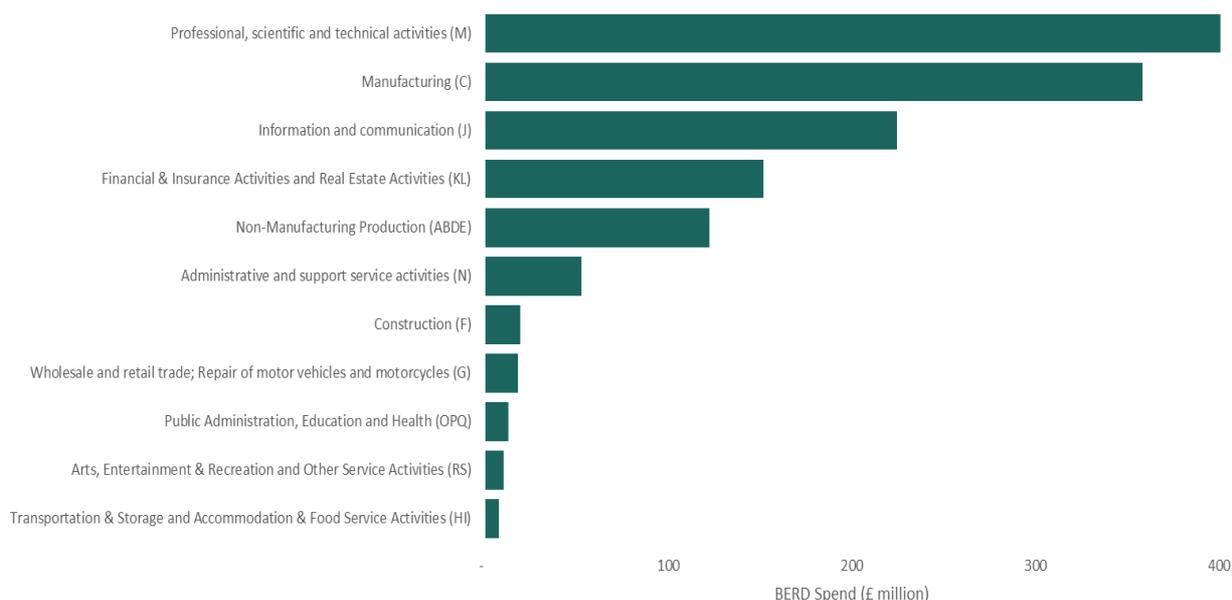
The recent increase in BERD spending on Other products was driven by an increase for ‘Construction’ (+£7 million) and ‘Extractive Industries’ (+£4 million) between 2019 and 2020.

BERD spend was highest in the Professional, scientific and technical activities industry sector

Note that estimates of research and development (R&D) expenditure by industry and product group are not the same. Businesses may report significant R&D in product groups that are different to the main classification of their business according to the [Standard Industrial Classification \(SIC\)](#). More information about the concepts of product groups and SIC codes can be found in the [UK Business Enterprise Research and Development Quality and Methodology Information \(QMI\)](#) report.

In 2020, BERD expenditure in the Professional, scientific and technical activities sector (Section M) (£460 million) accounted for almost a third (32.0%) of the Scottish total. Manufacturing (Section C) ranked second (£358 million) and accounted for almost a quarter of the Scottish total (24.9%) (Figure 3).

Figure 3. Professional, scientific and technical activities and Manufacturing had the highest BERD spend in Scotland in 2020



In 2020, Scientific Research and Development (within Section M) was by far the most research intensive division in Scotland with BERD spending accounting for 21.34% of turnover. Manufacture of Computer, Electronic and Optical Products and Other Manufacturing (within Section C) were the next most research intensive divisions, with BERD spend accounting for 7.35% and 6.07% of turnover respectively.

The growth sectors accounted for almost 70% of Scottish BERD spending

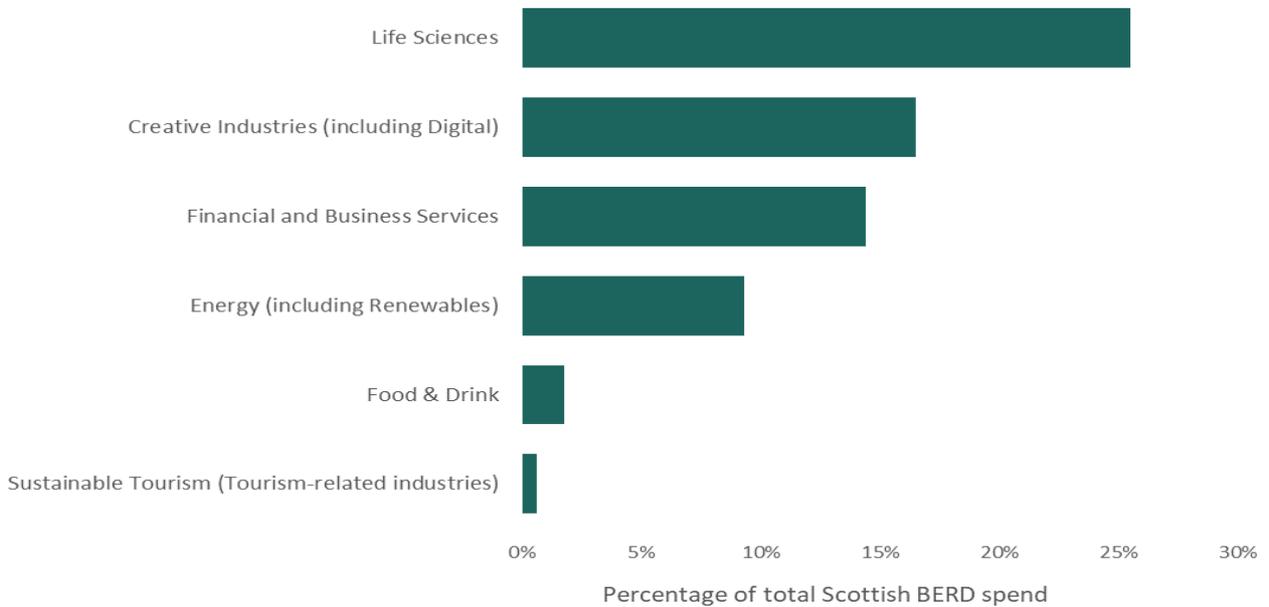
[Scotland's Economic Strategy](#) identified the following industry groups as key growth sectors where Scotland has a distinct comparative advantage:

- Food & Drink (including agriculture & fisheries)
- Creative Industries (including digital)
- Sustainable Tourism
- Energy (including renewables)
- Financial & Business Services
- Life Sciences

The growth sectors accounted for a large proportion of total BERD expenditure in Scotland in 2020 (68.1%). In 2020, Life Sciences had the highest BERD expenditure of the six Growth Sectors (£366 million), as it has since 2009 when the series began (Figure 4). Creative Industries (including digital) (£238 million) ranked second among the Growth Sectors in terms of BERD expenditure. The Food & Drink growth sector experienced the largest percentage increase between 2019 and 2020, with BERD expenditure increasing by 87.9% (+£12 million) in nominal terms. In 2020, Life Sciences accounted for over a quarter (25.5%) of total Scottish BERD spend, and Creative Industries accounted for 16.5%.

Life Sciences also had the highest number of BERD employees, accounting for over a fifth of all Scottish BERD employees (22.2%). Despite a 9.5% increase in the BERD employment between 2019 and 2020, Sustainable Tourism ranked lowest among the Growth Sectors in terms of BERD jobs. Creative Industries had the second highest level of BERD employment (18.1% of all Scottish BERD employees) in 2020.

Figure 4. Life Sciences accounted for the highest proportion of BERD spending among the six Scottish Growth Sectors

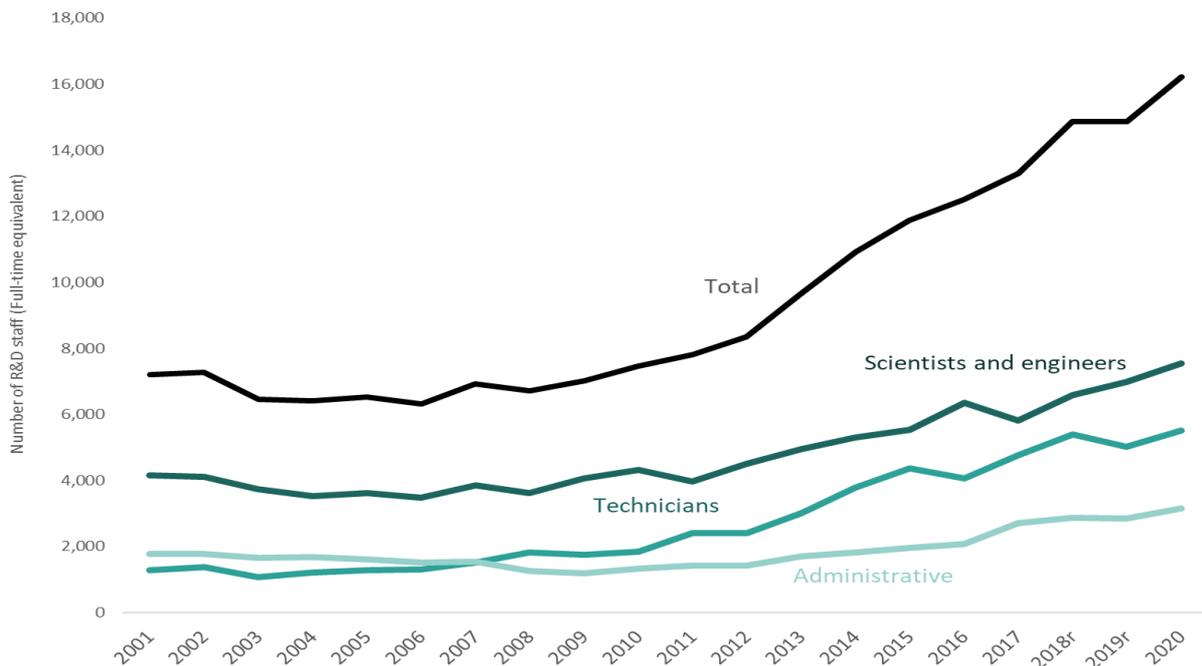


Scottish BERD employment increased over the year

In 2020, businesses in Scotland employed 16,208 R&D staff, 9.0% more than in 2019, which takes BERD jobs to the highest level in the series. Between 2001 and 2020, the number of R&D employees in Scotland has increased by 125%.

The relative proportions of the three types of R&D staff have changed since 2001. In 2001, over half of all R&D staff were Scientists and engineers (58%) and less than a fifth (18%) were Technicians, laboratory assistants and draughtsmen. Between 2001 and 2020, the number of technicians increased the most (326%), so that in 2020 over a third of all R&D staff in Scotland were technicians.

Figure 5. The number of R&D employees increased in all categories in Scotland over the latest year



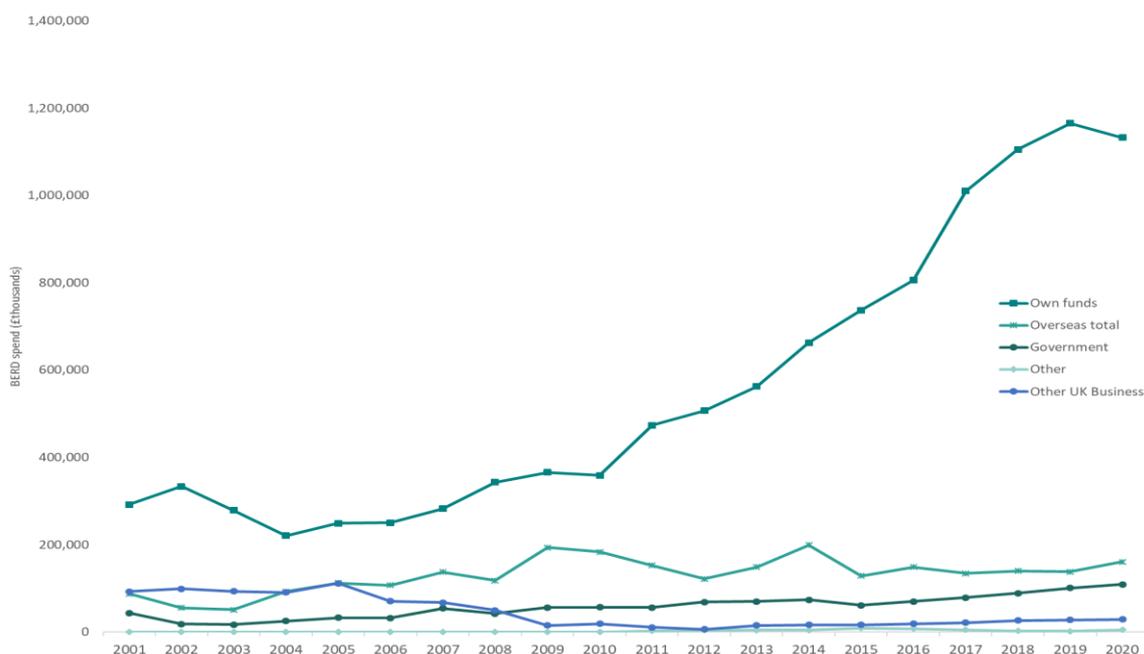
BERD expenditure, all product groups experienced an increase in BERD staff between 2019 and 2020. BERD employment increased the most over the latest year for 'Other' product groups (+81.0%). Increases were also seen for Manufacturing and Services product groups (+5.2% and +5.6% respectively).

Businesses' own funds represented the largest source of BERD funding

Since the series began in 2001, businesses' own funds have always represented the largest source of funding for R&D in businesses in Scotland. However since 2010, this has greatly increased – in 2010 businesses' own funds represented 58% of funds, growing to 79% in 2020 (Figure 6).

The proportion of overseas funding for R&D in businesses, which was the second largest source of funding for R&D in businesses in Scotland in 2020, has shown a general downward trend over recent years. In 2009, overseas funding accounted for 31% of all BERD expenditure in Scotland, whereas by 2020 it had decreased to 11% (Figure 6).

Figure 6. Businesses' own funds has been the fastest growing source of funds for BERD in Scotland

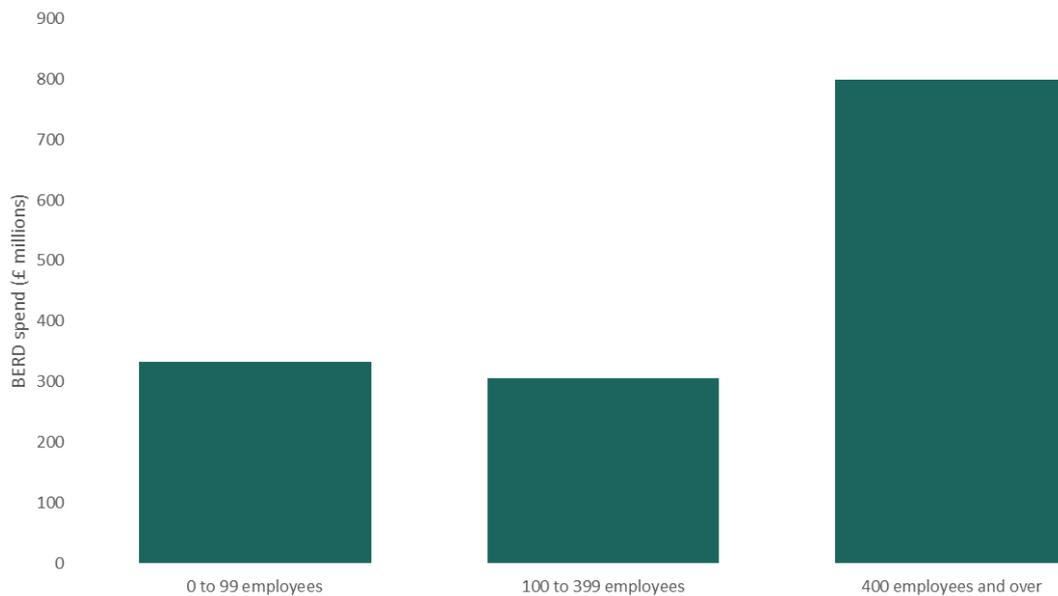


Average expenditure on R&D was highest within large businesses

In 2020, as in the previous years, there were fewer large businesses performing R&D, but they spent more: approximately 125 businesses with 400 or more employees performed R&D in Scotland, compared to 3,345 businesses with less than 100 employees. Businesses with 400 or more employees accounted for over half of BERD expenditure (55.6%), whereas the more numerous smaller businesses (less than 100 employees) accounted for 23.1% (Figure 7). As follows, businesses with 400 or more employees had a much higher average expenditure

on R&D (£6.4 million per business) than businesses with less than 100 employees (£99 thousand per business).

Figure 7. Large businesses (400+ employees) accounted for over half of BERD expenditure in Scotland



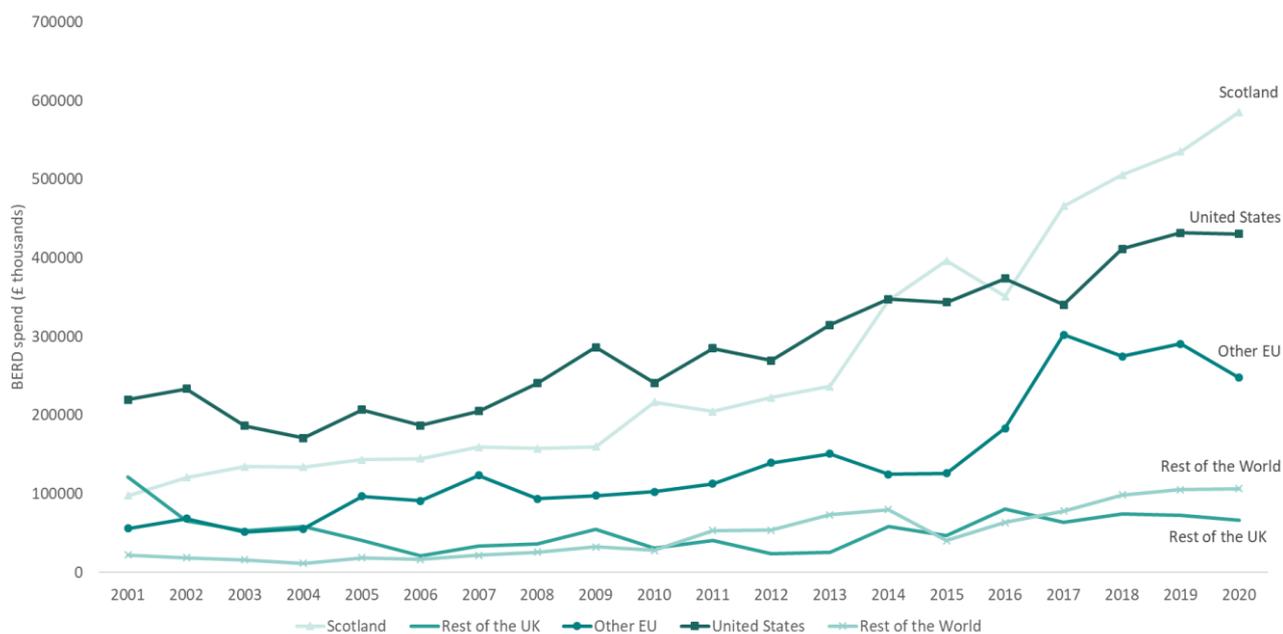
Spending on each of the broad product groups also varied between businesses of different sizes: the largest share of R&D spending in the smaller businesses (less than 100 employees) was on Services products (73.9%), whereas in businesses with 100-399 employees and 400+ employees it was on Manufacturing products (61.6% and 51.3% respectively).

Over half of R&D expenditure in Scotland was by foreign-owned businesses

Over half of R&D expenditure in Scotland was by foreign-owned business (54.6%) in 2020.

Scottish-owned businesses accounted for 40.8% of Scottish BERD spending in 2020. United States-owned businesses accounted for the second highest proportion of Scottish BERD spending in 2020 (30.0%) (Figure 8).

Figure 8. United States-owned businesses accounted for the second largest proportion of BERD expenditure in Scotland in 2020

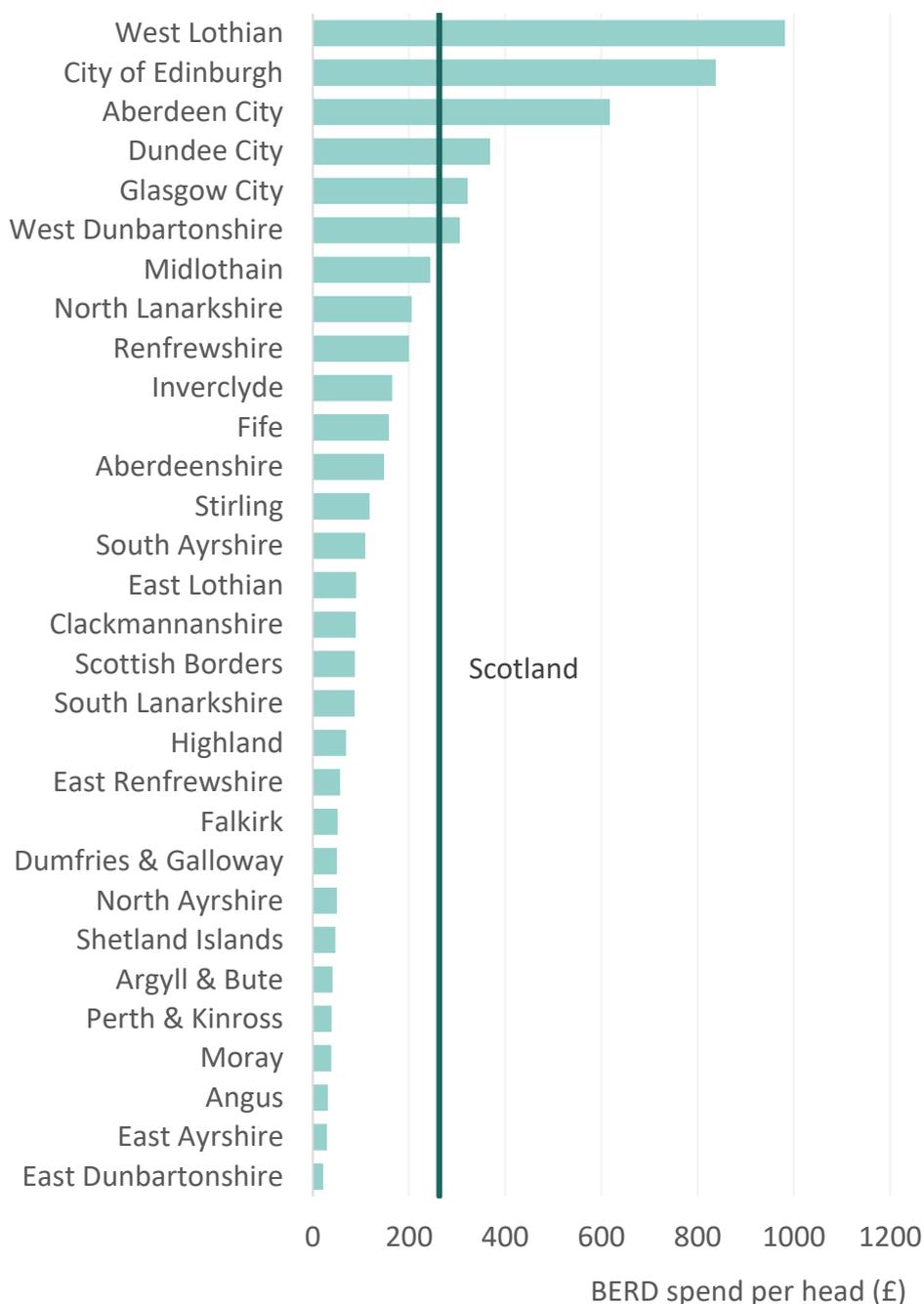


Businesses located in the City of Edinburgh accounted for almost a third of all Scottish BERD spending

Business spending on R&D in Scotland is not evenly distributed across the country: among the 32 local authority areas, City of Edinburgh was top, accounting for almost a third of BERD expenditure in 2020 (30.8%). Businesses in Glasgow City and West Lothian accounted for a further 14.2% and 12.6% respectively. Together businesses in these three local authority areas comprised nearly three fifths of the total Scottish BERD expenditure (57.6%).

An alternative way of comparing BERD spending across local authority areas is to calculate BERD spend per person. In 2020, businesses in West Lothian spent more per person than any other local authority area (£981) and the City of Edinburgh was a close second (£838) (Figure 9).

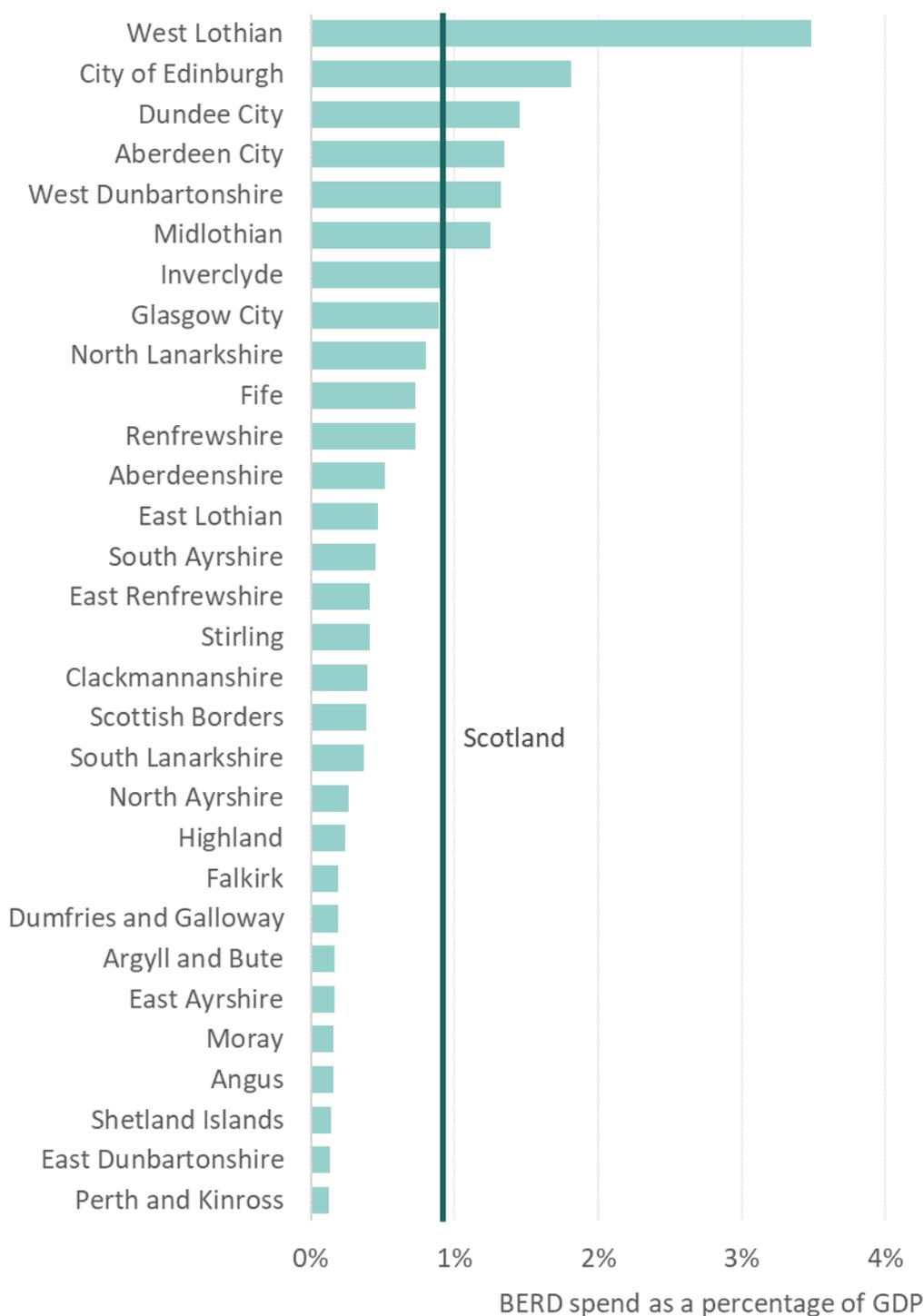
Figure 9. West Lothian and City of Edinburgh are top in terms of BERD spend per head of population in 2020



In 2020, BERD expenditure as a percentage of GDP was highest in West Lothian, where BERD spend accounted for 3.49% of GDP. City of Edinburgh ranked second among the local authority areas in terms of BERD spend as a percentage of GDP (1.82%). Dundee City, Aberdeen City, West Dunbartonshire and Midlothian were the only other Scottish local authority areas where BERD spend as a percentage of GDP was higher than the Scottish average (0.92%; Figure 10).

In terms of BERD employment, City of Edinburgh accounted for 27.4% of the Scottish total and Glasgow City ranked second among the local authority areas with 11.5%.

Figure 10. BERD expenditure as a percentage of GDP was higher than the Scottish average in six local authority areas



BERD expenditure as a share of GDP in Scotland was lower than that for the UK as a whole

Scottish BERD expenditure makes up a relatively small proportion of the total UK BERD expenditure: in 2020, it accounted for 5.3%.

Over the latest year, BERD spend in Scotland experienced a greater decrease than in the UK: 6.1% decrease in real terms in Scotland vs 3.0% in the UK. Over the

longer term, R&D spending by businesses in Scotland has increased more rapidly than in the UK: in real terms Scottish BERD spend increased by 99.5% between 2007 and 2020, whereas in the UK BERD spending increased by 29.4%.

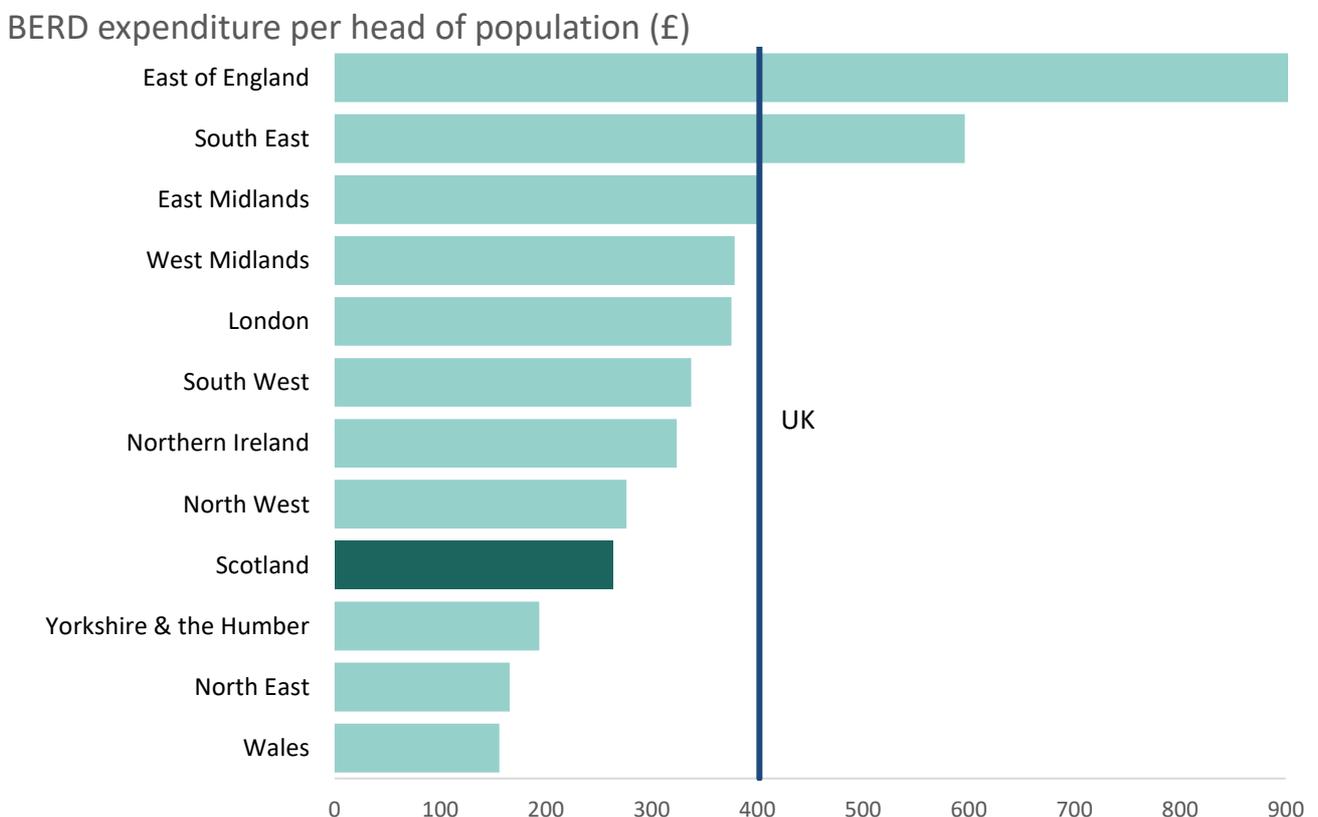
In 2020, BERD spend per person in Scotland was lower than for the UK (£263 vs £402). Similarly, BERD expenditure as a share of GDP in Scotland was lower than for the UK (0.92% vs 1.26%).

Scotland ranked eighth out of the twelve UK regions for BERD expenditure as a share of GDP in 2020

A large proportion of the UK's business spending on R&D occurs in the East of England and the South East: these two regions had the highest BERD expenditure and the highest BERD spend per person in 2020. As in 2019, Scotland ranked eighth out of the twelve UK regions in terms of BERD spending as a share of GDP in 2020.

R&D spending per person was over three times higher in the East of England than in Scotland (£933 vs £263). Only Yorkshire and the Humber, North East and Wales had a lower spend per person than Scotland in 2020 (Figure 11).

Figure 11. Scotland ranked ninth out of the twelve UK regions for BERD spend per head of population in 2020



Background Notes

Definition of R&D

While R&D is often thought of as synonymous with high-tech firms that are on the cutting edge of new technology, many established consumer goods companies spend large sums of money, on a systematic basis, improving existing products.

The activities that are classified as R&D differ from company to company, but there are two basic models. In one model, the primary function of R&D is to develop new products. In the second model, the primary function of R&D is to discover and create new knowledge about scientific and technological topics with the purpose of uncovering and enabling development of new products, processes, and services.

The majority of the data presented in this release are sourced from the Business Enterprise R&D (BERD) survey conducted by the Office for National Statistics (ONS).

The ONS BERD survey follows the definition of research and development proposed by the Organisation for Economic Cooperation and Development (OECD) and published in the 'Frascati' Manual. According to the manual, R&D is defined as:

“creative and systematic work undertaken in order to increase the stock of knowledge - including knowledge of humankind, culture and society - and to devise new applications of available knowledge”. R&D must contain an appreciable amount of novelty.

The Frascati Manual was originally written by, and for, the experts in OECD member countries that collect and issue national data on R&D. The definitions provided in this manual are internationally accepted and now serve as a common language for designing, collecting and using R&D data.

Sampling and Regional Estimates

The ONS BERD survey is an annual sample survey based on a continually updated register of R&D performers. The ONS 2020 BERD Statistical Bulletin is available at:

<https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/businessenterprisesresearchanddevelopment/latest>

The Northern Ireland Research and Development 2019 statistics are published at:

<https://www.nisra.gov.uk/statistics/business-statistics/research-and-development>

The UK sample size is approximately 5,400 businesses (4,000 in GB and 1,400 in NI). The response rate for the 2020 BERD survey in Great Britain was 54%, which was lower than usual because of the coronavirus (COVID-19) pandemic. This was the second year the pandemic has affected response; the rate for 2019 was 56%. The pre-pandemic rate for 2018 was 85%. This means that these estimates are subject to more uncertainty than usual because of fewer responders on which to base the survey results.

For Great Britain the top 400 businesses by size of previously reported R&D expenditure are automatically selected and receive the long form (referred to as “large R&D performers”).

The remaining 3,600 businesses are selected from the pre-determined list of R&D performers by stratified random sampling where the strata are defined using employment and industry product group.

For Northern Ireland, a census survey is carried out of approximately 1,400 known R&D performers.

A summary quality report for the ONS BERD survey is available at: <https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/methodologies/ukbusinessenterpriseanddevelopmentssurveyqmi>

Coverage

BERD includes business enterprise R&D performed in Scotland irrespective of the residence of the ultimate owner. BERD excludes R&D funded by Scottish businesses that is performed overseas.

BERD excludes R&D carried out by higher education or government (including government departments, agencies and non-departmental public bodies; local authorities; and private non-profit organisations). Public corporations are counted as business enterprises.

Gross expenditure on R&D in Scotland in 2020 performed by all sectors of the economy (i.e. business, higher education and government) will be reported separately in Spring 2022.

Product groups

The 400 large R&D performers are asked to select the industry product groups that best describe the type of R&D activities they undertake. In 2009, these product groups were updated to better reflect the new Standard Industrial Classification (SIC 2007) codes. For the smaller R&D performers, no product group data are collected in the BERD survey. However, the business' Standard Industrial Classification (SIC) codes are known from the Inter-Departmental Business Register (IDBR) and the assumption is made that the R&D expenditure is for the detailed product group corresponding to that

SIC. This approach must be regarded as approximate since, in practice, an individual business can perform R&D for a range of product groups.

The introduction of SIC 2007 in the 2009 survey resulted in some businesses' R&D moving to a different product group than previously published. The largest impact was for businesses with Publishing activities, as these moved out of the manufacturing sector to be included under Miscellaneous business activities. There was an increase in the Other manufactured goods product group due to businesses being reclassified from Textiles, clothing and leather products, Pulp and paper products, Rubber and plastic products, Fabricated metal products, Machinery and equipment and Precision instruments and optical products.

The broad product groups, which consist of aggregations of the detailed product groups, were refined and expanded in 2002 in order to more accurately categorise the data within the manufacturing and services. Since 2011, sewerage and waste management is included in the Other total, when previously it was included in manufacturing.

Discontinuities in the data

The BERD survey questionnaire was redesigned from the 2007 survey to better reflect user needs and to address concerns about data quality and difficulty in completion. While the changes are an improvement, they could have an impact on the comparability of the data returned. Unfortunately, it is not possible to measure this impact.

Employment

Employment is calculated by respondents to the ONS BERD survey on the basis of 'full-time equivalent' staff average over the year. The categories of employment used are:

- Researchers (scientists and engineers) – engaged in the conception or creation of new knowledge, products, methods and systems
- Technicians – perform scientific and technical tasks normally under the supervision of researchers
- Other (administrative) – support staff including skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects

Real terms

The cash values are converted to real terms using Treasury GDP deflators. The deflators are available at:

Time period for which the results relate

Respondents to the ONS BERD survey were asked to make a return for the calendar year 2020 or the nearest 12 month period for which figures were available. Data for all years published were collected on the same basis.

Revisions Policy

BERD Scotland follows the Revisions Policy for the ONS BERD results – the latest (year t) results are provisional until two years later (year t+2).

Latest Revisions

The 2018 and 2019 data have been revised to take account of company misreporting and late returns.

One indication of the reliability of the main indicators in this release can be obtained by monitoring the size of revisions. Table 1 records the size and pattern of revisions that have occurred since 2012.

Table 1: Revisions between first publication and most recent estimate, figures in thousands

Year	Year in which data was published									Change in expenditure between first and latest estimate	
	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Year the data relates to	2012	£706,804	£709,047	£708,662							£1,858
	2013		£797,704	£896,528	£801,043						£3,339
	2014			£905,193	£874,020	£957,080					£51,887
	2015				£870,863	£952,626	£952,625				£81,762
	2016					£1,072,134	£1,074,544	£1,052,052			£20,082
	2017						£1,247,278	£1,250,453	£1,250,453		£3,175
	2018							£1,355,924	£1,355,129	£1,364,258	£8,334
	2019								£1,408,905	£1,435,490	£26,585
	2020									£1,437,261	

There was a large revision in the 2015 data between the 2015 publication and the 2016 publication, which was partly due to a large increase in expenditure in the 'Miscellaneous business activities; Technical testing and analysis' Service product group.

Sampling variability

The estimates in this publication are based on a stratified sample drawn from the population of businesses known to actually perform R&D or are likely to be R&D performers. As with any sample survey, the R&D survey is subject to two types of possible errors:

Sampling errors, due to only a sample of the population being surveyed. The difference between the estimates derived from the sample and value that would be obtained from a census is referred to as the sampling error. The Business Enterprise Research and

Development Survey has provided standard errors information in the past but the methodology for estimation of the standard errors used to measure these is currently under review.

Non-sampling errors – these include factors such as population coverage misreporting and non-response bias; these errors are generally hard to quantify, because of the problems ensuring that businesses adhere to Frascati R&D definitions.

Analysis of R&D expenditure by SMEs (Small and Medium-sized Enterprises)

A table giving estimates of R&D expenditure by SMEs has been included. The SME definition used is that under European Commission Recommendation (2003/361/EC) of 1 January 2003, in which SMEs are defined as enterprises with less than 250 employees. In addition, a criterion of independence is used to exclude enterprises that are part of a larger enterprise group, so that only true SMEs are evaluated. This criterion is important in the context of R&D estimates, given that R&D activity is often carried out by smaller businesses which form part of larger, sometimes multinational businesses.

To apply the SME definition, historic information on business ownership has been obtained using that currently held on the IDBR. Caution should therefore be used in making comparisons over time.

Code of Practice for Official Statistics

This is a National Statistics publication. It has been produced to the high professional standards set out in the Code of Practice for Official Statistics.

In 2012, the Scottish Government Research and Development statistical publications were assessed by the United Kingdom Statistics Authority (UKSA) for compliance against the Code of Practice for Official Statistics. Details of the assessment are available at:

[Assessment Report 189 - Statistics on Scottish Businesses and Research and Development \(statisticsauthority.gov.uk\)](https://www.statisticsauthority.gov.uk/assessments/assessment-report-189-statistics-on-scottish-businesses-and-research-and-development/)

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics.

Designation can be broadly interpreted to mean that the statistics:

- meet identified user needs
- are well explained and readily accessible

- are produced according to sound methods, and
- are managed impartially and objectively in the public interest.

Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed.

Uses

Information from the Scottish BERD publication is used by the Scottish Government to monitor performance and inform economic policy. Some of the external users of R&D statistics published by the Scottish Government include the Enterprise Networks and Local Authorities.

User Engagement

If you would like to be kept informed about on-going developments with regards to the Scottish BERD publication and future releases of R&D data, please register to receive updates via [ScotStat](#) (under Economy topic pick R&D and Innovation).

There is also the ScotStat Scottish Economic Statistics Consultation Group (SESCG) – more information on the group is available at:

<https://www.gov.scot/groups/scottish-economic-statistics-consultation-group/>

If you would like to join SESCAG or provide feedback on the Scottish BERD publication, please contact us at:

Business and Innovation Statistics, Office of the Chief Economic Adviser, 5 Atlantic Quay, 150 Broomielaw, Glasgow, G2 8LU

Telephone: 0131 244 6813

Email: industrystatistics@gov.scot

There is also an ONS-led user community that may be of interest to R&D users. Details of this are available at the Business and Trade Statistics Community on the [StatsUserNet](#) website.

A National Statistics publication for Scotland

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics.

Designation can be interpreted to mean that the statistics: meet identified user needs; are produced, managed and disseminated to high standards; and are explained well.

Correspondence and enquiries

For enquiries about this publication please contact:

Marina Curran,
Office of the Chief Economic Adviser,
Telephone: 0131 244 6813,
e-mail: industrystatistics@gov.scot

For general enquiries about Scottish Government statistics please contact:

Office of the Chief Statistician, Telephone: 0131 244 0442,
e-mail: statistics.enquiries@gov.scot

How to access background or source data

The data collected for this statistical bulletin:

- are available in more detail through Statistics.gov.scot
- may be made available on request, subject to consideration of legal and ethical factors. Please contact industrystatistics@gov.scot for further information.
- cannot be made available by Scottish Government for further analysis as Scottish Government is not the data controller.

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