Office for National Statistics

Statistical bulletin

Business enterprise research and development, UK: 2021

Spending and numbers employed on research and development by businesses in the UK, including data on sources of funds and regional spread.

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1 . Main points

- Expenditure on research and development (R&D) performed by UK businesses (in current prices) was £46.9 billion in 2021, an increase of £2.9 billion since 2020 and £5.9 billion since 2018, which is the first data period produced using improved methodology.
- The methodology used to produce estimates of R&D performed by UK businesses has been improved to better represent smaller businesses.
- Values of expenditure on R&D performed by UK businesses in 2018, 2019 and 2020 were £15.8 billion, £16.1 billion, and £17.1 billion higher than previously published.

The new figures provide the current best estimate of R&D at the UK level which have been validated against other available data. However, there is less data for validation and increased uncertainty in the estimates below the UK level. To maintain the quality of the statistics, this publication will feature a reduced number of detailed breakdowns compared with previous releases. While the existing National Statistics designation for the total level R&D figures will remain, to help convey the uncertainty, the Office for National Statistics (ONS) asked the Office for Statistics Regulation (OSR) to temporarily pause the National Statistics status of the detailed breakdowns. OSR confirmed their agreement to this approach in their letter published on 21 November 2022. This is until further redevelopment takes place and there is more certainty on the distribution below this level. The methodological improvements have been implemented at the UK level from 2014 onwards, and at the detailed level from 2018 onwards, meaning that comparisons of detailed estimates before 2018 are not possible. Further work is underway to improve how the business enterprise research and development (BERD) statistics are compiled in the future, including developing a better method for drawing the sample to be used in the BERD 2022 survey.

2 . Business enterprise research and development data

Business enterprise research and development, UK (designated as national statistics)
Dataset | Released 22 November 2022
UK estimates of annual research and development (R&D) spending by UK businesses.

Business enterprise research and development, UK (designated as official statistics)
Dataset | Released 22 November 2022
Annual research and development (R&D) spending and employment by UK businesses, including data by product category and employment on R&D.

Business enterprise research and development time series
Dataset | Released 19 November 2021
The Business enterprise research and development (BERD) time series dataset will no longer be updated. All new data released as part of BERD statistical bulletins in the future will continue to be available in the datasets associated with the statistical bulletin.

The BERD time series dataset will remain on the Office for National Statistics' (ONS') website as last updated on 19 November 2021, when the 2020 statistical bulletin was published. If there are any revisions to previously published estimates in future BERD publications, these will no longer be reflected in the BERD time series dataset.

3 . Measuring the data

The main source of estimates for this publication is the annual business enterprise research and development (BERD) survey. This collects annual data on UK businesses that perform research and development (R&D).

In this statistical bulletin, R&D and related concepts follow internationally agreed standards defined by the Organisation for Economic Co-operation and Development (OECD), as published in the Frascati Manual 2015.

R&D can be measured by the expenditure on R&D performed by a business, or the funding received by a business for R&D work. These are often, but not always, the same. Performance is regarded as a more accurate measure than funding received, as not all funds received may be used as intended. This release reports on R&D expenditure in UK businesses irrespective of the country of residence of the ultimate owner or users of the R&D produced.

All figures quoted are in current prices unless otherwise stated.

4 . Methodological developments

Although our best available estimates at the time, it has been established that there is under-coverage of small businesses in previously published business research and development (BERD) statistics.

The population of businesses that the BERD survey sample is drawn from has been built up over time from responses to feeder questions on other Office for National Statistics (ONS) business surveys. These include the Annual Business Survey (ABS), the UK Innovation survey and the International Trade in Services survey. Historically, these feeder survey responses have been used to identify businesses that perform research and development (R&D), forming a reference list, or population, of businesses that the BERD sample is drawn from. The returns from businesses sampled by the BERD survey are then used to estimate for the BERD survey population.

It is this process that has resulted in the under-coverage of small businesses in the statistics. This approach is also unlike other business surveys that draw their sample directly from the Inter-Departmental Business Register (IDBR), and use their survey responses to estimate for all businesses on the IDBR.

The surveys with the feeder questions used to create the BERD reference list, such as the ABS, carry out a census of all large businesses (having an employment total of 250 employees or over) and smaller businesses are randomly sampled. Therefore, many small businesses will, historically, not have been sampled by surveys such as the ABS. These businesses could potentially perform R&D but have not had the chance to be identified as R&D performers and added to the BERD survey population, meaning they are not accounted for in BERD statistics.

In this release, methodological improvements have been made to address this under-coverage, so that the BERD survey results include a better representation of small businesses performing R&D. The approach uses uplift factors that have been applied to the survey results, which have otherwise been prepared using the usual BERD survey results processes.

Interim uplift factor approach

The BERD reference list does not include all R&D performers because of the design of the surveys that are used to update it. These surveys are random samples of the IDBR, which is a list of all UK businesses. They only sample a small fraction of IDBR businesses, from which they estimate UK-wide totals. All IDBR businesses not sampled have no potential to be added to the BERD reference list, so needed to be estimated for. This has been done by estimating the number of R&D businesses direct from the IDBR using the ABS – the largest of the surveys that update the BERD reference list. This “IDBR” estimate was divided by the estimated number of R&D businesses, as estimated by the BERD survey from its reference list – the “BERD” estimate. The ratio of the two was used to uplift the results from the BERD survey that had been produced using the usual survey methods.

The uplift has been carried out within each BERD published product group, for large and small businesses, separately. The BERD estimates for the 400 largest R&D performers did not have any uplift applied. They are automatically included in the BERD sample because of the size of their previously reported R&D expenditure, as they only represent themselves, and are not part of the process of estimating for other non-sampled businesses.

The 2018 period is the most robust recent period prior to the coronavirus (COVID-19) pandemic. Therefore, this period was used to calculate the uplift factors to create new estimates for 2018. Growths in the underlying survey results were then applied to the 2018 uplifted estimates, to calculate the annual BERD results up to and including 2021. This method was also applied to calculate estimates back to 2014, but only at a total level.

Further technical information about how and why the uplift approach was developed is available in our Comparison of ONS business enterprise research and development statistics with HMRC research and development tax credit statistics article published on 29 September 2022.

More information about the range of approaches considered and how these were validated can be found in our Options for transformation of business enterprise research and development statistics’ article published on 22 November 2022. Note that the 2018, 2019 and 2020 values for business R&D in these articles were the latest available at the time the work was undertaken, but they have been updated in the BERD 2021 statistical bulletin.

The new figures provide the current best estimate of UK-level BERD, which have been validated against other available data. However, as the uplift factors have been applied to the results after the survey has run in the usual way, the estimates are subject to some uncertainty. This uncertainty increases below the UK level and there is also less data for validation. To maintain the quality of the statistics, this publication features fewer detailed breakdowns than usual. We aim to reinstate these breakdowns in the next publication, once further development work to improve the quality of BERD statistics has been implemented.

The existing National Statistics designation for UK level business R&D expenditure in BERD will remain. However, to help convey the uncertainty, the Office for National Statistics (ONS) have asked the Office for Statistics Regulation (OSR) to temporarily pause the National Statistics status of the detailed breakdowns that involve BERD. This is until the further redevelopment takes place and there is more certainty on the distribution below the total level.

Northern Ireland

As the BERD statistics for Northern Ireland are compiled separately from those for Great Britain, a similar uplift approach has been applied independently to the results for Northern Ireland. The uplifted estimates for Great Britain and Northern Ireland have then been combined to provide UK totals in the usual way.

Future developments

The methodology changes implemented in this bulletin should be regarded as interim improvements. Work is underway to develop better sampling methods in the future, and this new design will be used for the BERD 2022 survey. This new design will account for businesses that previously would not have been identified as R&D performers, and therefore would not have been added to the BERD reference list. Further work is underway to improve how the BERD statistics are compiled.

Impact on gross domestic expenditure on research and development (GERD) statistics from new BERD methodology improvements

The GERD statistics measure total expenditure on R&D performed in the UK by all sectors of the economy. As the BERD sector is the largest sector by value of expenditure, the improvement to methods implemented in this BERD release will affect the GERD results, which can be seen in the 2020 GERD statistical bulletin also published on 22 November 2022.

Impact on measures of R&D as a proportion of gross domestic product (GDP)

The estimates of the percentage of gross domestic product (GDP) that was spent on R&D performed by businesses in the UK, that are usually published in the BERD results, are not available in this release. This is because we have not yet incorporated the improvements to the measurement of R&D in the business sector into the calculations of GDP. The earliest opportunity to add the revised R&D estimates into national accounts will coincide with completion of the next stage of development towards the end of 2023. We will look to reinstate this calculation in future releases once these changes have been incorporated fully into UK GDP estimates.

Quality

The methodological improvements have been implemented from 2014 onwards at the UK level, and at a detailed level from 2018 onwards. Revisions to the survey data have also been incorporated from 2018. As a result, users should consider growth rates from previously published BERD data as indicative of trends over time, but this should be done with caution.

More quality and methodology information on strengths, limitations, appropriate uses, and how the data were created is available in our Business Enterprise Research and Development Survey QMI.

5 . Related links

Gross domestic expenditure on research and development, UK: 2020
Bulletin | Released 22 November 2022
Annual estimates of research and development (R&D) performed and funded by business enterprise, higher education, government, UK Research and Innovation (UKRI), and private non-profit organisations.

Research and development expenditure by the UK government: 2020
Bulletin | Released 8 April 2022
R&D and related expenditure by UK government departments, research councils and higher education funding councils. Formerly released as UK government expenditure on science, engineering and technology (SET).

6 . Cite this statistical bulletin

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