Northern Ireland Research and Development Quality Report, 2025

Geographical Area: Northern Ireland

Theme: Economy

Frequency: Ad hoc

Introduction

This report refers to the Northern Ireland Research and Development (R&D) Survey and provides further information on the quality of the data used to produce the publication and the statistical time series. This will allow users to be better informed about the quality of the information upon which they may be drawing conclusions and making decisions.

Different quality dimensions related to the Code of Practice for Statistics are listed and assessment of the R&D survey data, and associated publication, against each dimension is provided.

The Northern Ireland R&D statistics are published annually on the NISRA website.

Contents

Dimension – Relevance

The degree to which the statistical product meets user needs in both coverage and content.

Assessment by the Author

R&D data is a key economic indicator which measures Research and Development activity over time and allows comparisons to be made with UK figures. R&D activity contributes to the development of new technologies, products and processes and is a key driver of productivity growth. The Northern Ireland R&D surveys cover the business sector, higher education and other government financed activities. It includes information on the level of R&D; sources of funding for R&D; R&D across sectors; employment in R&D. It provides important indicators of the extent to which Northern Ireland companies, higher education establishments and government departments are investing in the activities that underlie future economic development.

All of the data are obtained from statutory annual surveys of Research and Development (R&D) within Northern Ireland. Each of the three sectors (Businesses, (BERD), Higher Education Establishments (HERD), and Government Departments (GovERD)) receive a form.

A draft BERD form is available to view online here -
https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/RD-Form.pdf

R&D data are made widely available and used by those with an interest in the NI economy. This includes:

- Economists and economic commentators both within and outside Government in assessments of the state of the economy;
- The NI Assembly/Government Departments require a variety of indicators, which measure the state of the NI economy for planning, policy and monitoring purposes;
- The Northern Ireland R&D data is provided to the Office for National Statistics for inclusion in the UK published results;
- In addition, significant non-governmental users of the data include Employer's Associations, Universities and academics, the Economic Research Institute of Northern Ireland, academic researchers both home and abroad, the media and the general public.

The Northern Ireland Research and Development Survey is also a key indicator of innovation in the economy. The Economy Minister has laid out his economic vision for Northern Ireland and one of the key objectives is to raise productivity in the region. One of the main ways this can be achieved is through supporting R&D in business, higher education and government.

Dimension - Accredited Official Statistics Status of Northern Ireland R&D Statistics

Assessment by the Author

The figures included in this bulletin detail the best current estimates of R&D spend at a Northern Ireland level, which have been validated against other available data. However, due to a lack of other data sources to validate against there is less certainty in the estimates below the total Northern Ireland level.

To maintain the quality of the Northern Ireland R&D statistics, this publication will feature a reduced number of detailed breakdowns compared with pre-2021 R&D releases. The existing Accredited Official Statistics designation (previously referred to as National Statistics) for the Northern Ireland level R&D figures will remain (Chart 1, Chart 2, Chart 3, Chart 10 and Chart 11 of the most recent publication) as they comply with the standards of trustworthiness, quality and value in the Code of Practice for Statistics. To help convey the developmental nature of the sub-NI components, the Northern Ireland Statistics and Research Agency (NISRA) has asked the Office for Statistics Regulation (OSR) to temporarily pause the Accredited Statistics status of more detailed breakdowns. The OSR confirmed their agreement to this approach in their letter published on 8th December 2022.

In July 2024 OSR published their Spotlight on Quality Assessment for the Northern Ireland R&D statistics. This identified two requirements that NISRA need to fulfil in order to see the official statistics reaccredited. These are as follows:

- **Requirement 1:**
  To provide transparency and to further understand users' needs, NISRA should engage with users and ONS to further discuss the value of and the potential to provide a back series beyond 2018.
- **Requirement 2:**
  To further users' understanding, NISRA should work with users to identify what they require to understand the drivers of revisions to NI BERD statistics and how NISRA can improve communicating uncertainty. This will also enhance transparency and trust in NI BERD statistics.

Work is on-going to address these requirements. See sections 'Dimension - Accessibility and Clarity' and 'Dimension - Assessment of User Needs and Perceptions' for further information on how NISRA has directly engaged with users to both understand their needs and identify how to enhance transparency and trust in NI BERD statistics. Further engagement with the OSR is planned once work on the two requirements above is completed.

NISRA has worked closely with the Office for National Statistics (ONS) to redesign the BERD methodology to be more reflective of R&D performance across the Northern Ireland economy. This has ensured that there is consistency in approach and coherence with the methodological improvements implemented by the ONS for the UK equivalent figures. Further information on methodological improvements that have occurred over the previous two years can be found at the below links:

Options for Transformation of Business Enterprise Research and Development Statistics - Office for National Statistics

Business enterprise research and development, UK - Office for National Statistics (ons.gov.uk)
Gross domestic expenditure on research and development, UK: 2020 - Office for National Statistics (ons.gov.uk)

Methodological improvements have been implemented at the Northern Ireland level from 2018 to 2021 and again from 2022 to 2023. This creates a discontinuity in the series which means that comparisons of estimates before and after 2018 should be treated with caution.

Dimension – Accuracy

The proximity between an estimate and the unknown true value.

Assessment by the Author

Further details of the R&D survey methodology is contained in the background notes of the statistics bulletin.

BERD Methodology and Interim Improvements (2018 – 2021 reference periods)

Although these remain our best available estimates, it has been established that there was some under-coverage of small businesses in previously published Business Enterprise Research and Development (BERD) statistics up to the 2020 survey reference period.

For the 2021 Northern Ireland R&D publication, the 2018-2021 BERD statistics were adjusted to account for the under-coverage of small businesses. This interim approach led to a more accurate account of BERD than previously published. Previously, sample information was gained from:

- Previous NISRA R&D surveys;
- Extra information from various sources such as the Office for National Statistics (ONS) and Invest NI;
- SIC 72 (Scientific research and development) companies (drawn from the NISRA Business Register and Employment Survey (BRES));
- A filter question on the NISRA Annual Business Inquiry (ABI) (which asks businesses whether or not they completed R&D during the year).

As a result, sampling methods were improved from the 2022 reporting period onwards to better represent R&D performance across the Northern Ireland economy. This improvement in sampling methods has now produced figures which provide the best current estimate of Business level R&D spend at the Northern Ireland level and has been validated against other available data.

There is a good level of coherence between the uplifted figures for 2018-2021 BERD data and the figures obtained for 2022 and 2023 BERD data using the new methodology, however users should still consider comparisons between 2018-2021 and post-2022 data with caution.

Post-2022 BERD Sampling Method

As with previous years, the annual Business Enterprise Research and Development (BERD) Survey remains the main source of information for this report. This survey collects annual data on the nature and scale of R&D spend among NI businesses.

The 2023 sample was developed using a stratified sample design, where approximately 1,500 Northern Irish businesses were selected. Rather than relying on other NISRA business surveys to build and maintain the BERD sample, the new methodology draws businesses directly from the Inter-Departmental Business Register (IDBR) based on stratification by size band and industry, alongside census elements.

To maximise survey precision, the Neyman allocation approach to sampling is utilised. Neyman allocation is a sample allocation method that may be used with stratified samples. The purpose of the method is to maximize survey precision, given a fixed sample size. The survey universe is stratified by industry and employee size band, all businesses with over 250 employees or within certain industries are fully enumerated. In addition, some companies of special interest to government agencies (for

example Invest NI clients) are added to the sample. This information is then grossed up to the reporting unit population, to ensure that results are representative of the sampled population.

It is worth noting that a number of NI companies are part of national and international companies. Many concentrate their R&D at particular sites, not necessarily in NI, although all of their plants, including those in NI, will share in the benefits of research.

In 2023, 65% of businesses returned their BERD survey form. Continuing efforts are made each year to maximise response rates and to minimise the impact of non-response to the survey:

- Across the Economic and Labour Market Statistics branch there has been a drive to increase the rate of web form responses. For the 2023 R&D survey, over 90% of all returns were submitted via web form;
- The survey response window is often extended to allow businesses longer to submit their survey return;
- A specific list of high priority businesses receive additional contact near the end of the survey cycle to encourage a response.

As a result, 87% of total R&D spend in 2023 is covered by receipted businesses.

Processing/Validation errors

When data is submitted by businesses there are a range of comprehensive validation rules in place to ensure that data provided is sound and within expected ranges. Data validation is carried out on the returned forms ensuring internal consistency within the form. The various methods of data validation and quality assurance checks carried out include:

- Checking data falls within expected limits as per previous returns made by the company;
- If the data raises concerns, the company is contacted for clarification where appropriate;
- If we are unable to get in contact with a company regarding a validation error, the data is compared with clean responses from other companies to ensure any processing changes fall in line with information provided by similar returns in the sample;
- Sourcing missing data from other ELMS surveys. For example, several business surveys collect turnover and payroll information, which can be used to inform R&D data and imputation procedures.

These processes ensure that the data we analyse for our results production are robust, sound and fit for their originally intended purpose. Processing and validation errors have a negligible impact on the data series.

Disclosure control

Standard disclosure control methodology is applied to the R&D data. This ensures that information attributable to an individual or business is not identifiable in any published outputs. The Northern Ireland Research and Development Survey is carried out under the Statistics of Trade and Employment (Northern Ireland) Order 1988. Article 7 (1) of this order requires that:

> *No individual estimate or return, and no information relating to an individual undertaking, obtained by a Northern Ireland department under the foregoing provisions of this Order or under the Statistics of Trade Act (Northern Ireland) [1949 c. 7 (N.I.)] 1949 shall, without the previous consent in writing of the person carrying on the undertaking which is the subject of the estimate, return or information, be disclosed by any person…*

For BERD data the following disclosure controls are applied:

- If the top business in a breakdown accounts for more than 91% of the total value data values are suppressed;
- If the top business in a breakdown accounts for more than 47% of the total value; there are less than 10 businesses with >£0 spend in the cell; and the smallest N-2 businesses account for over 10% of the total, values are suppressed;
- Secondary disclosure is applied: if a suppressed value can be calculated by a subtraction from a total then a further value is suppressed.

SIC used

Data prior to 2009 are on a SIC 2003 basis, data post-2009 are on a SIC 2007 basis. Care should therefore be taken when making comparisons with reports pre-2009.

Non-response errors

Not all businesses respond to the survey. The characteristics of these businesses may be different from those that do respond. However, as the size and industrial classification of the non-responding businesses are known we are able to construct estimates based on this information and this has a limited impact on the overall series.

Non-responding businesses were estimated to make up 13% of total NI BERD spend for 2023.

The vast majority of estimates for non-responders are calculated using one of three methods:

1. For companies which were on the R&D survey the previous year – The median percentage change in total R&D spend across the year among responders within a given SIC code is used to estimate spend for those businesses in the same SIC code that failed to reply to the survey.

2. For companies which were not on the R&D survey the previous year – The median employment to R&D spend ratio among responders within a given SIC code was calculated and then used to estimate spend for those businesses in the same SIC code using employment information collected from other surveys within NISRA's Economic and Labour Market Statistics Branch.

3. Non-responding companies which reported zero R&D spend the previous year are imputed to have zero spend for the current year.

Estimates for Invest NI companies were based on the value of offers made to promote R&D investment and the contribution of Invest NI's assistance to total planned R&D expenditure. Estimates for Invest NI companies make up less than 1% of the total non-responding company spend in 2023.

To increase the number of returns, a number of standard processes are carried out:

- Three written reminders are issued after nine, eleven and thirteen weeks following initial form post to businesses who have not yet returned their forms. Email reminders are issued where respondents have expressed the desire to be contacted in this manner;
- Several rounds of Telephone Response Chasing (TRC) is carried out on all non-returning firms who, despite these reminders, have not submitted a return. This TRC is prioritised in descending order of importance businesses have to the coverage of R&D spend.

Specific processes are also carried out to increase returns among high priority businesses:

- Approaching the end of the survey response window, a bespoke list of still outstanding high priority businesses continue to receive contact via both email and telephone to encourage a response.

Provision of revised data

Revisions to data occur for a number of reasons: late returned questionnaires, incorrect estimates and changes to previous year's data. One dimension of measuring accuracy is reliability, which can be measured using evidence from the analyses of revisions to assess the closeness of first published estimates to subsequently revised values.

HERD Methodology

NISRA carries out an annual survey of R&D expenditure among Higher Education Establishments in Northern Ireland. The figures shown in Chart 10 of the 2023 PDF bulletin provide combined results from the two Northern Ireland universities - Queen's University Belfast (QUB) and the Ulster University (UU). The data collected refers to the academic year i.e. 2022/2023 ending 31/7/2023. The universities have made data available for this period on the basis of Transparency Review data collected within each respective institution.

GovERD Methodology

The ONS collects annual data on total UK government expenditure on science, engineering and technology (SET). SET expenditure by the UK government includes expenditure by Government Departments, Research councils and Higher Education Funding Councils (HEFCs). It also includes expenditure on R&D conducted within Government Departments.

ELMS acts as a 'post-box' for ONS on the GovERD Survey, with an administrative role in issuing the GovERD forms to the various NI Government departments. Once returned to ELMS, the GovERD survey forms are then uploaded to an ONS secure server where responses are processed and queries are sent through from ONS to ELMS to investigate further if required.

By collecting Government Department R&D data in conjunction with the results from the NISRA BERD and HERD surveys, it has been possible to compile a more complete picture of total expenditure on R&D in NI. The figures described in Charts 1, 2 and 3 of the 2023 PDF bulletin, expenditure by Businesses, Higher Education establishments and Government departments complement each other; i.e. there is no double counting.

Dimension Timeliness and Punctuality

The time gap between publication and the reference period. Punctuality refers to the gap between planned and actual publication dates.

Assessment by the Author

The Annual R&D bulletin is usually published 10 months after the end of the reference period.

The Economic and Labour Market Statistics (ELMS) publications schedule is available online and provides twelve months advance notice of releases: https://www.nisra.gov.uk/publications/elms-publication-schedule

The Annual R&D bulletin is usually published in December. In the unlikely event of a change to the pre-announced release schedule, public attention would be drawn to the change and the reasons for the change explained fully at the same time, as set out in the Code of Practice for Official Statistics.

The timeliness of when the R&D data can be published is influenced by the survey response window period, i.e. months during which businesses are able to return their form. This response window is around 6 months and usually commences in late Spring every year, this is to allow businesses to complete their year-end financial statements and subsequently provide higher quality R&D survey returns. There may also be reason to extend the response window to maximise survey returns from high priority businesses. For example, the 2023 R&D survey response window was extended to engage in further contact with a specific list of high priority R&D contributors, encouraging a response. As a result of such efforts, 87% of total R&D spend in 2023 is covered by returns submitted by businesses.

Dimension - Accessibility and Clarity

The ease with which users are able to access the data, also reflecting the format in which the data are available and the availability of supporting information. Clarity refers to the quality and sufficiency of the metadata, illustrations and accompanying advice.

Assessment by the Author

R&D statistical bulletins contain tables, graphs and text and conform to the standards set out in the Code of Practice for Official Statistics. The publication contains both 'Introduction' and 'Methodology' sections which provide information on the scope of the survey, details of the data collection process, validation process and methodology for users. It is published in the following formats on the NISRA website:

- HTML;
- PDF;
- Excel; and
- ODS.

The R&D statistical bulletin is available on the NISRA website and free to download from 09:30 on the day of publication in various formats (see the 'Timeliness and Punctuality' section above for more information).

The ELMS R&D Helpline can be contacted either by phone (0300 200 7832) or by email (rdhelpline@finance-ni.gov.uk).

Enquiries from the media are directed through the DoF Press Office.

NISRA operates a policy whereby publications are available on request in alternative formats such as Braille, large print and minority ethnic languages.

As part of the user online consultation which was conducted in September 2024 (for more detail on this see section 'Dimension - Assessment of User Needs and Perceptions' below) users were asked 'Which format/s do you find the most useful for the presentation/publication of NI R&D data'. Feedback indicated that users find the detailed excel publication document and the summary bulletin most useful. Copies of the 2023 detailed excel publication document and PDF/HTML summary bulletins can be accessed here. Archive publication documents (dating back to 2001) can also be accessed here.

Dimension - Coherence and Comparability

The degree to which data that are derived from different sources or methods, but refer to the same topic, are similar. Comparability is the degree to which data can be compared over time and domain.

Assessment by the Author

The data used to calculate R&D are sourced from the Annual Survey of Research and Development in Northern Ireland.

NISRA's BERD figure in comparison to ONS's NI BERD figure: NISRA has worked closely with the Office for National Statistics (ONS) to redesign the BERD methodology to be more reflective of R&D performance across the Northern Ireland economy. This has ensured that there is consistency in approach and coherence with the methodological improvements implemented by the ONS for the UK equivalent figures (see the 'Accredited Official Statistics Status of Northern Ireland R&D Statistics' section above for more information).

It should be noted that the total BERD figure for Northern Ireland published by NISRA is slightly lower than the regional estimate published by ONS. This is because of a small proportion of R&D being performed in Northern Ireland, but by GB businesses (£37 million in 2022; £49 million in 2023). These businesses are in scope for the GB BERD survey and are excluded from the results published by NISRA. We continue to work closely with the ONS to ensure no duplication exists.

Cross survey checks with the Northern Ireland Annual Business Inquiry (ABI): While there is no directly comparable source for R&D information, the Northern Ireland ABI data (also carried out by the Economic and Labour Market Statistics Branch) are available for checks to be undertaken to ensure consistency between the R&D returns and the data returns from the ABI. Specifically, a filter question on the ABI asks companies whether or not they carried out R&D during the reporting period (the same reporting period as the NI R&D survey).

Comparisons of Northern Ireland BERD Data across years: As methodological improvements have been implemented for the 2022 and 2023 surveys, users should consider comparisons between pre-2022 BERD data and post-2022 BERD data with caution. This is in addition to the interim changes (discussed above) made for 2018-2021 BERD data – therefore users should also consider comparisons between pre-2018 BERD data and 2018-2021 BERD data with caution (see the 2021 NI Research and Development publication for more information on the changes previously made for 2018-2021 data).

For the 2022 NI R&D release and future releases, the total BERD figure (£840.1m in 2023) refers to in-house BERD, rather than in-house plus purchased BERD as published in previous Northern Ireland Research and Development releases. This change harmonises the NI BERD figures with BERD data published by the ONS, ensuring coherence and comparability between the two sources. This change has also been applied to all previous years' data in current releases.

Revised back series update: Results for reference periods prior to 2022 are currently only available at the NI level. Work is underway, in collaboration with the ONS, and we aim to publish more detailed time series estimates (pre-2022) as soon as possible. Users will be updated when this has been completed.

NISRA's NI BERD Data in Comparison to HMRC R&D Tax Credit Data: Another source of data on R&D expenditure is HMRC's annual publication of R&D Tax Credits, both sources are compiled differently and for different purposes but both capture data in line with internationally recognised guidelines

outlined in the Frascati Manual. NISRA's BERD estimate is taken from an annual survey of R&D performers (see the 'Recent developments with BERD Survey Design' section above for more information). HMRC's R&D statistics are based on administrative data where businesses have applied for and received R&D tax credits. The two sources are similar but not exactly the same and there will always be some element of difference between them, there are known reasons for this, and these are outlined in more detail in ONS's article from September 2022.

ONS's analysis of the two data sources found that there has been a significant increase in the number and value of claims under HMRC's small and medium-sized enterprise scheme and the current NISRA R&D methodology employed for the 2022 and 2023 data is structured in a way that should be more reflective of R&D performed across the Northern Ireland economy.

The chart below shows that the change in R&D spend across the year (from 2022 to 2023) is very similar across both R&D data sources (NISRA BERD data = +12.9% across the year; HMRC R&D Tax Credits data = +14.5% across the year).

Chart: Difference in NISRA BERD data and HMRC R&D Tax Credits data (£millions), 2022-2023 (NISRA) and 2021/2022-2022/2023 (HMRC)*
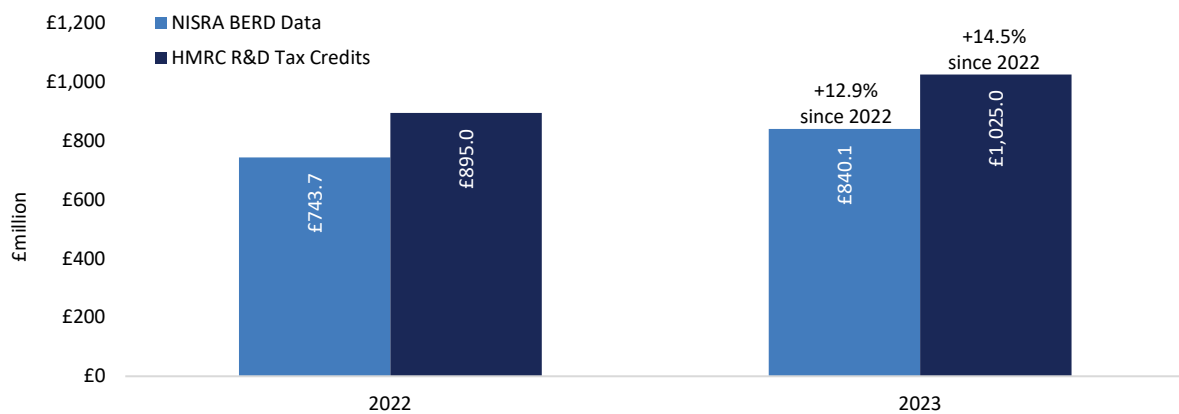
*NISRA BERD data refers to calendar year; HMRC R&D Tax Credits data refers to financial year.
Source = Corporate tax: Research and Development Tax Credits

Dimension - Trade-offs between Output Quality Components

The extent to which different aspects of quality are balanced against each other.

Assessment by the Author

As R&D is a short-term indicator, user demand is focussed on the timeliness of the estimates. The main limiting factor is the availability of activity data from businesses. Estimates are published as soon as possible after validation and quality assurance is finished and statistical analysis has completed. As a result, revisions are an inevitable consequence of the trade-off between timeliness and accuracy. Revisions are typically very small in nature.

Dimension – Improvements made to in-house statistical processing

In-house changes which improve the timeliness, accuracy and overall replicability of statistical processing of the data.

Assessment by the Author

Alongside the changes made to the sampling methodology, we have implemented new and improved statistical processing methods. Although our previous statistical processing system (largely SPSS based) was fit for purpose, the new processes (mainly R) have many benefits including:

- Modern statistical architecture, that provides easily repeatable, through using Reproducible Analytical Pipeline (RAP) principles, and more efficient processing of data;
- The ability to be flexible with sample design changes, both now and in the future;
- Flexibility in the system to change and improve the processing data in the future (when a need is identified);
- More efficient and timely statistical processing.

Dimension - Assessment of User Needs and Perceptions

The processes for finding out about users and uses, and their views on the statistical products.

Assessment by the Author

Key users of the R&D data were informed, in advance, that changes were being made to the methodology for the production of 2022 NI BERD results.

In light of the methodological changes to the survey, details of which were made available to the wider public with the release of the 2022 and 2023 R&D publications, NISRA held a Northern Ireland Research and Development expert user group on 13th September 2024. This meeting was attended by various users of the R&D data including fellow government statisticians, academics, policy officials and other professionals across both the public and private sectors.

During this meeting, users were presented with an overview of:

- The NISRA R&D survey;
- Progress to date of the improved methodology;
- Progress on new statistical analysis with emphasis placed on the growing use of R (as part of the NISRA RAP strategy) and it's benefits to data validation, quality assurance and statistical analysis;
- Office for Statistics Regulation engagement and recommendations updates.

Users were also informed of an online survey consultation being conducted which sought to gather more detailed expert views on the following so the team can investigate how to further improve the survey outputs:

- How and why they use the NISRA R&D data;
- How well the current NISRA R&D outputs meet their needs;
- Areas for improvement in outputs;
- Their need for a back series;
- If the recent methodological changes were well explained to them;
- If they feel NISRA provided sufficient information regarding the uncertainty of the new R&D data;
- Personal insights.

Overall, the findings from the consultation have been very positive and encouraging to the NISRA R&D team. The majority of users who responded indicated that the publication meets their needs and only minor changes are needed in order to meet the needs of the other respondents.

The results of this consultation have highlighted some areas were NISRA could improve the NI R&D publication to further meet user needs, these are as follows:

- NISRA will investigate developing confidence intervals for the data in order to give users a better understanding of the level of confidence in the data;
- NISRA will investigate the appropriateness of additional breakdowns which have been requested and seek to publish them in the next release if possible;
- NISRA are working alongside colleagues in ONS on publication of a revised back series which will be published in due course;
- NISRA will seek to include the NI R&D data on the Data Portal before the next publication date.

Dimension - Performance, Cost and Respondent Burden

The effectiveness, efficiency and economy of the statistical output.

Assessment by the Author

The latest NISRA report and a list of survey compliance costs for the Northern Ireland departments is available at: NI Statistical Surveys – Assessment of burden on businesses, households and individuals | Northern Ireland Statistics and Research Agency (nisra.gov.uk)

Dimension - Confidentiality, Transparency and Security

The procedures and policy used to ensure sound confidentiality, security and transparent practices.

Assessment by the Author

The data are held on a network that is accredited to the security level of the data and is accessible only to staff involved in the production process. During the publication process all hard copies of interim results are locked away or shredded.

Staff are regularly trained and reminded of the protocols for ensuring the data remain confidential. This covers physical security, IT security and data disclosure issues.

The Research and Development Survey operates under the Official Statistics Code of Practice and Associated Protocols. The ELMS Confidentiality Statement is available at the following link:

https://www.nisra.gov.uk/publications/dof-confidentiality-statement

All survey respondents are provided with a link to this statement as part of the documentation attached to the questionnaire.

Standard disclosure control methodology is applied to the R&D data. This ensures that all information attributable to an individual or business is not identifiable in any published outputs. More information is available in the section 'Dimension – Accuracy'.

In line with the Code of Practice guidelines on presentation and publication of official statistics, statistical announcements and statements are issued separately from other statements or comment about the figures.