

**Documentation of statistics for  
Business Enterprise Research and Development (BERD) 2022**

## 1 Introduction

The purpose of the R&D statistics of the enterprise sector is to analyse the scope of research and experimental development undertaken within the sector. This is carried out by estimating the resources used in the area, measured in R&D-expenditure and R&D-personnel broken down on industry, size class and the regional level. The survey is conducted in accordance with OECDs guidelines for R&D statistics as described in the Frascati Manual. The Danish data are comparable with the data of other OECD- and EU-countries.

## 2 Statistical presentation

The purpose of the R&D statistics is to present the scope of research and experimental development undertaken within the Danish business sector. The aim is to secure detailed statistical information on the R&D activities.

### 2.1 Data description

The total intramural expenditure is often used as an economic indicator to gauge the national innovation systems. The R&D expenditures are used as input to the "3 per cent objective", the EU goal of spending 3 per cent of GDP on R&D. 2 per cent in the business enterprise sector and 1 per cent in the Government-, Higher Education, and Private-Non-Profit sectors. R&D expenditure is also an indicator used for the Innovation Union Scoreboard (IUS). Besides R&D expenditure information on R&D activities are published as numbers of R&D personnel and broken down on regions, size class and industry.

The statistics are compiled in accordance with definitions and guidelines in the OECD's Frascati Manual.

The following indicators are measured:

- intramural R&D-expenditure
- Extramural R&D-expenditure
- Number of employees engaged in research and development (both headcounts and fulltime equivalents)

Additional variables in odd years - R&D personnel head counts and full time equivalent distributed by sex - intramural R&D expenditure by source of funds - extramural R&D expenditure by source of funds - R&D expenditures distributed - by area - by Field of Science - by type of R & D - income from R&D service - Cooperation in R&D activities - Sales of R&D services - Budget for the following year as a voluntary question

The statistics are broken down on industry (Nace rev.2), size class and regions.

## 2.2 Classification system

Industry (NACE rev.2), Size class based on number of employees (in FTE).

Size class of enterprise, based on number of full-time equivalents by the following size classes:

- 10-49 full-time employees
- 50-249 full-time employees
- 250(+) full-time employees

### Type of enterprise

- Without R&D in foreign affiliates
- With R&D in foreign affiliates

### Type of staff

- Researchers
- Other R&D-personnel including technicians

Geographically the statistics is distributed by regions.

## 2.3 Sector coverage

The statistics covers all R&D performing units in the business enterprise sector or enterprises from other sectors acting under market conditions. Also enterprises from the enterprise sector not acting under market conditions are allocated to the Private-Non-Profit sector.

## 2.4 Statistical concepts and definitions

Research and Development: Research and experimental development (R&D) comprise 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.

The five criteria for identifying R&D: To be aimed at new findings (novel) To be based on original, not obvious, concepts and hypotheses (creative) To be uncertain about the final outcome (uncertain) To be planned and budgeted (systematic) To lead to results that could be possibly reproduced (transferable and/or reproducible) There are three types of R&D: 1) Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. 2) Applied research is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. 3) Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

## 2.5 Statistical unit

The statistical unit is the enterprise.

## **2.6 Statistical population**

The survey frame is based on an extract from the National Business Register.

## **2.7 Reference area**

The survey covers Denmark.

## **2.8 Time coverage**

2007-2022

## **2.9 Base period**

Not relevant for these statistics.

## **2.10 Unit of measure**

R&D-expenditures are in 1000 DKK. R&D-personnel in headcount (HC) and full time equivalents (FTE).

## **2.11 Reference period**

The statistics is compiled annually.

## **2.12 Frequency of dissemination**

Yearly. The number of variables varies between even years (overall variables only) and odd years (overall variables supplemented with detailed information).

## **2.13 Legal acts and other agreements**

From 2007 the statistics is mandatory and produced in accordance with section 8 of the Act on Statistics Denmark (Consolidated act No 599 of 22 June 2000. Up to and including the year 2006 the survey was voluntary. Data is collected in accordance with Decision No 1608/2003/EC of the European Parliament and of the Council of 22 July 2003 concerning the production and development of Community statistics on science and technology and Commission Regulation (EC) No 995/2012 implementing Decision No 1608/2003/EC of the European Parliament and of the Council as regards statistics on science and technology.

## **2.14 Cost and burden**

- The estimated response burden is 3,9 million DKK.

## **2.15 Comment**

More information can be found on <https://www.dst.dk/fui>

### **3 Statistical processing**

The statistics is based on a survey sample of approx. 3.600 units weighted to a frame of approx 20.000 enterprises. The statistics is compiled in one joined questionnaire which covers both the R&D domain and the innovation statistics. An extensive validation process of the data is carried out. One part of the validations is integrated in the data collection in the dynamic web-questionnaire, another part is carried out after the data collection using micro- and macro validation techniques.

#### **3.1 Source data**

The statistics are an annual, sample-based questionnaire survey based on information collected from approx. 3600 companies from most size classes and all NACE-industries in the Danish enterprise sector. For 2022, information will be collected from 3,545 companies, sampled as a sample from a framework population of approx. 20.000 companies.

The data collection for R&D and innovation in business is carried out as one complete data collection in one questionnaire. For equal reference years, overall data on R&D expenditure and staff as well as the purchase of R&D services are collected. For the odd reference years, a full R&D survey is collected with detailed information on, for example, sources of funding.

The companies for the sample are selected depending on the number of employees and industry. The committee probability is 100 per cent. among the largest companies (companies with 100+ employees or turnover greater than DKK 1 billion), and the committee probability is decreasing as the number of employees decreases. To ensure the overall quality of the statistics, R & D-intensive industries have higher coverage than smaller R & D-intensive industries. The companies in the sample are randomly selected.

Based on a gross population retrieved from the Business Statistics Register, ESR, a survey population (framework population) is formed, from which companies in specific industries or with very few employees (depending on industry) are sorted. The survey population is the population that is later counted up to and thus the population that the survey describes. In 2021, the survey population consists of approx. 20.000 companies.

#### **3.2 Frequency of data collection**

Yearly. The number of variables varies between even years (overall variables only) and odd years (overall variables supplemented with detailed information).early.

#### **3.3 Data collection**

It is mandatory to reply to the statistics using the web-based questionnaire from [Virk](#)

#### **3.4 Data validation**

An extensive validation process of the data is carried out. One part of the validations is integrated in the data collection in the dynamic web-questionnaire, another part is carried out after the data collection using micro- and macro validation techniques. The individual reports from the enterprises are compared to former years reports and the registered information on number of employees and turnover. Outlier detection is also used as a validation process.

### **3.5 Data compilation**

A stratified random sampling is used on the basis of the activity of the enterprise and the number of employees. By grossing up a weighting and calibration using regression techniques is applied to the weight of the individual enterprise.

Non-response from enterprises of a certain size are imputed with "last known data" (cold deck imputation). If data from former surveys is not available for the specific record then nearest neighbor (hot deck, donor imputation) is used. Other enterprises that have not answered the questionnaire (unit non-response) are handled during the enumeration.

### **3.6 Adjustment**

Not relevant for these statistics.

## **4 Relevance**

Statistics have users in ministry of science, business organizations, researchers, business and students. Statistics are used in publications on research and in international comparisons. R&D statistics is describing the knowledge society. Part of the EU's Innovations Union Scoreboard. Micro-data is available for research through Research Service at Statistics Denmark.

### **4.1 User Needs**

- Users: Ministries, public authorities, business organizations, researchers, students, private business enterprises and the media.
- Fields of application: The statistics are included in the collection of knowledge for the Knowledge Society. Data are made available for purposes of research.

### **4.2 User Satisfaction**

Not compiled for this statistical domain. The assumption is that the intensive users are confident to the extend that they are seeking further details from data.

### **4.3 Data completeness rate**

The statistics is complete according to the Commission Regulation and the guidelines from the Frascati Manual.

## **5 Accuracy and reliability**

To minimize errors the questionnaires are supported with guidelines and instructions. However some data reports are not error-free and may reflect misinterpretations from the respondents which can lead to certain errors.

Coefficients of variance (CV) have been compiled for a range of central indicators.

### **5.1 Overall accuracy**

As the survey is based on a sample, uncertainty is attached to all the figures in form of random variation.

### **5.2 Sampling error**

Estimate of CV for 2021

- expenditures R&D 1,3 pct.
- number of FTE concerning R&D 1,6 pct.

### **5.3 Non-sampling error**

Non-sampling error primarily relate to unit not response and measurement errors. Unit not response is limited for this statistic, as the response rate in the survey is generally high - about 97 percent. R & D statistics cover a complex area, characterized by concepts that can be defined in theory, but in practice it may be difficult to make a clear separation, for example. between R & D activities and other innovation activities. To address understanding problems for the reporting of the concepts of research, development work and innovation activities, targeted efforts have been made to guide the reporting. It should be mentioned that compared to reducing the significance of measurement errors, it is considered an advantage to compare the individual enterprises' reports for R & D and innovation activities.

### **5.4 Quality management**

Statistics Denmark follows the recommendations on organisation and management of quality given in the Code of Practice for European Statistics (CoP) and the implementation guidelines given in the Quality Assurance Framework of the European Statistical System (QAF). A Working Group on Quality and a central quality assurance function have been established to continuously carry through control of products and processes.

### **5.5 Quality assurance**

Statistics Denmark follows the principles in the Code of Practice for European Statistics (CoP) and uses the Quality Assurance Framework of the European Statistical System (QAF) for the implementation of the principles. This involves continuous decentralized and central control of products and processes based on documentation following international standards. The central quality assurance function reports to the Working Group on Quality. Reports include suggestions for improvement that are assessed, decided and subsequently implemented.

### **5.6 Quality assessment**

As part of the general quality assessment a quality manual has been published for the statistical domains of Business Enterprise R&D and innovation Statistics. The manual - which is only in Danish - can be downloaded at <http://www.dst.dk/fui>. From 2009 the latest published statistics is regarded as not final - this is to secure that experiences and information from the following reference year are used to validate the data. The survey has - as all surveys based on samples - uncertainty attached to all the figures in form of random variation.

## **5.7 Data revision - policy**

Statistics Denmark revises published figures in accordance with the [Revision Policy for Statistics Denmark](#). The common procedures and principles of the Revision Policy are for some statistics supplemented by a specific revision practice.

## **5.8 Data revision practice**

The 2022 statistics is published as preliminary numbers. The reference years 2007-2021 are produced as final statistics. At the publication of the 2023 statistics the 2022 statistics will be published as final data.

## **6 Timeliness and punctuality**

The statistics is published no later than 12 months after the end of the reference year. Statistics with reference year 2022 was published 14. December 2023.

### **6.1 Timeliness and time lag - final results**

We aim at publishing the statistics not later than 12 months after the year of reference.

### **6.2 Punctuality**

The statistics is published as scheduled.

## **7 Comparability**

The statistics is compiled according to the guidelines of the Frascati Manual and the EU Regulation. There are no other comparable Danish R&D-statistics, but the Danish statistics is comparable to the R&D statistics from other EU-member states and OECD-countries. The statistics is from 2007-2016 comparable. There was a break in time series from 2016 to 2017. From 2017-2021 the statistics is comparable.

### **7.1 Comparability - geographical**

The statistics is compiled according to the guidelines of the Frascati Manual and the Regulation. The statistics is comparable with R&D statistics for other countries. The sample is drawn on a regional level and statistics on regional level is comparable.



## 7.2 Comparability over time

The statistics have been compiled since 2007 and are largely comparable in the period from 2007 until 2016. However, a data breach in time has been found from 2016 to 2017 as a result of a clarification of the definitions that follow from the update of the Frascati Manual 2015.

Data are provided to the EU Statistical Office and the OECD, both publish aggregated data in their databases. The statistics have been collected as part of an EU regulation which, among other things, describes which variables are to be delivered and for which groupings (e.g. size and industry), and the statistics are thus comparable with other EU countries' corresponding inventories.

As of the 2009 statistics, recent years are published as preliminary figures to thereby ensure that experiences and information from the latest data collection and statistics production are also included in the processing of the data material.

## 7.3 Coherence - cross domain

There are no other comparable Danish statistics. The results can be compared to other EU countries, since there is a harmonized methodological foundation.

## 7.4 Coherence - internal

There is a high degree of internal coherence in the data due to the routings of the web-based questionnaire and the intense validation process.

## 8 Accessibility and clarity

The statistics are published in Focus On Statistics Denmark (Nyt fra Danmarks Statistik) and are available from Statistics Denmark's website at <http://www.dst.dk/fui> and from the database StatBank Denmark (<http://www.dst.dk/statistikbanken>). The statistics can also be found at the Eurostat databases (under the STI-domain). For the years 2012-2020 Statistics Denmark published a more extensive publication concerning R&D and innovation: "Innovation og Forskning 2020" (Innovation and research 2020). The publication is available (Danish only) on <http://www.dst.dk>

### 8.1 Release calendar

The publication date appears in the release calendar. The date is confirmed in the weeks before.

### 8.3 User access

Statistics are always published at 8:00 a.m. at the day announced in the release calendar. No one outside of Statistics Denmark can access the statistics before they are published.

### 8.2 Release calendar access

The Release Calendar can be accessed on our English website: [Release Calendar](#).

#### **8.4 News release**

When the statistics is released a Focus on-article is published on Statistics Denmark's website - <http://www.dst.dk>. The articles can be downloaded from <http://www.dst.dk/fui>

#### **8.5 Publications**

The Business Enterprises' R&D statistics is a part of the publication "Innovation og forskning". The 2019 publication was released in April 2019 and is in Danish only.

#### **8.6 On-line database**

The statistics are published in the StatBank under [Research and development](#) in the following tables:

- [FORSKO1](#): Enterprises expenses for own R&D by industry, sizeclass and region
- [FORSKO2](#): Erhvervslivets udgifter til købte FoU-tjenester
- [CFABNP](#): Research and Development costs in per cent of GDP

#### **8.7 Micro-data access**

Researchers and other analysts from authorized research institutions, can be granted access to the underlying Microdata by contacting [Research Services](#).

#### **8.8 Other**

Statistics Denmark's website (<http://www.dst.dk>) and on the Eurostat database.

#### **8.9 Confidentiality - policy**

[Data Confidentiality Policy](#) for Statistics Denmark.

#### **8.10 Confidentiality - data treatment**

Confidentiality is not an issue because of the used publication level. However the data transmitted to Eurostat demand some anonymization processes to secure the enterprises' confidentiality

#### **8.11 Documentation on methodology**

See: [http://www.dst.dk/FUI\\*](http://www.dst.dk/FUI*) where documents on the used methodology can be found.

#### **8.12 Quality documentation**

Results from the quality evaluation of products and selected processes are available in detail for each statistics and in summary reports for the Working Group on Quality.

## **9 Contact**

The administrative placement of these statistics are in the division of Science, Technology and Culture. The person responsible is Anne-Sofie Dam Bjørkman, tel. +45 3917 3396 e-mail: asd@dst.dk

### **9.1 Contact organisation**

Statistics Denmark

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N/A