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Introduction

1. Introduction

The present Quality report on European statistics on research and development, 2024 edition, looks at the quality of the R&D data reported by the Member States, EFTA countries and candidate and potential candidate countries of the European Union. The report is meant to be a useful tool for data producers and users alike.

The quality concept applied in this report is in conformity with the common quality framework of the European Statistical System[2]. According to this framework, the quality of a statistical output includes the following components: relevance and completeness, accuracy and reliability, timeliness and punctuality, comparability and coherence, accessibility, and clarity. Each quality component consists of several sub-components and is shortly explained at the start of the respective section in this report[3].

R&D statistics provide an overview of the research and development expenditure spent within the European Union (EU) across various economic sectors, as well as the number of R&D personnel and researchers engaged on the EU territory. The national R&D data is collected annually by Eurostat from the National Statistical Institutes (NSIs) and published on Eurostat's website together with EU aggregated figures.

Together with the data, the NSIs provide to Eurostat the national reference metadata/quality

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[2] 'The common quality framework of the European Statistical System is composed of the European Statistics Code of Practice, the Quality Assurance Framework of the European Statistical System and the general quality management principles (such as continuous interaction with users, commitment of leadership, partnership, staff satisfaction, continuous improvement, integration and harmonisation).' Available at: https://ec.europa.eu/eurostat/web/products-catalogues/-/KS-02-18-142
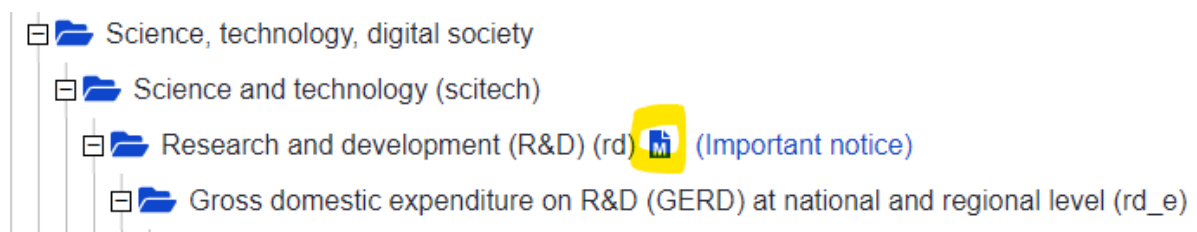
[3] Most of the introductory texts shortly explaining each quality component are taken from the 'ESS handbook for Quality Reports', available at: European Statistical System (ESS) handbook for quality and metadata reports — 2020 edition - Products Manuals and Guidelines - Eurostat (europa.eu)

reports, in Eurostat's Metadata Handler (MH) which is the repository of the metadata/quality reports. These reference metadata files present the methods used to collect and process the R&D data until their dissemination. This is an instrument used to assure the users that the R&D data disseminated on Eurostat's website are comparable across countries and are of high quality.

The present report is structured as follows: Introduction, Coverage, Legal basis, and a quality assessment based on the following output-related concepts of quality: Relevance and Completeness, Accuracy and Reliability, Timeliness and Punctuality, Comparability and Coherence, Accessibility and Clarity.

The individual country metadata/quality reports for R&D statistics for reference year 2021 were submitted to Eurostat by the NSIs at the end of October 2023. They are the main source for the present report. The most recent ESS reference metadata format is the single integrated metadata structure (SIMS) and this applied for the reference year 2021.

The metadata/quality reports were published in Eurostat's online database on 8 March 2024, attached to the R&D European metadata file:

as annexes to the file:

The present metadata/quality report closely follows the standard quality report format developed by Eurostat. The goal of this standard format is to report homogeneous production processes within each country. However, information from the individual countries is, in some cases, not sufficient to provide a comprehensive summary.

Eurostat wishes to thank all experts in the countries for their participation, for providing the data and metadata, the descriptions as well as for their essential support in compiling this report.

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Coverage

2. Coverage

This report covers the thirty-six participating countries that provided Eurostat with R&D statistics in 2021: the Member States of the European Union (EU), three EFTA countries (Iceland, Norway, and Switzerland) and six candidate countries (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia and Türkiye). R&D expenditure and personnel data are collected by national statistical authorities. The data are collected through sample or census surveys, from administrative registers or through a combination of sources. R&D statistics are compiled for four institutional sectors of performance: business enterprise (BES); government (GOV); higher education (HES) and private non-profit (PNP). These sectors are defined based on the System of National Account (SNA), with the difference that higher education has been established as a separate sector because of its policy relevance, and households have, by convention, been merged with the private non-profit (PNP) sector. The report does not cover the publicly funded R&D.

3

Legal basis and guidelines

3. Legal basis and guidelines

The collection of R&D statistics is based on Commission Implementing Regulation (EU) No 2020/1197 of 30 July 2020 (EBS GIA). The Regulation sets the framework for the collection of R&D statistics and specifies the main variables of interest and their breakdowns at predefined level of detail.

R&D data are compiled in accordance to the guidelines laid down by OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities and Eurostat's European Business Statistics Methodological Manual for R&D Statistics.

4

Relevance and completeness

4. Relevance and completeness

4.1. Relevance

Relevance is the degree to which statistics meet current and potential users' needs. It includes the production of all needed statistics and the extent to which concepts used (definitions, classifications etc.) reflect user needs. The aim is to describe the extent to which the statistics are useful to, and used by, the broadest array of users. For this purpose, statisticians need to compile information, firstly about their users (who they are, how many they are, how important is each one of them), secondly on their needs, and finally to assess how far these needs are met.

4.1.2. Users' Needs

When assessing the users of the R&D data and the users' needs, the following type of users are identified in the SIMS metadata/quality report for the different sectors of R&D statistics:

Mainly institutions at:

- European level: European Commission (Directorates Generals, Secretariat General), European Council, European Parliament, European Central Bank, other European agencies etc.,

- Member States level, at the national or regional level: ministries of economy or finance, other ministries (for sectoral comparisons), NSI and other statistical agencies (norms, training, etc.), and

- International organisations: OECD, UN, IMF, ILO, etc.

Then, the second main users are social actors: employers' associations, trade unions, lobbyists, among others, at the European, national, or regional level.

Followed by the media: International or regional media – specialized or for the public – interested both in figures and analyses or comments. The media are the main channels of statistics to the public.

On the 4th position are researchers and students (Researchers and students need statistics, analyses, ad hoc services, access to specific data).

Enterprises or businesses are on 5th position (Either for their own market analysis, their marketing strategy (large enterprises) or because they offer consultancy services)

On the 6th position are other users (a user class defined for national purposes, different from the previous classes).

When looking at the information reported by Member States, regardless of the reporting country, the users who make the most use of R&D data are:

- **Institutions –** with Eurostat and other European Commission' s Directorates General disputing the first place with national/federal authorities.

- **Social actors -** a wide variety of actors such as trade unions, lobbyist, banks, business association.

For eight EU Member States the second most important users were the media (national and regional). For six Member States the second most important user were researchers and students/PhD students - Universities. For the Higher education sector one country listed as the most important users the researchers, while the great majority of countries listed as most important users the Institutions.

4.1.2.1. EU Users' needs and satisfaction

To evaluate if users' needs have been satisfied, the best way is to conduct user satisfaction surveys.

EUROSTAT USERS AND THEIR NEEDS - REPORT ON EUROSTAT USER SATISFACTION SURVEY

The most recent Eurostat User Satisfaction Survey (USS) dates from 2022. The USS did not include direct questions about the R&D data. There were 1 486 replies - almost 50% more than in the previous USS in 2019 - and many aspects of data dissemination received the highest satisfaction rating since the beginning of user satisfaction surveys at Eurostat.

The survey was designed to increase knowledge about users, their needs and their satisfaction with Eurostat's services. The survey covered four main aspects:

- information on types of users and uses of European statistics;

- quality;

- trust in European statistics;

- dissemination of statistics.

Almost half of the respondents were students, academic and private users, followed by users working for a government (22%) and for EU and international organisations (14%). Looking at user types, most of the respondents identified themselves as intermediate users (38%), followed by advanced users (35%) and light users (27%).

72% of all users indicated that European statistics were either 'essential' or 'important' for their work. About a third of the users stated they used European statistics in their daily or weekly activities, 29% use them on a monthly basis and the remaining 36% at other intervals.

User assessment of the quality and user friendliness of Eurostat's products was generally positive, too, with shares of 'very good/good' replies at 60% or above. The 'Eurostat euro indicator releases' and 'Eurostat database' were rated highest for quality, followed by 'Statistics Explained' articles.

Users continue to trust European statistics: 95% of users said they trusted European statistics greatly or tended to trust them.

Recently Eurostat has launched the 2024 USS[4] which was accessible to all users for a delimited period. Eurostat encourages users to participate in general in USS. The USS surveys are an excellent tool for improving the quality of data and services with a focus on the data quality indicators such as timeliness, comparability and completeness and accessibility of the data, doubled by a focus on specific users' needs.

Furthermore, Eurostat has also launched a short survey on the metadata files and a recruitment form of metadata users, with information sessions taking place in May and June 2024. The form to participate were accessed via the metadata files or at a specified link[5].

Eurostat has put in place designated services[6] which receive inquiries from users via the Eurostat's User Support Team. Thus, Eurostat has first-hand information on how users use Eurostat data for analyses, news articles, reports, etc. For the reference year 2021 the User Support Team has received inquiries from, among other countries, users in France, Italy, UK, Poland, Portugal, Luxembourg, and the United States.

Another service offered by Eurostat is a tool[7] to offer support to representatives of the media and social actors and to other European Institutions.

Lastly, Eurostat Media Support Team is dedicated to the mass media users of Eurostat data. All these channels are also used to evaluate the users' satisfaction with Eurostat data. In 2021 Eurostat received 33 inquiries into R&D data.

4.1.2.2. Country level Users' needs and satisfaction

User satisfaction with the national R&D statistics is reported as high. In most countries, this assessment is based not on specific user satisfaction survey but on ad-hoc feedback received from users.

Although the great majority of countries do not conduct dedicated national USS for R&D data, the NSIs make all efforts to meet the needs of their users in an ongoing process via several actions especially regular meetings with the stakeholders. The NSIs are aware of the users' needs and they monitor that the users are satisfied with the published R&D data. This information results either from general USS (most recently online ones) carried out by NSIs (9 NSIs), or from annual workshops or seminars and other regular consultations the NSIs have with representatives from business, science, and politics (five NSIs).

One NSI conducted between October 2022 and January 2023 a user satisfaction survey on all its statistical products among 381 experts. Included were four questions on the topics 'Research, Innovation, Digitalisation' with the following results: percentage of users assessing the following dimensions with 'very good' or 'good': Timeliness: 78%; Accuracy: 75%; Comparability: 78%; Quality: 75%.

Another NSI conducted a USS that covered several statistical areas, where products of R&D

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[4] Have your say with the 2024 user satisfaction survey - Eurostat (europa.eu)
[5] EUSurvey - Survey (europa.eu)
[6] Contact us - Eurostat (europa.eu)
[7] Press services - Eurostat (europa.eu)

statistics were included together with innovation, energy, and environment statistics in one category and the average rate of user satisfaction with products of these statistics was 68,9 %.

A third NSI conducted a USS specific for R&D data and collected information on how interested users were in current R&D figures and time series. The survey concluded that commercial associations were interested in R&D data of their own NACE[8] class and that users were interested in the methodology of the R&D survey.

Even if dedicated and regular R&D users' satisfaction surveys are not carried out, the statistical program is announced every year by the NSIs and is given for consultation to ministries, universities, and scientists, who can put forward suggestions which are taken into consideration and the statistical plan may be changed accordingly.

Another source of information from the users are the discussions with the representatives of ministries and other political actors (four NSIs). In one Member State, as a result of the workshops, some additional breakdowns have been added to the R&D questionnaires. In another Member State the data was produced at a more detailed level of the fields of research and development (FORD) because of user needs.

In the case of another NSI there exists a specific users' council for R&D statistics that advises the NSI. For another NSI the R&D statistics fall within the scope of the Statistical Advisory Committee on Research and Development Activities and Technologies (however last meeting of the Committee was in 2021). Results showed that R&D indicators are used at least once every three months by institutional users, and they are considered very important.

The specific needs of users are also considered when revising the survey design (two NSIs), in order to adapt the content of the survey to their specific requirements increasing the level of satisfaction. The results of the surveys and workshops are applied to provide better services for users as well as the improvement of statistical products.

In addition to this, each year, in two NSIs, the statistical units surveyed receive a link to the NSIs website with a summary of the main results of the survey.

Moreover, in the R&D survey the surveyed units can give feedback in the additional field that is provided in the survey (two NSIs).

More recent developments to help measure users' satisfaction were mentioned by an NSI and also by Eurostat: the official statistics portal traffic was monitored, website visitor opinion polls, general opinion polls on the products and services, target user groups' opinion polls and other IT-based uses measurements are conducted.

When it comes to specific sectoral user satisfaction, for the Higher education sector (HES) statistics one NSI organised a survey on data use and customer satisfaction in 2023 but they did not have the results yet. Still for this sector, other NSIs have mentioned in their HESSI reference metadata files that no additional demands on R&D statistics on HES were addressed to them and the comments they received from key users (ministries, universities) proved that users were satisfied with the available information on R&D-related variables. Another NSI reported they reduced the burden of data delivery by using more administrative sources of data.

NSIs reported that in general users are satisfied with the R&D statistics for HES. One NSI reported having published in 2023 the expenditure data for HES (HERD data) earlier than in previous years

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[8] NACE (Statistical classification of economic activities in the European Community)

and launching several new statistics on an annual basis, e.g., on diversity in research personnel and a monitoring system for researcher recruitment.

The NSIs report in their metadata reports, the complex balancing they do between satisfying new users' requests and maintaining a correct reporting burden for the statistical units.

Occasionally some users want timelier data or more detailed breakdowns but accept the difficulties in reducing the duration of the production process (feedback received by three NSIs). In such a case one NSI conducted additional surveys to the ordinary R&D surveys and combined the data, but this NSI reported the conflict between user needs and response burden.

We can conclude that, irrespective of the formula the NSIs use for monitoring the users' satisfaction with the R&D statistics, the NSIs do make efforts to assess the users 'needs and the users' satisfaction, and adapt, wherever possible, their statistical products accordingly. Both the NSIs and Eurostat are reassured that their main users, when asked to comment on the overall quality of the R&D data published, the users are satisfied that the data were useful, on time and in sufficient detail.

4.2. Completeness – Data completeness rate and Overview

Completeness is assessed via the comparison of the data delivered against the requirements of Commission Implementing Regulation (EU) No 2020/1197. Data completeness of both preliminary and final mandatory data are very good. Optional variables in the BES, GOV and HES are less complete, as a few countries do not collect part or all of these data in their national surveys.

Most of the NSIs reported 100% completeness rate for R&D data for 2021 reference year.

The completeness rate for Intramural R&D expenditure was calculated based on the data requirements listed for the breakdowns on Annex I, Part B. Elements of data requirements, Table 18, and Table 31 of the Regulation (EC) 2020/1197, respectively.

- TABLE 1: Completeness rate overview for Intramural R&D expenditure, by country, 2021
- TABLE 3: Completeness rate overview for Regional intramural R&D expenditure, by country, 2021

The completeness rate for R&D personnel and researchers was calculated based on the data requirements listed for the breakdowns on Annex I, Part B. Elements of data requirements, Table 19 and at Table 32 of the Regulation (EC) 2020/1197.

- TABLE 2: Completeness rate overview for R&D personnel and researchers, by country, 2021
- TABLE 4: Completeness rate overview for Regional R & D personnel and Researchers by country, 2021

4.2.1 Overview of Completeness

Most of the NSIs scored 100% completeness rate when reporting the R&D expenditure data with the breakdown by sector of performance. In all, 9 countries scored a completeness rate of 80.00% for the sectors of performance indicators - please refer to TABLE 1: Completeness rate overview for Intramural R&D expenditure, by country, 2021.

Regarding reporting for the source of funds, a majority of NSIs scored 100% completeness rate. Denmark scored the lowest with only 9.62%, seven Member States scored 80.77% and four scored over 50%.

TABLE 1:
Completeness rate overview for Intramural R&D expenditure, by country, 2021

Country	R&D expenditure breakdowns[9] by								industry orientation (optional)	socioeconomic objective (optional)
	sector of performance	source of funds	type of R&D	type of cost	activity	size class	source of fund and size class	major field of R&D		
BE	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported
BG	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
CZ	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported
DK	Very good	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Missing data	Optional: partially reported
DE	Good	Satisfactorily	Satisfactorily	Good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
EE	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
IE	Good	Good	Satisfactorily	Good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
EL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported
ES	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
FR	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
HR	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
IT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
CY	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
LV	Good	Satisfactorily	Satisfactorily	Good	Good	Very good	Satisfactorily	Very good	Missing data	Optional: partially reported
LT	Good	Good	Satisfactorily	Good	Very good	Very good	Good	Very good	Missing data	Optional: partially reported
LU	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
HU	Good	Good	Satisfactorily	Good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
MT	Good	Good	Satisfactorily	Good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
NL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
AT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
PL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
PT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
RO	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
SI	Very good	Very good	Very good	Very good	Very good	Good	Very good	Good	Optional: fully reported	Optional: partially reported
SK	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
FI	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: partially reported
SE	Very good	Unsatisfactorily	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported
CH	Very good	Satisfactorily	Very good	Very good	Unsatisfactorily	Satisfactorily	Satisfactorily	Satisfactorily	Optional: partially reported	Optional: partially reported
NO	Good	Good	Satisfactorily	Good	Good	Very good	Very good	Very good	Missing data	Optional: partially reported
IS	Good	Good	Satisfactorily	Good	Very good	Very good	Very good	Very good	Missing data	Optional: partially reported
BA	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported
ME	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Missing data	Missing data
MK	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Missing data	Missing data
RS	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported
TR	Good	Satisfactorily	Satisfactorily	Good	Satisfactorily	Very good	Very good	Very good	Missing data	Optional: partially reported

Legend:
- Very good
- Good
- Satisfactorily
- Unsatisfactorily
- Optional: fully reported
- Optional: partially reported
- Missing data

Source: Eurostat's online database (Eurobase), (R&D) (rd)

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[9] Country-level business statistics on intramural R&D expenditure, Annex I, Part B. Elements of data requirements, Table 18 of the Regulation (EC) 2020/1197.

TABLE 2:
Completeness rate overview for R&D personnel and researchers, by country, 2021

Country	R & D personnel and researchers breakdowns[10] by											
	sector of performance	sector of performance and occupation	sector of perf_occup_gender	activity	major field of R&D and gender	activity_gender	sizeclass	sector of performance and gender	sector of perf and qualifications (optional)	sector of performance_qualifications_gender (optional)	sector of performance_age group_gender (optional)	sector of performance_citzenship_gender (optional)
BE	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
BG	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
CZ	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
DK	Satisfactorily	Satisfactorily	Unsatisfactorily	Satisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Optional: partially reported	Missing data	Missing data	Missing data
DE	Good	Good	Good	Very good	Very good	Very good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
EE	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
IE	Good	Good	Good	Very good	Very good	Very good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
EL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
ES	Very good	Very good	Very good	Unsatisfactorily	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
FR	Very good	Very good	Very good	Very good	Unsatisfactorily	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
HR	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
IT	Very good	Very good	Very good	Very good	Good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
CY	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
LV	Good	Good	Good	Very good	Very good	Very good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
LT	Good	Good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
LU	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
HU	Good	Good	Very good	Very good	Very good	Very good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
MT	Good	Very good	Very good	Very good	Very good	Very good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
NL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
AT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: fully reported	Optional: fully reported	Optional: fully reported
PL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: fully reported	Optional: fully reported	Optional: fully reported	Optional: fully reported
PT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
RO	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
SI	Very good	Very good	Very good	Very good	Very good	Good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Missing data
SK	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
FI	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
SE	Good	Good	Good	Very good	Very good	Very good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
CH	Good	Good	Good	Very good	Satisfactorily	Unsatisfactorily	Satisfactorily	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
NO	Good	Good	Good	Very good	Good	Good	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
IS	Good	Good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
AL	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Missing data	Missing data	Missing data	Missing data
BA	Very good	Very good	Very good	Very good	Unsatisfactorily	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
ME	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Missing data	Missing data	Missing data	Missing data
MK	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Unsatisfactorily	Missing data	Missing data	Missing data	Missing data
RS	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported
TR	Good	Good	Good	Good	Very good	Satisfactorily	Very good	Good	Optional: partially reported	Optional: partially reported	Optional: partially reported	Optional: partially reported

Legend:
- Very good
- Good
- Satisfactorily
- Unsatisfactorily
- Optional: fully reported
- Optional: partially reported
- Missing data

Source: Eurostat's online database (Eurobase), (R&D) (rd)

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[10] Country level business statistics on employment in R&D, Annex I, Part B. Elements of data requirements, Table 19 of the Regulation (EC) 2020/1197.

The picture of completeness for R&D personnel is more complex than the one for R&D expenditure. In this case the majority of the NSIs scored 100% completeness rate when reporting the R&D personnel data with the breakdown by sector of performance. In all, eleven countries scored a completeness rate of 80.00% for the sectors of performance indicators - please confer TABLE 2: Completeness rate overview for R&D personnel and researchers, by country, 2021.

TABLE 3:

Completeness rate overview for Regional intramural R&D expenditure, by country, 2021

Country	Regional Intramural R&D expenditure by breakdowns [11]
BE	Very good
BG	Very good
CZ	Very good
DK	Unsatisfactorily
DE	Good
EE	Very good
IE	Good
EL	Very good
ES	Very good
FR	Very good
HR	Very good
IT	Very good
CY	Very good
LV	Very good
LT	Good
LU	Very good
HU	Good
MT	Good
NL	Good
AT	Very good
PL	Very good
PT	Very good
RO	Very good
SI	Very good
SK	Very good
FI	Very good
SE	Very good
CH	Satisfactorily
NO	Good
IS	Good
AL	Unsatisfactorily
BA	Unsatisfactorily
ME	Unsatisfactorily
MK	Unsatisfactorily
RS	Very good
TR	Good

Legend:
Very good	(dark green)
Good	(light green)
Satisfactorily	(brown)
Unsatisfactorily	(tan)

Source: Eurostat's online database (Eurobase), (R&D) (rd)

In the case of the Regional intramural R&D expenditure we note that the great majority of countries (30) scored very good and good for the completeness rate.

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[11] Regional business statistics on R&D expenditure, Annex I, Part B. Elements of data requirements, Table 31 of the Regulation (EC) 2020/1197.

TABLE 4:

Completeness rate overview for Regional R&D Personnel and Researchers by country, 2021

Country	Regional R & D personnel and researchers breakdowns[12] by	
	region and sector of performance	sector of performance and gender
BE	Very good	Optional: partially reported
BG	Very good	Optional: partially reported
CZ	Very good	Optional: partially reported
DK	Unsatisfactorily	Missing data
DE	Good	Optional: partially reported
EE	Very good	Optional: partially reported
IE	Good	Optional: partially reported
EL	Very good	Optional: partially reported
ES	Very good	Optional: partially reported
FR	Satisfactorily	Optional: partially reported
HR	Very good	Optional: partially reported
IT	Very good	Optional: partially reported
CY	Very good	Optional: partially reported
LV	Good	Optional: partially reported
LT	Good	Optional: partially reported
LU	Very good	Optional: partially reported
HU	Good	Optional: partially reported
MT	Good	Optional: partially reported
NL	Very good	Optional: partially reported
AT	Very good	Optional: partially reported
PL	Very good	Optional: partially reported
PT	Very good	Optional: partially reported
RO	Very good	Optional: partially reported
SI	Very good	Optional: partially reported
SK	Very good	Optional: partially reported
FI	Very good	Optional: partially reported
SE	Good	Optional: partially reported
CH	Satisfactorily	Optional: partially reported
NO	Good	Optional: partially reported
IS	Good	Optional: partially reported
AL	Unsatisfactorily	Missing data
BA	Unsatisfactorily	Missing data
ME	Unsatisfactorily	Missing data
MK	Unsatisfactorily	Missing data
RS	Very good	Optional: partially reported
TR	Satisfactorily	Optional: partially reported

Legend:
- Very good
- Good
- Satisfactorily
- Unsatisfactorily
- Optional: partially reported
- Missing data

Source: Eurostat's online database (Eurobase), (R&D) (rd)

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[12] Regional business statistics on employment in R&D, Annex I, Part B. Elements of data requirements, Table 19 of the Regulation (EC) 2020/1197.

In the case of the Regional R&D personnel and researchers we note that the great majority of countries (28) scored very good and good for the completeness rate.

4.3. Conclusions on Relevance and Completeness

The quality indicator relevance has been treated comprehensively both referring to the relevance of R&D data at the national level and at the EU level. One clear conclusion is that the wide array of users of R&D data (institutions, researchers, business, mass media, etc.) are satisfied with the availability, breakdowns and quality of the R&D data and they provide useful feed-back to the data producers.

As regards completeness, the four overview tables on R&D data completeness for the reference year 2021 draw a telling picture: Member States' completeness is very good or good in almost all the cases except for DK which had issues on sending the data for the 2021 reference year.

5

Accuracy

5. Accuracy

Accuracy in the statistical sense denotes the closeness of computations or estimates to the exact or true values. Statistics are not equal with the true values because of variability (the statistics change from implementation to implementation of the survey due to random effects) and bias (the average of the possible values of the statistics from implementation to implementation is not equal to the true value due to systematic effects).

5.1. Assessment of the accuracy with regards to the main indicators

For the three main R&D sectors of performance: BES, GOV, and HES the following table presents the reporting countries' self-assessment of accuracy regarding the main R&D indicators. The reference metadata reports for PNP sector lack this analysis because the sector is so small. The overview of the accuracy self-assessment presented below for the main R&D sectors is based on the information filled by the countries in the national reference metadata reports:

- for the business sector (BES), the great majority of countries (19) reported 'very good' and 'good' accuracy for all three main indicators; only one Member State reported 'satisfactory' and 'poor' for all three indicators.

- for the government sector (GOV) 20 countries reported 'very good' accuracy for all three indicators; there was no 'poor' accuracy reported.

- for the higher education sector (HES) 19 countries reported 'very good' accuracy for all three main indicators; there was no 'poor' accuracy reported.

TABLE 5:

Overview of the accuracy self-assessment[13] for the main R&D indicators by country, for BES, GOV, and HES, 2021

Country	Total intramural R&D expenditure			Total R&D personnel in FTE			Total researchers in FTE		
	BES	GOV	HES	BES	GOV	HES	BES	GOV	HES
AT	Very good	Good	Good	Good	Good	Very good	Very good	Good	Good
BE	Satisfactory	Good	Good	Satisfactory	Good	Good	Poor	Good	Good
BG	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
CY	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
CZ	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
DE	Satisfactory	Very good	Good	Very good	Very good	Good	Satisfactory	Very good	Good
DK	Very good	Good	Satisfactory	Very good	Good	Very good	Very good	Good	Very good
EE	Very good	Good	Good	Good	Good	Very good	Very good	Good	Good
EL	Good	Good	Good	Good	Good	Very good	Good	Good	Good
ES	Very good	Very good	Good	Very good	Very good	Very good	Very good	Very good	Good
FI	Good	Very good	Very good	Good	Good	Very good	Good	Good	Good
FR	Good	Very good	Good	Good	Very good	Good	Good	Very good	Good
HR	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
HU	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
IE	Very good	Very good	Very good	Good	Very good	Very good	Very good	Very good	Very good
IT	Good	Good	Good	Satisfactory	Satisfactory	Poor	Good	Good	Good
LT	Satisfactory	Good	Very good	Good	Good	Very good	Satisfactory	Good	Good
LV	Very good	Good	Good	Good	Good	Very good	Very good	Good	Good
LU	Very good	Very good	Good	Very good	Good	Very good	Satisfactory	Very good	Very good
MT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
NL	Very good	Very good	Missing	Very good	Very good	Missing	Very good	Very good	Missing
PL	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
PT	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
RO	Good	Good	Very good	Good	Good	Good	Good	Good	Good
SE	Very good	Very good	Very good	Very good	Very good	Satisfactory	Very good	Very good	Satisfactory
SI	Good	Good	Good	Good	Good	Good	Good	Good	Good
SK	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
CH	Good	Very good	Good	Satisfactory	Good	Good	Satisfactory	Good	Good
NO	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
IS	Very good	Very good	Good	Good	Very good	Very good	Good	Very good	Very good
BA	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good	Very good
ME	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing
MK	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing
RS	Good	Good	Good	Good	Very good	Very good	Good	Very good	Very good
TR	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing

Legend:
- Very good
- Good
- Satisfactory
- Poor
- Missing

Source: Eurostat's Metadata Handler (MH)

5.2. Compilation methods

Apart from collecting the data directly through a statistical survey, R&D data is also collected through administrative data sources or a combination of the two.

Administrative data may include both financial data from revenue agencies as well as other types of administrative sources such as company records. Frascati Manual 2015 cautions that

[13] Sub-concept 13.1.2. Assessment of the accuracy with regard to the main indicators, at BESSI, GOVSI and HESSI national reference metadata reports

'Particular attention should be paid to the use of administrative data in the identification of R&D performing and funding institutions'[14]. Frascati Manual underlines the need that the administrative data uses the same concepts, definitions and coverage as defined in the Manual and cautions against discrepancies between the concepts used by the administrative data sources and the Manual. The uses of administrative data vary across countries based on their availability and quality.

TABLE 6:

Overview of the data sources for R&D sectors, by country

Country	R&D data sources – general information[15]			
	BES	**GOV**	**HES**	**PNP**
BE	census and sample survey	census	census	census
BG	census	census	census	census
CZ	census	census	census	census
DK	sample survey	census	census	census
DE	census	census	administrative data	PNP included in GOV
EE	census	census	census	census
IE	census	sample survey	census	no PNP data
EL	census and sample survey	census	census	census
ES	census	census	census	census
FR	census and sample survey	census and administrative sources	census and administrative data	census
HR	census	census	census	census
IT	census	census	administrative data	census
CY	census	census	census	survey, no sampling is used
LV	threshold survey	census	census	no PNP data
LT	census and sample survey	sample survey	census	PNP included in BES
LU	sample survey			
HU	census	census	census	PNP included in GOV&HES
MT	census	survey	survey	no PNP data
NL	census and sample survey	census and sample survey	administrative data	census and sample survey
AT	census	census	census	census
PL	census	census	census	census
PT	census	census	census	census
RO	census and sample survey	census	census	
SI	census	census	census	census
SK	census	census	census	census
FI	census/panel and sample survey	census, panel of known or supposed R&D performers	census, administrative sources and time-use survey of university personnel	census
SE	census and sample survey	census	census	model based extrapolation

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[14] Frascati Manual 2015 edition, pages from 184 to 188.

[15] Concept 18.1.1. Data source – general information, BESSI national reference metadata reports

Country	R&D data sources – general information[15]			
	BES	**GOV**	**HES**	**PNP**
CH	survey	census	administrative data/ precompiled statistics	
NO	census and sample survey	census	census	no PNP data
IS	census	census	census	
BA	sample survey	sample survey		
ME				
MK				
RS	census	census	census	census
TR	census	census	census	census

Source: Eurostat's Metadata Handler (MH)
Legend: Empty cell = missing

5.3. Statistical errors

Several types of statistical errors occur during the survey process. The following typology of errors has been adopted:

1. Sampling errors. These only affect sample surveys. They are due to the fact that only a subset of the population, usually randomly selected, is enumerated.

2. Non-sampling errors. Non-sampling errors affect sample surveys and complete enumerations alike and comprise:

a) Coverage errors,

b) Measurement errors,

c) Non-response errors and

d) Processing errors.

5.3.1. Sampling errors

The sampling error is part of the difference between a population value and an estimate thereof, derived from a random sample, which is due to the fact that only a subset of the population is enumerated.

The main indicator used to measure sampling errors is the coefficient of variation (CV).

CV= (Square root of the estimate of the sampling variance) / (Estimated value).

In the table below are listed the coefficient of variations for R&D indicators (R&D expenditure and R&D personnel (FTE)) and total NACE sectors or Total Size Classes) filled by the counties in the BESSI national reference metadata reports, at sub-concepts '13.2.1.2. Coefficient of variation for key variables by NACE' and '13.2.1.3. Coefficient of variation for key variables by Size Class'.

TABLE 7:

Overview of the status of the Coefficient of variations, by country, BES, 2021

Country	CVs for R&D expenditure and R&D personnel (FTE) indicators, by NACE and by size class[16]	
BE	not relevant (as 97.5% of R&D expenditures come from the census share of surveyed set of enterprises)	
BG	not applicable, census	
CZ	not applicable, census	
DK	R&D expenditure => 1.9	R&D personnel (FTE) => 2.9
DE	not relevant	
EE	not applicable, census	
IE	not applicable, census	
EL	R&D expenditure => 1.49	R&D personnel (FTE) => 2.65
ES	not applicable, census	
FR	R&D expenditure => 5.71	R&D personnel (FTE) => 3.98
HR	not applicable, census	
IT	not applicable, census	
CY	not applicable, census	
LV	Since the year 2021 the CV is no longer calculated. Threshold sampling and no changes in strata.	
LT	R&D expenditure => 1.43	R&D personnel (FTE) => 2.75
LU	R&D expenditure => 0.01	R&D personnel (FTE) => 0.01
HU	not applicable, census	
MT	not applicable, census	
NL	not applicable	
AT	not applicable, census	
PL	not applicable, census	
PT	not applicable, census	
RO	R&D expenditure => 0.02;	R&D personnel (FTE) => 0.01
SI	not applicable, census	
SK	not applicable, census	
FI	not applicable	
SE	R&D expenditure => 0.01	R&D personnel (FTE) => 0.01
CH	R&D expenditure => 2.15	R&D personnel (FTE) => 2.37
NO	R&D expenditure => 0.8	R&D personnel (FTE) => 0.9
IS	not applicable, census	
AL		
BA		
ME		
MK		
RS	not applicable, census	
TR	not applicable, census	

Source: Eurostat's Metadata Handler (MH)
Legend: Empty cell = missing

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[16] Sub-concepts 13.2.1.2. Coefficient of variation for key variables by NACE, 13.2.1.3. Coefficient of variation for key variables by Size Class, BESSI national reference metadata reports

5.3.2. Non-sampling errors

Non-response occurs when a survey failed to collect data on all survey variables from all the population units designated for data collection in a sample or complete enumeration.

There are two elements of non-response:

1. **Unit non-response,** which occurs when no data (or so little as to be unusable) are collected on a designated population unit.

2. **Item non-response,** which occurs when data only on some, but not all survey variables are collected on a designated population unit.

The extent of response (and accordingly of non-response) is measured with response rates.

5.3.2.1. Unit non-response

In assessing the unit non-response, the main interest is to judge if the response from the target population was satisfactory by computing the weighted and un-weighted response rate.

Eligible are the sample units which indeed belong to the target population. Frame imperfections always leave the possibility that some sampled units may not belong to the target population. Moreover, when there is no contact with sample units and no other way to establish their eligibility, they are characterised as 'unknown eligibility units'.

The formulas used to calculate the two unit non-response rates are:

➢ Un-weighted Unit Non- Response Rate = 1 - (Number of units with a response) / (Total number of eligible and unknown eligibility units in the survey)

➢ Weighted Unit Non- Response Rate = 1 - (Total weighted responding units) / (Total weighted number of eligible / unknown eligibility units in the sample)

In the table below are listed the unit non-response rates by NACE or Size Classes filled by the countries in the BESSI national reference metadata reports, at sub-concepts '13.2.1.2. Coefficient of variation for key variables by NACE' and '13.2.1.3. Coefficient of variation for key variables by Size Class'.

Overview of the unit non-response rate, by country, BES, 2021

Country	Unit Non-response rates	
	un-weighted	weighted
BE	40%	41%
BG	9.1%	not applicable, census
CZ	10.4%	not applicable, census
DK	2.70%	
DE	78%	not applicable, census
EE	8.25%	not applicable, census
IE	43.80%	not applicable, census
EL	25.06%	35.65%
ES	5.9%	0.91%
FR	34.1%	not applicable
HR	-	not applicable, census
IT	31.1%	not applicable, census
CY	0%	not applicable, census
LV	4.7%	0.05%
LT	0.8%	0.99%
LU	2.8%	
HU	23.1%	not applicable, census
MT	28%	not applicable, census
NL	12%	24%
AT	5.20%	not applicable, census
PL	11%	not applicable, census
PT	11%	not applicable, census
RO	8.4%	0.12%
SI		not applicable, census
SK	17.5%	not applicable, census
FI	33.40%	
SE	21.3%	
CH	16.30%	16.30%
NO	0.9%	
IS	18.1%	18.1%
AL		
BA		
ME		
MK		
RS	37%	not applicable, census
TR	0%	0%

Source: Eurostat's Metadata Handler (MH)
Legend: Empty cell = missing

The imputation has been applied to treat non-response for units that did not provide questionnaires by the deadline. In some countries, the imputation is used only for units which filled R&D questionnaire in the previous years.

The response rates for the 2021 data collection are very good with a few exceptions.

In many reporting countries conducting surveys, the questions in the R&D surveys are perceived to be difficult, too specific, or too detailed. In some cases, the R&D data are reportedly not available in the enterprise or difficult to estimate. According to the respondents the questionnaire is too long and requires too many resources and too much time. Non-R&D performers or small enterprises often state the questionnaire is not relevant/does not apply to them.

Therefore, to reduce the burden, no non-response surveys are conducted in majority of the countries. Confidentiality constraints are also sometimes raised. One Member State did conduct a unit non-response survey. However, the respondents did not reply even though they received

several reminders to submit the filled in questionnaire.

Another reason for not conducting the non-response surveys is due to limited resources in the NSIs.

In one Member State non-response occurs mostly among very small units (62% of all non-responders have less than 10 persons employed). Some of them might not exist anymore; no R&D activity is the most likely reason for non-response. Due to the COVID-19 pandemic especially smaller enterprises could not be reached or have stopped economic activities.

In another Member State conducting a combination of sample survey with census, for BES, weighting for the sampling part was used and imputation using previous survey data for known R&D performers were used to impute unit non-response for R&D performers.

In the majority of the cases, even if a non-response survey was not conducted, the countries did contact all non-responding enterprises that were expected to have R&D activity.

5.3.2.2. Item non-response

The un-weighted Item non-Response Rate is calculated using the following formula:

un-weighted item non-response rate (%) = 1-(Number of units with a response for the item) / (Total number of eligible, for the item, units in the sample) * 100

TABLE 9:

Overview of the item non-response rates, by country, BES, 2021

Country	Un-weighted item non-response rate[17]		
	R&D Expenditure	**R&D Personnel (FTE)**	**Researchers (FTE)**
BE	46%	51%	62%
BG	0%	0%	0%
CZ	0%	0%	0%
DK			
DE	23%	34%	48%
EE	0%	0%	0%
IE	0%	0%	0%
EL	0%	0%	0%
ES	3.5%	3.5%	3.5%
FR	8.9%	33.4%	33.4%
HR	0%	0%	0%
IT	0%	0%	0%
CY	0%	0%	0%
LV	0%	0%	0%
LT	1%	1%	1%
LU	1%	1%	1%
HU	0%	0%	0%
MT	0.01%	0.01%	0.01%
NL	0%	0%	0%
AT	0%	if none reported => imputed	if none reported => imputed
PL	1.50%	1.40%	1.40%
PT	0%	0%	0%
RO	0%	2.7%	24%

[17] Sub-concept 13.3.3.2.1. Un-weighted item non-response rate, BESSI national reference metadata reports

Country	Un-weighted item non-response rate[17]		
	R&D Expenditure	R&D Personnel (FTE)	Researchers (FTE)
SI	0%	0%	0%
SK	0%	0%	0%
FI	1.4%	5,6%	11,4%
SE	0%	0%	0%
CH	0.43%	5.46%	6.55%
NO	0%	0%	0%
IS	0%	6.48%	N/A
AL			
BA			
ME			
MK			
RS	0%	0%	0%
TR	0%	0%	0%

Source: Eurostat's Metadata Handler (MH)
Legend: Empty cell = missing

One country used ratio imputation (with last values) in case of item non-response. Other Member States also mentioned in the metadata files that they are using imputations for the item non-response rate based on replies they received from those statistical units in the previous survey.

5.4. Conclusions on Accuracy

The accuracy concept in the SIMS reference metadata files is referring both to the self-assessed accuracy by the reporting countries as well as to the clear indicators referring to errors that could occur during the data collecting and processing phases. The chapter presented both elements. The conclusion is that the accuracy of the reporting is good but of course there are margins to improve it.

From consulting the metadata/quality files, it results that the NSIs are taking all the measures available to diminish the unit and item non-response rates. Explanatory notes are included in the questionnaires throughout. Some countries also provide the statistical units with a glossary containing a detailed description of concepts as well as some examples according to the sector. The field work for data collection is conducted by experienced and well-trained staff with the R&D domain. Manuals and training documents are also made available.

Intensive follow-up activities are carried out and in case of missing data, respondents are contacted to either correct or confirm the data. Different checking and validation routines are in place to detect any omissions by the respondents while filling the online questionnaires. Data are also compared to the respondents' data from previous years. Reporting units are provided with methodological instructions and classifications needed to fill in the questionnaire.

A large amount of time is spent re-contacting the reporting units and providing additional methodological support to reduce the number of errors: several phone calls and several emails are made to the reporting units.

Some countries provide the opportunity for giving a feed-back on the survey methodology for the reporting unit to indicate if the concepts and definitions in the surveys are clear enough.

To further diminish the unit and item non-response rates increased resources in the National Statistical Institutes would be necessary, and this would also increase the burden for the statistical units. While the former is a constant desiderate, the latter, i.e., increased burden for the reporting units, is to be avoided altogether.

6

Coherence and comparability

6. Coherence and comparability

Comparability aims at measuring the impact of differences in applied statistical concepts and definitions on the comparison of statistics between geographical areas, with other statistical domains or over time. It is the extent to which differences between statistics are attributed to differences between the true values of the statistical characteristics.

The factors that may cause two statistical figures to lose comparability are attributes of the surveys that produce them. These attributes may be grouped into two major categories:

a) concepts of the survey and

b) measurement / estimation methodology.

In order to assess the comparability of data among the reporting countries, the SIMS reference metadata/quality report assesses the non-deviation of the definitions, concepts and methodology with the Frascati Manual definitions and concepts.

Table 10 is based on the information provided by the countries in the reference metadata focused on two important concepts: the issues non-deviation from Frascati Manual recommendations and the methodological issues non-deviations from the recommendations of the Manual.

TABLE 10:

Overview of comparability of datasets among reporting countries based on the alignment with the Frascati Manual definitions and concepts, by country

Country	Survey Concept Issues compliance with recommendations[18]	Methodological issues compliance with recommendations[19]
BE		
BG		
CZ		
DK		
DE		
EE		
IE		
EL		
ES		
FR		
HR		
IT		
CY		
LV		
LT		
LU		
HU		
MT		
NL		
AT		
PL		
PT		
RO		
SI		
SK		
FI		
SE		
CH		
NO		
IS		
AL		
BA		
ME		
MK		
RS		
TR		

Legend:
- Very good
- Good
- Satisfactorily
- Unsatisfactorily
- Missing

Source: Eurostat's Metadata Handler (MH)

Most of the deviations reported by countries refer to R&D personnel and come in the majority of the cases from the fact that no distinction is possible for internal and external personnel in the country.

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[18] Sub-concept 15.1.3. Survey Concepts Issues, BESSI national reference metadata reports

[19] Sub-concept 15.1.4. Deviations from recommendations, BESSI national reference metadata reports

For one country the concept of researcher does not resonate with respondents in the enterprise sector in the way that the concept is supposed to, and some more conceptual work is needed for adequately collecting this data.

Another common reason is the deviation from the statistical unit enterprise, for some countries it is not the statistical unit enterprise but rather the legal unit. Another reason for deviation is the enterprise size coverage and breakdown; not all class sizes are surveyed. NACE section 72 is the only section where enterprises with less than 10 employees are included in the survey.

Some issues in terms of coverage that may affect comparability have been identified and are currently still under investigation.

6.1. Comparability over time

Another important aspect of comparability refers to how comparable are data over time for the four sectors of performance, i.e., whether breaks in the time series have occurred. The information regarding breaks in time series is sent to Eurostat in both the data and the accompanying metadata files. The years when breaks in time series occurred are flagged with the 'b' flag when data is sent to Eurostat and the flag will appear in Eurostat's online database (Eurobase). In the national metadata/quality files there are dedicated concepts under which the breaks in time series are reported and explained for each sector of performance. The following three tables below present the years when a break in the time series was notified by the reporting countries in the data.

TABLE 11:

Overview of comparability over time for the four sectors of R&D expenditure, by country (years of breaks in time series)[20]

Country	TOTAL	BES	GOV	HES	PNP
BE	1983, 1989, 1993	1992	1983, 1989, 1993, 1998, 2012	1983, 1989, 1993, 1998	1983, 1989, 1993, 2012
BG	1996, 1999	1996, 1999	1996, 1999	1996, 1999	1996, 1999
CZ	1995	1995	1995	1995	
DK	2007	2007	2002, 2007	2002, 2007	2007
DE	1991	1991	1991, 1992, 2022	1991, 2016	2022
EE					
IE					
EL	1981, 1989, 1995, 2008	2008	2008	1981, 1983, 1989, 1995, 2008	2008
ES	1992	2002, 2008		1992	1989, 2002
FR	1981, 1997, 2000, 2004, 2010	1992, 1997, 2001, 2004, 2006	1992, 1997, 2000, 2010	1981, 1997, 2000, 2004	1992
HR					
IT	1991, 1997, 2016, 2021	1991, 2016	1991	1997, 2005	
CY					

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[20] Sub-concept 15.2.2. Breaks in time series, BESSI national reference metadata reports

Country	TOTAL	BES	GOV	HES	PNP
LV					
LT	1996				
LU	2012	2012	2009		
HU	1994, 2004, 2018	1994, 2018	1994, 2004, 2018	1994, 2018	
MT	2004	2004			
NL	1982, 1990, 1994, 1996, 1999, 2011, 2012, 2013	1994, 1996, 2011, 2012, 2013	1994, 2000, 2003, 2012, 2013	1982, 1990, 1999, 2013	1991, 1994, 2013
AT			1993		1993, 2009
PL	1995	1995	1995		
PT	2008	2013		2008, 2013	1995, 2013
RO	1992, 1995, 2011	1995, 2011	1995, 2011	1995, 2011	2011
SI	2008, 2011	2008, 2011	2011	2011	2011
SK	1992, 1994, 1997	1992, 1994, 1997	1992, 1994, 1997	1992, 1994	
FI	1981, 1991		1981, 1991, 1994	1981, 1991, 1997	
SE	1981, 1993, 1995, 2005	1981, 1995, 2005	1993, 2005, 2019	1981, 1995, 1997, 2019	1993, 1995, 2005, 2007, 2009, 2011
CH	1983, 1986, 1988, 1989, 1996, 1998, 2010	1983, 1986, 1988, 1989, 1996	1998	2010	
NO	1984, 1995	1984, 1995	1989, 2007	2007	
IS	2011, 2013	2010, 2011, 2013	2011, 2013	2010, 2011, 2013	2011, 2013
AL	N/A	N/A	N/A	N/A	N/A
BA					
ME					
MK					
RS		2014	2014		
TR					

Source: Eurostat's online database (Eurobase), (rd_e)
Legend: Empty cell = not applicable; N/A = no data available

We notice that the majority of the reporting countries have one or maximum two years of break in time series. In the case of eight countries there are three years of 'b'. For five countries there are more than four years flagged 'b', with one case of eight 'b' flags for Total, having the last break in series in 2013.

Overview of comparability over time for the four sectors of R&D personnel in full time equivalent (FTE), by country (years of breaks in time series)[21]

Country	TOTAL	BES	GOV	HES	PNP
BE	1989, 1993, 2021	1989, 1992, 2021	1989, 1993, 1998, 2012	1989, 1993, 1998	1989, 1993, 2012
BG					
CZ	2005	2005	2005	1995, 2005	2005
DK	2007	2007	2002, 2007	2002, 2007	2007
DE	1987, 1991	1991	1991, 1993, 2022	1987, 1991, 2006, 2016	2022
EE					
IE			1992, 2001	1993, 2001	1998
EL	1989, 1995, 2011	1986, 2011	1983, 2011	1983, 1989, 1995, 2011	
ES	1989	2002, 2008			1989, 2002
FR	1981, 1997, 2000, 2010	1992, 1997, 2001, 2006	1992, 1997, 2000, 2010	1981, 1997, 2000	1992, 1997
HR					
IT	1998, 2016	2016		1998, 2005	
CY					
LV					
LT					
LU	2012	2012			
HU	2004, 2018	2018	2004, 2018	2018	
MT	2004	2004			
NL	1982, 1990, 1994, 1996, 2003, 2011, 2012, 2013	1994, 1996, 2011, 2012, 2013	1994, 2000, 2003, 2012, 2013	1982, 1990, 1999, 2013	1991, 1994, 2013
AT			1993		1993
PL					
PT	2008	2013		2008, 2013	1995, 2013
RO	2011	2011	2011	2011	2011
SI	2008, 2011	2008, 2011	2011	2011	2011
SK	1997	1997	1997		
FI	1981, 2011		1994, 1995	1981, 1997, 2011	
SE	1981, 1993, 2005, 2007, 2021	1981, 1995, 2005, 2007, 2021	1993, 2005, 2011, 2021	1981, 1993, 2005, 2021	1993, 1995, 1997, 2007, 2009, 2011
CH					
NO	1991, 1995	1984, 1995	1989, 2007	1991, 2007	
IS	2011, 2013	2011, 2013	2011, 2013	2011, 2013	2011
AL	N/A	N/A	N/A	N/A	N/A
BA					
ME					
MK					
RS					
TR					

Source: Eurostat's online database (Eurobase), (rd_p)
Legend: empty cell = not applicable; N/A = no data available

Similarly, to the expenditure data, the majority of reporting countries have none or maximum two years of break in time series for R&D personnel. For 7 countries there are more than 4 years flagged 'b', with one case of eight 'b' flags for the Total, having the last break as well in 2013.

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[21] Sub-concept 15.2.2. Breaks in time series, BESSI national reference metadata reports

TABLE 13:

Overview of comparability over time for the four sectors of R&D personnel in head count (HC), by country (years of breaks in time series)[22]

Country	TOTAL	BES	GOV	HES	PNP
BE	2021	2021	2012		2012
BG					
CZ					
DK	2007	2007	2002, 2007	2002, 2007	2007
DE	1991	1991	1981, 1983, 1985, 1991, 1992,	1991, 1995, 2016	1991
EE					
IE			2001	2001	
EL	2011	2011	2011	2011	
ES		2002, 2008			2002
FR	2002, 2010	2001, 2006	2002, 2010	2002	
HR					
IT	2016	2016		2005	
CY					
LV					
LT					
LU					
HU	2004, 2018	2018	2004, 2018	2018	
MT	2004	2004			
NL	2003, 2011, 2012, 2013	2011, 2012, 2013	2000, 2003, 2012, 2013	1999, 2013	2013
AT					
PL					
PT	2008	2013		2008, 2013	1995, 2013
RO	2011	2011	2011	2011	2011
SI	1993, 2008, 2011	1993, 2008, 2011	1993, 2011	1993, 2011	2011
SK					
FI					
SE	1993, 2005, 2007, 2009, 2021	1995, 2005, 2007, 2021	1993, 2005, 2011, 2021	1993, 2005, 2021	1993, 1995, 2007, 2009, 2011
CH					
NO					
IS	2011, 2013	2011, 2013	2011, 2013	2011, 2013	2011
AL	N/A	N/A	N/A	N/A	N/A
BA					
ME					
MK					
RS					
TR					

Source: Eurostat's online database (Eurobase), (rd_p)
Legend: Empty cell = not applicable; N/A = no data available

We notice that most of the reporting countries have none or maximum 2 years of break in time series. For 2 countries there are more than 4 years flagged 'b', with one case of 5 'b' flags for the Total.

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[22] Sub-concept 15.2.2. Breaks in time series, BESSI national reference metadata reports

6.2. Coherence

The coherence of statistics is their adequacy to be reliably combined in different ways and for various uses. The coherence of statistical information reflects the degree to which it can be successfully brought together with other statistical information within a broad analytic framework and over time.

When originating from a single source, statistics are coherent in that elementary concepts can be combined reliably in more complex ways. When originating from different sources, and in particular from statistical surveys of different frequencies, statistics are coherent insofar as they are based on common definitions, classifications and methodological standards. The messages that statistics convey to users will then clearly relate to each other, or at least will not contradict each other. The coherence between statistics is orientated towards the comparison of different statistics, which are generally produced in different ways and for different primary uses.

The legal basis Regulation (EC) 2020/1197 introduces elements of coherence by using the same variables (R&D expenditure and R&D personnel) in more business topics (e.g. IFATS - Inward Foreign Affiliates Statistics).

6.2.1. Coherence between R&D and IFATS data

Both business statistic domains are covered now by the EBS Commission Implementing Regulation (EU) No 2020/1197 and there have been no major changes in the legal requirements concerning the data collections in the two domains. Table 14 from Annex I of the EBS Regulation describes the 'Country-level business statistics on enterprises by country of ultimate control' (IFATS). Table 18 from the same Annex describes country-level business statistics on intramural R&D expenditure, and table 19 describes country level business statistics on employment in R&D (R&D domain).

Among the variables reported under Table 14 as part of the IFATS data are the EBS variables Intramural R&D expenditures and R&D personnel. At the same time the variable R&D expenditure is also part of Table 18 and the R&D personnel is part of Table 19, both transmitted to Eurostat as part of the R&D statistics.

In terms of timeliness the R&D statistics precede the IFATS data as the deadline for R&D transmission is T+18 months in comparison to T+20 months for IFATS. Another difference between the 2 statistical domains is the coverage due to the 1% rule[23] applicable for IFATS. This rule, based on 'net turnover' or 'number of employees and self-employed persons' at relevant NACE A*38 level aggregates for NACE Sections B to F, may be applied for Table 14 of the EBS regulation but not for the Tables 18 and 19 referring to R&D statistics. Therefore, some discrepancies are expected in the aggregates of the EU total when comparing the IFATS and R&D outputs. Table 14 presents the percentage difference comparing the national data provided on the variable R&D personnel in the IFATS dataset to the data provided in the national R&D dataset for the reference year 2021.

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[23] 1 % rule as defined in Annex III.A.1 of the EBS General Implementing Act: the 1 % rule concerns specific variables indicated in Annex I to this Regulation. It is not necessary to compile those variables if the contribution of the Member State for a related indicator (e.g. value added, turnover or number of employees and self-employed persons), or total services volume (imports plus exports of services) in a specific activity (NACE), EBOPS 2010 category or product (CPA) breakdown is less than 1 % of the EU total; cf.pg. 86

TABLE 14:

Overview of coherence between IFATS and R&D data: R&D personnel difference comparing IFATS and R&D data, in head count

COUNTRY	NACE_B	NACE_C	NACE_D	NACE_E	NACE_F	NACE_BTF
	R&D personnel (IFATS vs R&D) in head count					
AT	-0.64%	-0.46%	-0.62%	-3.49%	-3.04%	-0.50%
BE	Missing IFATS data					
BG	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CY	1% RULE					
CZ[24]	-64.29%	-24.82%	-86.32%	-52.02%	-33.83%	-26.04%
DE	-27.41%	-5.04%	-88.88%	-41.62%	-40.92%	-5.60%
DK	Missing R&D data					
EE	1% RULE					
EL	-100.00%	-95.09%	-100.00%	-100.00%	-98.06%	-95.93%
ES	0.00%	0.00%	0.00%	0.00%	-7.31%	-0.29%
FI	0.00%	-2.95%	4.74%	-17.16%	-0.08%	-2.72%
FR	273.38%	10.27%	-52.90%	-31.81%	-58.55%	5.64%
HR	0.00%	-22.06%	-6.25%	-69.57%	-2.67%	-21.60%
HU	-11.11%	-4.68%	76.89%	-5.50%	-2.80%	-3.55%
IE	0.00%	-7.41%	-69.05%	0.00%	29.51%	-7.43%
IS	Missing IFATS data					
IT	0.00%	0.01%	-0.14%	1.20%	0.13%	0.02%
LT	1% RULE					
LU	1% RULE					
LV	1% RULE					
MT	1% RULE					
NL	-1.80%	-10.26%	-6.32%	-15.10%	-3.10%	-9.89%
NO	1.40%	-4.36%	0.00%	-47.00%	-9.74%	-4.72%
PL	-1.84%	-3.47%	-1.59%	-9.49%	-6.47%	-3.58%
PT[24]	-82.41%	-67.53%	-98.01%	-87.94%	-40.79%	-67.46%
RO	-100.00%	-17.70%	-100.00%	-100.00%	-100.00%	-20.49%
SE	-99.81%	-51.18%	-96.53%	-91.57%	-91.27%	-52.75%
SI	1% RULE					
SK	-33.33%	-32.64%	-4.84%	-82.61%	-77.46%	-33.05%

Source: Eurostat, Unit G6 - Foreign Affiliates Statistics and Unit G4 - R&D
Note: R&D data subtracted from IFATS data

The colour coding in the Table 14 and Table 15 is based on the filter where the cells are highlighted where the absolute difference between the two domains is larger than 10%. This is an indicative threshold that is used to assess annually the compliance of Member States with the data transmission requirements.

We can notice that for 5 Member States the differences are '0' or minimal for the R&D personnel between the two domains. Differences are important for the rest of the Member States where data are available.

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[24] For Tables 14 and 15, the country has notified Eurostat of corrective actions that will be reflected in the next data transmission

TABLE 15:

Overview of coherence between IFATS and R&D data: Intramural R&D expenditures difference comparing IFATS and R&D data

COUNTRY	NACE_B	NACE_C	NACE_D	NACE_E	NACE_F	NACE_BTF
	Intramural R&D expenditures (IFATS vs R&D)					
AT	0.00%	-0.01%	0.00%	0.00%	-1.23%	-0.02%
BE	Missing IFATS data					
BG	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CY	1% RULE					
CZ	0.00%	-0.54%	0.00%	0.00%	-0.55%	-0.53%
DE	-57.10%	17.38%	-60.08%	-44.07%	-42.76%	17.01%
DK	Missing R&D data					
EE	1% RULE					
EL	-100.00%	-81.13%	-100.00%	-99.78%	-94.79%	-82.73%
ES	0.00%	0.00%	0.00%	0.00%	-12.70%	-0.28%
FI	0.00%	-2.63%	3.32%	-24.05%	-0.36%	-2.44%
FR	545.36%	8.83%	-27.72%	-28.57%	-78.80%	6.19%
HR	0.00%	-37.69%	-8.48%	-41.13%	0.08%	-36.71%
HU	0.00%	-1.04%	66.33%	-2.52%	1.60%	-0.38%
IE	0.00%	-11.30%	-19.14%	0.20%	111.42%	-11.24%
IS	Missing IFATS data					
IT	0.00%	0.00%	0.00%	0.54%	0.07%	0.01%
LT	1% RULE					
LU	1% RULE					
LV	1% RULE					
MT	1% RULE					
NL	-0.87%	-8.53%	-1.84%	-14.72%	-4.27%	-8.42%
NO	0.49%	-5.05%	-0.33%	c	-6.29%	c
PL	-0.95%	-2.56%	-2.11%	-15.62%	-5.09%	-2.70%
PT	-100.00%	-98.01%	-97.90%	-98.73%	-99.80%	-98.12%
RO	-100.00%	-3.52%	-100.00%	-100.00%	-100.00%	-9.76%
SE	-99.99%	-38.80%	-95.14%	-78.76%	-99.66%	-40.06%
SI	1% RULE					
SK	0.45%	-0.19%	0.18%	0.00%	0.00%	-0.18%

Source: Eurostat Unit G6 - Foreign Affiliates Statistics and Unit G4 - R&D
Note: R&D data subtracted from IFATS data

We can notice that for 9 Member States the differences are '0' or minimal for the R&D expenditure between the two domains. Differences are important for the rest of the EU Member States where data are available.

Eurostat is further investigating the coherence between these two business topics. The BESSI metadata templates have been updated to include a new concept on the coherence between these two domains, thus increasing the awareness of experts in the NSIs that they need to collaborate with their colleagues on the IFATS domain to corroborate the R&D and IFATS data.

6.2.2. Coherence between the preliminary versus the final R&D data

When referring to the concept of coherence for the R&D domain another important viewpoint to assess the coherence of R&D data is provided by the comparison between the final R&D data versus the preliminary data (**TABLES 16, 16a and 17, 17a**).

TABLE 16:

Overview of the differences between the final and preliminary R&D expenditure for 2021, by country

Country / Sector of per-formance	R&D expenditure (final data minus preliminary data)				
	Millions of national currencies				
	BES	GOV	HES	PNP	TOTAL
BE	700	83	321	-21	1084
BG	0	0	0	0	0
CZ	0	0	0	0	0
DK	0	0	0	0	0
DE	572	-287	48	N/A	334
EE	0	0	0	0	0
IE	291	0	29	N/A	319
EL	0	11	-1	0	11
ES	0	0	0	0	0
FR	196	-261	159	89	182
HR	0	-2	0	N/A	0
IT	-634	58	41	9	-526
CY	-13	0	7	-2	-9
LV	17	0	0	N/A	17
LT	1	0	0	N/A	1
LU	39	-26	2	N/A	14
HU	0	0	0	N/A	0
MT	4	1	0	N/A	5
NL	16	-4	423	0	436
AT	101	20	159	-6	274
PL	0	0	0	0	0
PT	42	4	-2	0	44
RO	0	0	0	0	0
SI	-4	0	0	-1	-5
SK	0	0	0	0	0
FI	0	0	0	0	0
SE	3688	0	0	0	3688
CH	Final data only	Final data only	Final data only	N/A	Final data only
NO	-2	0	0	N/A	-2
IS	852	0	0	N/A	852
AL					
BA	Final data only	Final data only	Final data only	Final data only	Final data only
ME					
MK					
RS	0	0	0	0	0
TR	Final data only	Final data only	Final data only	N/A	Final data only

Source: Eurostat free online database (Eurobase)
Legend: Empty cell = not available; N/A = no data available

We notice that for 9 Member States there are no differences, in absolute figures, between the final and the preliminary data for R&D expenditure which is a good indicator of the coherence of their R&D expenditure data. One Member State greatly overestimated the preliminary data. In the case of 8 Member States the final data, in absolute figures, is significantly higher while for three

countries there are quite significant differences between the final and the preliminary data.

TABLE 16a:

Overview of the relative difference between the final and preliminary R&D expenditure for 2021, by country

Country / Sector of performance	R&D expenditure				
	Percentage points				
	BES	GOV	HES	PNP	TOTAL
BE	5.753	5.967	12.969	-19.239	6.709
BG	0	0	0	0	0
CZ	0	0	0	0	0
DK	0	0	0	0	0
DE	0.761	-1.683	0.235	N/A	0.296
EE	0	-0.001	0	0.007	0
IE	8.105	0	3.843	N/A	7.096
EL	0	1.954	-0.081	0.247	0.406
ES	0	0	0	0	0
FR	0.539	-3.860	1.416	8.376	0.329
HR	-0.013	-1.163	0.026	N/A	0.008
IT	-3.893	1.617	0.665	1.940	-1.982
CY	-13.706	3.957	9.451	-7.624	-4.088
LV	21.767	0.006	-0.029	N/A	7.174
LT	0.449	0	0	N/A	0.220
LU	11.247	-12.549	0.952	N/A	1.891
HU	0	0	0	N/A	0
MT	7.144	55.673	0.336	N/A	5.187
NL	0.124	-0.332	8.135	N/A	2.255
AT	1.120	1.997	5.505	-8.377	2.113
PL	0	0.038	0	-0.595	0
PT	2.002	2.715	-0.195	-0.155	1.242
RO	0	0	0	-0.001	0
SI	-0.516	0.146	0.179	-7.447	-0.404
SK	-0.001	0.002	0	-1.140	0
FI	0	0	0	0	0
SE	2.804	-0.001	0	0	2.016
CH	Final data only	Final data only	Final data only	N/A	Final data only
NO	-0.004	0	0	N/A	-0.002
IS	1.323	0	0	N/A	0.944
AL					
BA	Final data only	Final data only	Final data only	Final data only	Final data only
ME					
MK					
RS	0	0	0	-0.134	0
TR	Final data only	Final data only	Final data only	N/A	Final data only

Source: Eurostat free online database (Eurobase)
Legend: Empty cell = not available; N/A = no data available; higher than (+5); lower than (-5)

Looking at TABLE 16a, we notice that 10 countries show differences of more than 5% points between their preliminary and final data, while for the rest of the countries there are differences, or they are not significant. Looking by sector, we can see that BES and PNP are the ones for which more countries present a difference of more than 5% between the preliminary and final data. On the other hand, for GOV, only three countries present significant differences.

TABLE 17:

Overview of difference between the final and preliminary R&D personnel and researchers, in full time equivalent (FTE), by country, 2021

Country / Sector of performance	R&D personnel (final data minus preliminary data)					R&D researchers (final data minus preliminary data)				
	Gender: Total									
	Full time equivalent (FTE)									
	BES	GOV	HES	PNP	TOTAL	BES	GOV	HES	PNP	TOTAL
BE	-1837	93	3365	-1921	-301	-1983	80	2344	-521	-79
BG	0	0	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	0	0	0	0	0
DK	0	0	0	0	0	0	0	0	0	0
DE	778	2368	943	N/A	4089	733	1001	401	N/A	2135
EE	0	0	0	0	0	0	0	0	0	0
IE	2560	0	1164	N/A	3723	1861	0	1229	N/A	3089
EL	-25	440	751	0	1165	-4	287	745	0	1028
ES	0	0	0	0	1	0	0	0	0	0
FR	-685	-2373	-2510	765	-4803	-4051	-1618	-848	312	-6204
HR	0	-60	0	N/A	0	0	-35	0	N/A	0
IT	-23862	741	-1466	-5	-24593	-11910	-101	-1716	-31	-13759
CY	-47	-27	5	-7	-76	-40	-9	3	-18	-63
LV	12	0	0	N/A	12	11	0	0	N/A	11
LT	27	0	0	N/A	26	20	0	0	N/A	19
LU	-54	-303	16	N/A	-339	21	-105	13	N/A	-70
HU	0	0	0	N/A	0	0	0	0	N/A	0
MT	21	44	-2	N/A	62	42	42	-2	N/A	82
NL	-558	-84	1873	0	1231	-1246	-151	1432	0	35
AT	244	-364	540	-10	410	1166	-266	582	0	1481
PL	0	0	0	0	0	0	0	0	0	0
PT	194	20	-49	-23	141	171	15	-18	-5	163
RO	0	0	0	0	0	0	0	0	0	0
SI	-51	0	0	-4	-55	-1	0	0	-2	-3
SK	0	0	-1	0	0	0	0	0	0	0
FI	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	-1	0		-1
CH	Final data only	Final data only	Final data only	N/A	Final data only	Final data only	Final data only	Final data only	N/A	Final data only
NO	-92	0	359	N/A	267	3	0	353	N/A	356
IS	345	0	-6	N/A	339	186	0	-6	N/A	180
AL										
BA	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only
ME										
MK										
RS	0	0	0	0	0	0	0	0	0	0
TR	Final data only	Final data only	Final data only		Final data only	Final data only	Final data only	Final data only		Final data only

Source: Eurostat free online database (Eurobase)
Legend: Empty cell = not available; N/A = no data available

We notice that for ten Member States, in absolute figures, there are no differences between final and preliminary R&D personnel data which is a good indicator for the coherence of their R&D personnel data. However, in the case of 13 countries there are significant or very high differences between these datasets for R&D personnel, four of them overestimating the preliminary data.

In the case of the R&D researchers' data we notice that for 12 Member States there are no differences between the final and the preliminary data which is a good indicator of coherence. We

notice again the case of overestimation of the preliminary data and 4 cases of significant differences between the final and preliminary data.

TABLE 17a:

Overview of the relative difference between the final and preliminary R&D personnel and researchers, in full time equivalent (FTE), by country, 2021

Country / Sector of performance	R&D personnel					R&D researchers				
	Gender: Total									
	Full time equivalent (FTE)									
	BES	GOV	HES	PNP	TOTAL	BES	GOV	HES	PNP	TOTAL
BE	-2.211	1.069	13.469	-71.360	-0.252	-4.043	1.265	11.820	-46.853	-0.104
BG	0	0	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	0	0	0	0	0
DK	0	0	0	0	0	0	0	0	0	0
DE	0.163	2.026	0.606	N/A	0.545	0.265	1.596	0.333	N/A	0.465
EE	0	0	0	0	0	0	0	0	0	0
IE	12.558	0	8.904	N/A	10.723	17.771	0	10.396	N/A	13.435
EL	-0.141	2.970	2.719	0	1.924	-0.030	3.362	3.335	0	2.320
ES	0	0	0	0	0	0	0	0	0	0
FR	-0.226	-4.469	-1.847	8.484	-0.959	-1.929	-5.055	-0.917	5.599	-1.825
HR	0	-1.699	0	N/A	0	0	-1.639	0	N/A	0
IT	-10.74	1.800	-1.676	-0.071	-6.875	-14.134	-0.410	-2.912	-0.629	-7.966
CY	-5.562	-12.000	0.571	-1.842	-3.269	-6.957	-9.000	0.392	-9.730	-3.877
LV	0.654	0	0	N/A	0.170	0.952	0	0	N/A	0.243
LT	0.478	0	0	N/A	0.175	0.588	0	0	N/A	0.172
LU	-1.829	-20.160	1.017	N/A	-5.624	2.075	-12.883	0.942	N/A	-2.183
HU	0	0	0	N/A	0	0	0	0	N/A	0
MT	1.775	122.222	-0.301	N/A	3.293	8.589	182.609	-0.376	N/A	7.854
NL	-0.449	-0.870	4.852	0	0.714	-1.675	-2.376	5.660	0	0.033
AT	0.405	-6.219	2.668	-1.495	0.471	3.346	-6.515	3.719	0	2.690
PL	0	0	0	0	0	0	0	0	0	0
PT	0.563	0.737	-0.157	-1.769	0.203	0.695	0.840	-0.062	-0.535	0.290
RO	0	0	0	0	0	0	0	0	0	0
SI	-0.448	0	0	-2.484	-0.315	-0.015	0	0	-1.724	-0.027
SK	0	0	-0.010	0	0	0	0	0	0	0
FI	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	-0.024	0		-0.001
CH	Final data only	Final data only	Final data only	N/A	Final data only	Final data only	Final data only	Final data only	N/A	Final data only
NO	-0.339	0	2.036		0.517	0.015	0	2.470		0.922
IS	12.950	0	-0.484		8.319	15.857	0	-0.557		7.560
AL										
BA	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only	Final data only
ME										
MK										
RS	0	0	0	0	0	0	0	0	0	0
TR	Final data only	Final data only	Final data only	N/A	Final data only	Final data only	Final data only	Final data only	N/A	Final data only

Source: Eurostat free online database (Eurobase) (% points)
Legend: Empty cell = not available; N/A = no data available; higher than (+5); lower than (-5)

Looking at the TABLE 17a we note that for ten countries there are significant differences (more than 5%) on the personnel data, being especially significant in the case of MT. We can see as well that more significant differences exist for researchers than for the total R&D personnel between the preliminary and the final data.

6.3. Conclusions on Coherence and Comparability

These two quality indicators are very important because data should be comparable to be useful. This chapter looks at comparability over time and non-deviation from the Frascati Manual definitions and methodology. The comparability of the R&D data is good as it comes out from the four tables in the chapter.

In order to check and validate the datasets, these have to be coherent among the business domains where the EBS General Implementing Act 2020/1197 requests common R&D indicators. The chapter looked at the coherence between the R&D and IFATS domains arriving at the conclusion that more work has to be done by Eurostat and NSIs to ensure the coherence of the common indicators.

Regarding the coherence between the final and the preliminary data the picture is a mixed one as it results from the four dedicated tables.

7. Timeless and punctuality

Timeliness and punctuality refer to time and dates, but in a different manner: the timeliness of statistics reflects the length of time between their availability and the event or phenomenon they describe. Punctuality refers to the time lag between the release date of the data and the target date on which they should have been delivered, with reference to dates announced in the official release calendar.

7.1. Timeliness

Table 18 uses the information provided by the countries in the SIMS reference metadata/quality files for the Business enterprise sector (BESSI metadata files). The reason other sectors are not presented separately is because usually data for all sectors come together. The SIMS template provides for a dedicated concept to report on the timeliness of preliminary and final R&D data.

TABLE 18:

Overview of Timeliness of R&D BES data at national level for preliminary and final data, by country, 2021

Country	Timeliness of R&D 2021 data at national level	
	Time lag – First/ preliminary results[25]	Time lag - Final results[26]
BE	no release of preliminary national data	546 days
BG	303 days	423 days
CZ	298 days	298 days
DK	330 days	690 days
DE	280 days	530 days
EE	360 days	360 days
IE	450 days	450 days
EL	300 days	540 days
ES	305 days	547 days
FR	270 days	630 days
HR	300 days	300 days
IT	270 days	540 days
CY	no release of preliminary national data	570 days
LV	240 days	540 days
LT	280 days	523 days
LU	330 days	570 days
HU	285 days	544 days
MT	300 days	300 days
NL	300 days	570 days
AT	no release nationally (only sent to Eurostat) 303 days	570 days
PL	297 days	297 days
PT	217 days	356 days
RO	320 days	329 days
SI	300 days	420 days
SK	300 days	540 days
FI	300 days	300 days
SE	195 days	300 days
CH	no preliminary results	360 days
NO	299 days	412 days
IS	332 days	427 days
AL		
BA	330 days	
ME		
MK		
RS		
TR	no preliminary results	292 days

Source: Eurostat Metadata Handler (MH)
Legend: empty cell = missing

[25] Sub-chapter 14.1.1. Time lag - First result, BESSI national reference metadata reports

[26] Sub-chapter 14.1.2. Time lag - Final result, BESSI national reference metadata reports

7.2. Punctuality

Table 19 presents the punctuality of the data sent by the countries as received by Eurostat via the single-entry point EDAMIS. Based on the punctuality of data sent, Eurostat is calculating the compliance of the reporting countries with the EBS General Implementing Act 2020/1197, i.e., if all the datasets were sent on the deadline foreseen by the Regulation or with delays.

TABLE 19:

Overview of Punctuality of R&D final 2021 data, by country

Country	Punctuality
BE	Very good
BG	Very good
CZ	Very good
DK	Satisfactorily
DE	Very good
EE	Very good
IE	Very good
EL	Very good
ES	Very good
FR	Good
HR	Very good
IT	Very good
CY	Very good
LV	Very good
LT	Very good
LU	Very good
HU	Very good
MT	Very good
NL	Very good
AT	Good
PL	Very good
PT	Very good
RO	Very good
SI	Very good
SK	Very good
FI	Very good
SE	Very good
LI	Satisfactorily
CH	Very good
NO	Very good
IS	Very good
AL	Satisfactorily
BA	Good
ME	Satisfactorily
MK	Very good
RS	Very good
TR	Very good

Legend

Very good	
Good	
Satisfactorily	
Unsatisfactorily	

Source: Eurostat single entry point (EDAMIS)

We notice that for the reference year 2021 there have been no major issues regarding the punctuality of the data.

7.3. Conclusions on Timeliness and Punctuality

The two tables dedicated to these two quality indicators draw a complete picture: there are no major issues where punctuality and timeliness are concerned, except for a few Member States. In terms of punctuality, we do not notice issues except for DK which is assessed as satisfactorily.

We notice that the average time lag for the national dissemination of the preliminary data is 297 days ranging from 195 lag days to 485 lag days. In the case of final data, the average publication lag is 462 days ranging from 292 lag days to 690 lag days depending on the country.

8

Accessibility and Clarity

8. Accessibility and Clarity

8.1. Accessibility

The SIMS concept Accessibility refers, as it can be inferred from its name, to how accessible the national datasets are in terms of their availability via different dissemination products. Another important criterion for easy access to data is the cost policy of the NSIs for their R&D data.

Table 20 summarises the accessibility of the data at the national level in the reporting countries based on the information the NSIs have provided in the BESSI metadata. The data are easily accessible when there are regular R&D data releases and the data are accessible as well via other means of data dissemination (NSIs internet sites, data extractions, ad hoc extractions).

Other criteria for data accessibility are the access to microdata for the research community and research projects and a moderate access cost policy. Aggregate data is free in all reporting countries.

TABLE 20:
Accessibility of data at the national level, by country

Country	Regular releases[27]	Access to microdata by researchers[28]	Access cost policy for micro-data[29]
BE	Y	Y	no charge
BG	Y	Y	access costs
CZ	Y	Y	n/a
DK	Y	Y	no charge
DE	Y	Y	access costs
EE	N	Y	no charge
IE	Y	n/a	no charge
EL	Y	N	no charge
ES	Y	Y	access costs
FR	N	Y	access costs
HR	Y	Y	access costs
IT	Y	Y	no charge
CY	Y	Y	access costs
LV	N	Y	no charge
LT	Y	Y	no charge
LU	N	Y	no charge
HU	Y	Y	access costs
MT	Y	N	no charge
NL	N	Y	n/a
AT	N	Y	access costs
PL	Y	N	n/a
PT	N	Y	no charge
RO	Y	Y	no charge
SI	Y	Y	no charge
SK	N	Y	access costs
FI	Y	N	access costs
SE	Y	Y	access costs
CH	Y	for OECD and governmental projects only	no charge
NO	Y	Y	access costs
IS	Y	Y	access costs
AL			
BA	Y	N	not available
ME			
MK			
RS	Y	Y	no charge
TR	Y	n/a	n/a

Source: Eurostat Metadata Handler (MH)
Legend: Y= yes/ N= no; n/a= not applicable; empty cell = missing

[27] Sub-concept 10.1.1. Availability of the releases, BESSI national reference metadata reports

[28 & 29] Sub-concept 10.4.1. Provisions affecting the access, BESSI national reference metadata reports

8.2. Clarity

The concept Clarity assesses the type(s) of data accompanying information available for users to enhance clarity (metadata, graphs, quality reports) at national level, whether the R&D data production methodology is well explained.

For all countries, R&D statistical data are always accompanied by a metadata/quality report. The countries provide metadata accompanying the data released and each R&D statistical release contains a short note on methodology or an entire methodology section/chapter with definitions of the R&D variables and the methodological guidelines regarding the R&D survey. This information is nowadays available on the NSIs' websites and links to the relevant pages are included in the releases. Users can download free of charge textual description of latest developments in R&D activities, graphical displays, comprehensive methodological notes/glossaries of terminology giving information on the respective national R&D survey and its scope, concepts, and definitions, and for some countries also a copy of the questionnaire used. At least one country has a dedicated webpage with links to reference documents (Commission Regulation, Frascati Manual, etc). Links to related publications and data tables and the link for the online R&D questionnaire are made available. The same NSI has put in place an online helpdesk available for authorized users (i.e., respondents) while the FAQ page is open to the public. Another NSI put in place a Statistical Information Centre to offer additional explanations and assistance to the users.

Some countries prepare national quality reports/quality handbook/executive summary of the quality report; some are available in English for all users' convenience. The national quality reports describe the methodology of surveys in detail. The reports published on the results also contain methodological information.

The SIMS metadata templates provide for dedicated concepts to assess the opinion of users on the clarity of the accompanying information to the data and if there are requests on further clarification of most problematic issues. The reporting countries note that further clarifications are sometimes requested by users who are not familiar with the Frascati Manual, or with the confidentiality policy applied. Questions on differences between full time equivalent and head count (HC) measurements, differences between researchers and technicians, questions on enterprises if their activities qualify or not as R&D activities, are some of the most frequent questions asked by users. Many users of the R&D statistics are interested in historical comparisons and time series, therefore the comparability of the results to historical numbers is an important concern.

Most of the countries note in their metadata files that most users are satisfied with the clarity of the metadata and methodological information offered.

The NSIs are continuously working to improve the clarity of the data and accompanying metadata/methodological notes.

8.3. Conclusions on Accessibility and Clarity

The last quality indicators treated in this summary report refer to how accessible the R&D data is and if it is clear for the user what the data are presenting. The conclusion on accessibility is that R&D data is very accessible both at the national and regional level. The data are disseminated via several dissemination products. With the major uptake of online dissemination products, the data and metadata are literally at the tip of the fingers of all users. The other important criterion

on accessibility refers to access costs. About half of the NSIs do not charge for access to microdata for the research community.

The last conclusion refers to the clarity of the data, how well data is accompanied by metadata, graphs that explain what data present. All the NSIs publish together with the data also the accompanying metadata and methodology chapters/sections. Users are aware of what the data presents.

9

Conclusions on the Summary Quality Report

9. Conclusions on the Summary Quality Report

The purpose of this summary quality report is to provide the users and producers of the R&D data with a tool for assessing the quality of these statistics for the reference year 2021. It provides a brief description of the main quality indicators which are: relevance, accuracy, accessibility and clarity, timeliness and punctuality, comparability, and coherence. Each indicator has been presented and supported with information provided by the countries in their SIMS metadata files.

Regarding the relevance of the R&D data, countries have mostly reported that the main users are institutional users, followed by the mass media and the research community. Regarding completeness, Eurostat's assessment shows that the mandatory R&D datasets are complete both at the national and regional level.

In their self-assessment, countries have mostly reported a high level of accuracy of their reported variables. They have also provided detailed information in their metadata files on the errors that could occur during the data collecting and processing phases. We note that the countries are making sustained efforts to have a high accuracy. The conclusion is that the accuracy of the reporting is good but of course there are margins to improve it.

On coherence and comparability more work is necessary, both regarding the coherence with the IFATS domain as well as in some cases on the coherence between preliminary and final data.

In terms of timeliness and punctuality, countries were mostly punctual on delivering their data to Eurostat and we can observe that there are different practices when it comes to the timeliness of the release of their national figures.

Last but not least, on accessibility, countries have reported that their R&D data is very accessible both at national and regional level. Regarding clarity, all the NSIs publish metadata and methodology chapters or sections together with the data.