Organisation for Economic Co-operation and Development

DSTI/STP/NESTI(2022)8/FINAL

Unclassified

English - Or. English

8 December 2022

DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INNOVATION
COMMITTEE FOR SCIENTIFIC AND TECHNOLOGICAL POLICY

Cancels & replaces the same document of 8 December 2022

Working Party of National Experts on Science and Technology Indicators

What drives revisions to business R&D statistics in OECD countries and how does the OECD deal with them?

A methodological note for data producers and users

This document sums up relevant OECD guidance on measuring business R&D, setting out what are the most common and significant drivers of revisions on business R&D statistics reported by countries and explaining how the OECD deals with them. The note concludes with proposed recommendations for R&D data producers.

This report was declassified by the Committee for Scientific and Technological Policy (CSTP) on 7 December 2022.

For further information, please contact:
Mr. Fernando Galindo-Rueda, Science and Technology Policy Division, OECD Directorate for Science, Technology and Innovation, RDSurvey@oecd.org

JT03509654

Note from the OECD secretariat

At its annual meeting held on 13-14 September 2022, the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) discussed proposals for undertaking methodological work in response to priorities from countries and the OECD. NESTI agreed to address these topics through informal in-depth discussions, to be supported by written and oral contributions from individual countries and the secretariat. These contributions should highlight how circumstances and practices differ across countries, with a view to identifying possible recommendations.

Two of the subjects discussed were considered central to ensuring the quality and international comparability of business R&D statistics, namely the:

- Treatment of non-response to R&D surveys and under-coverage of the relevant target population.
- Impact of R&D tax incentives on R&D statistics, on how the availability and design of R&D tax incentives are influencing or could contribute to R&D statistics in terms of business reporting and use of administrative data for the compilation of statistics.

This note has been prepared by the OECD secretariat with input from the NESTI Bureau to inform upcoming discussions at the level of the R&D statistics expert groups to be convened on these two subjects.

Considering fast-growing user interest in how OECD deals with revisions to national data on business R&D statistics, it has been deemed appropriate to prepare and disseminate a dedicated methodological document for the benefit of both data producers and users. This document sums up relevant OECD guidance on measuring business R&D, explaining what have been the main drivers of business R&D revisions reported by countries and how the OECD deals with them. The note concludes with recommendations for data producers and users.

NESTI delegates were invited to provide feedback on the document through a written procedure ending on 4th November 2022. Comments from delegations have been incorporated in a revised version that was declassified by the CSTP via written procedure on 7 December 2022.

Executive summary

In recent months and weeks, there has been a step increase in demands from R&D statistics producers in OECD member countries on data quality enhancement methods, particularly in the domain of business R&D statistics. This has been accompanied by rapidly growing user interest in how OECD deals with revisions to national data on business R&D statistics.

In view of these demands, the OECD Working Party of National Experts on Science and Technology Indicators has deemed appropriate to prepare and disseminate a dedicated OECD methodological document for the benefit of both data producers and users. This document sums up relevant OECD guidance on measuring business R&D, explaining what have been the most common drivers of business R&D revisions reported by countries and how the OECD deals with them.

Data revisions help improve our collective understanding of R&D investment patterns by correcting previous deficiencies and updating procedures that have ceased to be fit for purpose in light of structural or other changes. However, no matter how appropriate these might be, revisions may paradoxically and unintendedly contribute to undermining trust in the national and international processes. This might occur since users may perceive that prior to such revisions, the reported R&D statistics have provided a potentially misleading picture to inform policy discussions for some time. While this challenge is not unique to R&D statistics, the complexity of R&D measurement calls for a collective assessment of what procedures should be improved going forward, ensuring that there are strong incentives to recognise problems and propose improvements as promptly as possible.

From the OECD experience of working with data revisions from countries, revisions provide an opportunity to communicate with its users several points and existing recommendations that emerge from its regular work on R&D statistics:

1. Given that R&D statistics do not have many effective benchmarks, the comparison with other statistical and administrative data sources should be an integral part, where possible, of the regular process of data quality checks. Some degree of data redundancy should be actively encouraged in all instances, with due caution, while taking into account the underlying conceptual and practical differences.
2. The realisation of data gaps should lead to exhaustive analysis and decompositions of observed differences to inform the most appropriate set of corrective actions. It should not stop at the level of conceptual considerations that may induce conformity and complacency with established procedures. Data stakeholders should not rush to reach conclusions about what data are correct and which data are not without a detailed understanding of the specific situation.
3. There should be broad recognition that there are complex mechanisms at play through which statistical survey-based indicators and administrative business R&D data are interrelated, in terms of available business records, R&D reporting practices and actual R&D behaviour, and as mediated through data processing methods that feed on each other. The R&D statistical and policy communities need to exchange insights on these phenomena and the OECD provides a forum through NESTI to enable mutual learning across countries.
4. The revision of business R&D statistics is bound to result in a review of a country's own standing in comparative international statistics, but is unlikely to result in a wholesale upgrade of statistics for other countries. As indicated, revisions take

place at the pace dictated by domestic resources and assessment, even if motivated by OECD level comparisons and recommendations. When revisions are required and effectively implemented, countries should strive to undertake them in the most thorough possible manner and minimise the presence of contemporary breaks in the indicators that reduce their usefulness to the international R&D data user community. In other words, to the extent that it is methodologically and technically possible and where analytically appropriate, the past should also be thoroughly revised so that at least the trends for key indicators are longitudinally consistent.

5. The revision of business R&D statistics is also likely to contribute to a shift in inferences about the perceived effectiveness and additionality of government R&D policies. This will require careful analysis that might in most cases lie beyond the core mandate of statistical offices but that such statistics should effectively support. Statistical bodies should proactively engage with the domestic and international policy-making community to ensure that the economic and policy implications of data revisions can be analysed to the full, for example drawing upon the methods and findings of the OECD microBeRD project.

What drives revisions to R&D statistics in OECD countries and how does the OECD deal with them?

1. Background: The OECD role on R&D statistics

1. The Organisation for Economic Co-operation and Development (OECD) has worked since its creation on providing methodological guidance and statistical resources to inform government policies on research and innovation. The OECD Frascati Manual, first published in 1963 and currently in its 7th edition, provides recommendations on how to collect and report data on R&D so that it can be rendered internationally comparable and thus support comparative analysis and benchmarking. These statistics are the object of close domestic and international policy scrutiny as they are frequently used as R&D policy targets. Furthermore, they have become a mainstay of statistical systems in OECD and partner economies, which also use them as inputs in the construction of indicators of economic activity such as GDP and investment, in recognition of the role of R&D as knowledge-asset building economic activity.

2. In close synergy with its statistical standards setting role, the OECD reviews and publishes national R&D statistics first compiled by the organisations in charge within those countries. These feature within the OECD R&D Statistics database and other publications like the OECD Main Science and Technology Indicators. The OECD also publishes detailed information on the various national R&D sources and methods in a companion metadata resource, based on the information provided by national contact points. All this work is carried under the auspices of the OECD body mandated to oversee work on science and technology indicators, the OECD Working Party of National Experts on Science and Technology Indicators (NESTI), in close collaboration with other international organisations, in particular Eurostat with whom it shares data collection and review protocols for EU member and associate states that are also OECD members. OECD R&D statistics are part of the OECD statistical programme of work under the oversight of the OECD Committee for Statistics and Statistical Policy (CSSP). The last internal quality review of OECD R&D statistics took place in 2017 [DSTI/EAS/STP/NESTI(2016)7].

3. OECD member countries and partners engage in this committee's deliberations on R&D methodology and analysis via their representatives from National Statistical Offices (NSOs) and ministries in charge of research and innovation policy. This group is in charge of updating the Frascati Manual and oversees the production of complementary guidance such as a recent model for business R&D surveys. The programme of work at NESTI also includes active monitoring and analysis of R&D policies, and in that capacity convenes a network of experts on the monitoring and analysis R&D tax incentives, in collaboration with analysts and statisticians in responsible organisations such as Finance ministries and tax agencies. For completeness, NESTI also oversees analytical work making use of R&D data that helps inform OECD R&D policy discussions and provides a valuable source of evidence on the validity of R&D data and indicators for the intended purposes.

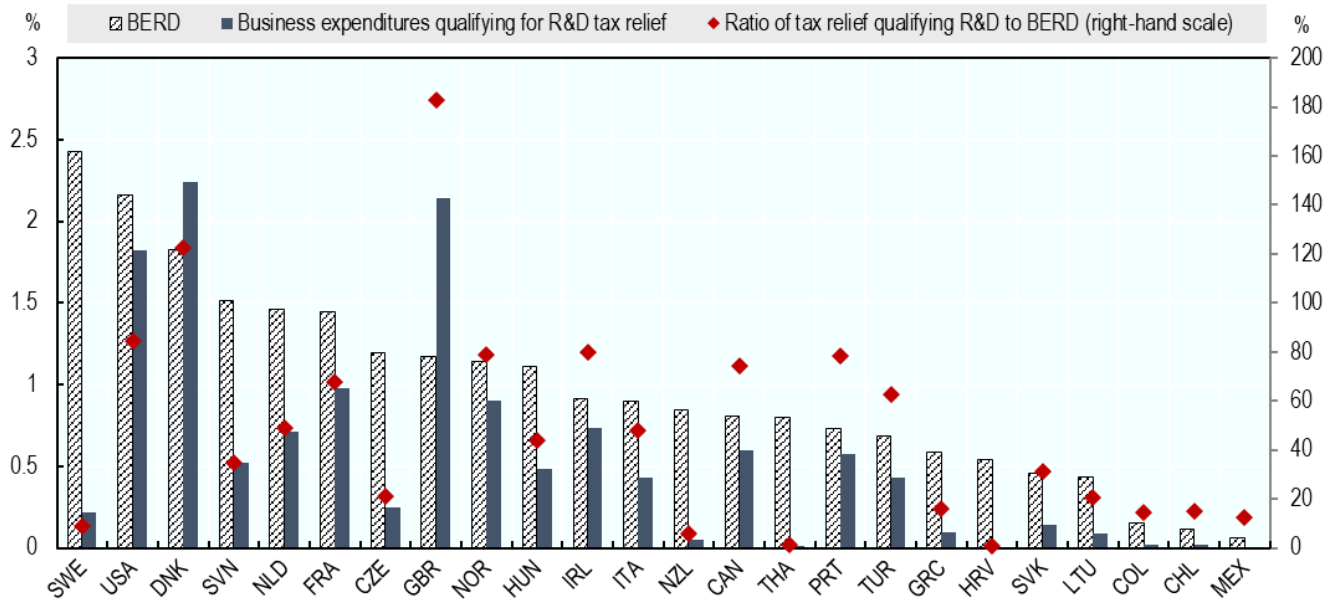
2. OECD contribution to the detection of methodological problems with business R&D statistics

4. As a major source of competitive advantage, R&D is a highly sensitive economic activity for companies to report on to third parties and there is a shortage of independent proxy measures that one can use for validation, and when those exist, they are rarely available on a jurisdictional basis, cover different elements and one should always recall the motivations for disclosure. Furthermore, since R&D is a highly concentrated and skewed activity, the optimal data collection strategy is to focus resources on securing accurate information from the largest R&D performers. This in turn requires some prior knowledge of where to look for companies that engage in R&D so as to extrapolate confidently to the entire sector once data have been collected from a sample. **Chapter 7** of the OECD Frascati Manual explains these measurement considerations and recommends the use of survey-based approaches that guarantee respondent confidentiality and make optimal allocation of data collection resources to target the largest R&D performers on the basis of high quality and up-to-date register information.

5. The manual also highlights the potential of **administrative data** – i.e., data that exists for administrative purposes as opposed to data that solely exist to produce statistics like the surveys that are carried out by NSOs – as a valuable source for identifying the reference population for the sampling of R&D surveys. In some instances, administrative data also exists on R&D expenditures of firms. As the manual points out, such administrative data can also help inform non-response imputation or potentially be used for direct replacement in the case of non-response. Comparisons between survey- and administrative-based data at the extensive and intensive levels, both macro and micro, can provide some indicative insights about both data generating processes.

Figure 1. Business expenditures qualifying for R&D tax relief compared to BERD, 2019

As percentage of GDP (left-hand scale); ratio of tax relief qualifying R&D to BERD (right-hand scale)



Note: This chart provides a comparison of two conceptually and empirically distinct indicators.
Source: Report on the OECD R&D Tax Incentives Database (2021 edition, December 2021; updated February 2022) https://www.oecd.org/sti/rd-tax-stats-database.pdf ; http://oe.cd/rdtax

6. For some OECD countries, this contrast has allowed the identification of gaps between statistical R&D data and administrative-based statistics on declared R&D expenditure eligible for tax relief, as depictured in Figure 1, which compares what R&D expenditure companies declare for the purposes of receiving tax relief, and what official estimates report for business R&D performance in terms of expenditures for projects undertaken within this sector.

7. There are several conceptual and practical reasons why these two indicators should not be expected to be identical. Either of them should not be considered as preferred versus the other regardless of the purpose. The definition of R&D used in surveys by OECD countries and those included in OECD R&D statistics is consistent with the OECD "Frascati" definition, a definition developed for statistical purposes, but this is not a guarantee that respondent firms correctly interpret the definition in responding to various survey items. With that proviso, the official R&D survey-based estimate of BERD is under normal circumstances the preferred indicator for international comparisons of the R&D expenditures. For a majority of countries, the definition of R&D used for tax relief administration is literally or contextually consistent with the OECD "Frascati" definition. However, as also documented by the OECD work on R&D tax incentives, specific guidance and regulations for tax relief apply not only to the definition of what is R&D for relief purposes, but also to which companies and what R&D expenditures are eligible for tax relief. Every country is different in this regard, as policy priorities and choices differ, as well as business behaviour since not all companies engaged in R&D will necessary apply for tax relief from government.

8. When data that are closely connected from a conceptual viewpoint differ by a considerable margin, the OECD strongly encourages domestic authorities in charge to engage on record linking and inform the analysis by decomposing observed data differences between these series. The OECD microBeRD project, a distributed examination of R&D microdata across several countries, has the aim of undertaking internationally coordinated analysis of R&D dynamics and impacts of government support to business innovation. As part of the microBeRD project, several countries have put in place mechanisms allowing to link survey and tax administrative data for secure, confidentiality preserving, statistical analysis. Indeed, the implications for policy from diverging statistical views about R&D can be very important, since the implied impact of changes in government support to R&D in empirical econometric analysis would appear to be highly sensitive to the choice of dependent variable between the administrative and survey-based indicator.

3. How pervasive are business R&D data revisions and what are the main causes?

9. Countries occasionally revise their R&D methodologies and outputs, often as part of continuous methodology and data source review. Sometimes this may occur in response to anomalies and shortcomings identified by the data producers themselves or, in some cases, by stakeholders such as the OECD, following exploration of options for improvement and greater alignment to OECD standards. The revisions ultimately implemented are conditioned by the availability of resources to conduct the necessary adjustments and is constrained by domestic restrictions such as data source availability and

burdens for business statistics, particularly for SMEs. The most common forms of revisions to business R&D data in OECD statistics stem from the drivers discussed below.[1]

3.1. Reclassification decisions on statistical units in or out of the business sector

10. When reclassification takes place, units that were previously assigned to another institutional sector are re-assigned to the business enterprise population (or vice versa). This may relate for example to judgements on whether certain non-profit research institutes are primarily serving business and being reclassified as part of the Business/ corporate sector, or government-controlled organisations being deemed to operate in the market and therefore also part of the business sector as public (i.e., government-controlled) corporations.

11. Reclassifications may change R&D estimates for one sector but not that of the entire economy, unless reclassification involves non-resident units or if a reclassified unit is assigned different weights in the original and reclassified sectors. It is also important to distinguish from a change in the nature of the statistical unit that drives a concomitant change in classification. Such reclassifications should not be interpreted as a data revision even if the data appear to be "broken"; compared with a change in the criterion or information used to classify units, which does represent a revision and a break from the point in which it is implemented. For example, several countries introduced revisions following privatisation processes. Netherlands and Poland saw major reclassifications in 2013 and 2016, respectively stemming from changes to the classification of a number of R&D institutes. Many data users are not fully aware for instance that private non-profit institutions oriented towards serving principally businesses should be classified as part of the Business enterprise sector, in line with both System of National Accounts (SNA) and Frascati guidance. The OECD is preparing to publish a working paper on the contribution of R&D specialist organisations in R&D expenditure, helping data users understand how these institutions contribute to the reported R&D of the business, government, higher education and non-profit sectors.

3.2. Updates to the R&D population coverage and sampling

12. As previously noted, compiling R&D statistics requires making inferences about a highly skewed activity from a sample of respondents to a relevant population, hence the need to build a sound knowledge of the reference population as well as a reliable procedure for extrapolating from the sample to aggregate population estimates.

13. Maintaining a good and up-to-date register of R&D performers within a country and over time is a key task for business R&D compilers, who often need to rely on the inputs of other data providers. Building and effectively using a register is not only one of the major stumbling blocks found by countries building their R&D statistics "ex-novo", since they need to build connections with several different data sources that may not exist within their organisations, but also requires constant attention and updating. Within rapidly changing economies, methods that were previously satisfactory may fall out of sync with the shifting situation. The longer it takes to incorporate such structural changes, the likely greater size of the necessary revision.

14. Paragraph 7.75 of the Frascati manual refers to a range of data sources for updating directories of potential R&D performers, citing among them list of companies claiming tax

[1] Organisational changes regarding reallocation of responsibility for compiling R&D statistics can also trigger many of the changes reported in this section.

relief for R&D activities, as well as list of enterprises reporting any R&D in innovation surveys or other structural business surveys. These complementary sources can indicate potential for R&D performance, but cannot be assumed to provide accurate measurements. For instance, companies may prefer not to disclose their R&D performance if they expect to be presented with a large and burdensome survey as a result. Alternatively the opposite may be the case (e.g. if by law they cannot be obliged to participate in other surveys for several years) and companies might prefer the "warm glow" of describing themselves as R&D performers. In countries with strict R&D criteria and enforcement practices there will be relatively fewer R&D tax relief beneficiaries compared to the number covered in R&D statistics, relative to those countries with more open and less strict tax relief criteria.

15. Comparisons of official R&D and administrative data can prompt some significant revisions. For example, the UK Office for National Statistics has recently published a Comparison of ONS business enterprise research and development statistics with HMRC research and development tax credit statistics - Office for National Statistics, effectively announcing a major increase to previously published estimates on expenditures on R&D performed in UK business enterprises. As noted in the release, "the value of expenditure on R&D performed by UK businesses in 2020 would be approximately GBP 43.0 billion compared with GBP 26.9 billion that was previously published in BERD. This equates to an underestimate of approximately GBP 16.1 billion". The ONS note explains that the revision (a 60% increase) relates to the previous under-identification of the population of R&D performers used for estimation purposes.

16. Examples such as this highlight that R&D statisticians have to confront a delicate balance when it comes to both coverage and sampling in relation to business size. Micro-sized firms with less than 10 persons employed and no prior record of R&D performance have been traditionally excluded from sampling frames by data compilers on the grounds that there is very limited scope for capturing systematic R&D activity that can sufficiently shift aggregate results to compensate for the burden and effort. For some years, the United States has launched a targeted survey instrument to measure R&D in microbusiness (up to 9 employees) and the assessed contribution to total BERD is only about one percent of the estimated total aggregate. Data compilers may opt to take as actual performers pockets of presumed R&D performers within the population of micro and small firms and extrapolate, avoiding diluting survey efforts on them. This bears the risk that imprecise weighting factors may render unreliable results. They may alternatively choose to include them in their surveys at great economic cost and burden. Some of the most commonly reported revisions by OECD countries seek to more systematically capture small enterprises performing R&D. These have resulted in upward revisions to the level of R&D of up to 20-30% at most (for instance Greece and Slovenia both in 2008 and the Netherlands in 2011). Overall, accounting for the smallest R&D performers can make some difference but not a huge one if the primary interest is the total volume of R&D that is unaccounted for rather than the number of firms.

17. Size is not the only factor at stake. Major revisions can arise from changes to coverage and sampling intensity that can be highly concentrated in specific regions and industries. Agriculture and personal services are industries traditionally under-covered by R&D surveys in many countries, often on grounds that the R&D that used in these industries is typically carried out elsewhere, such as labs and service providers (professional services) or producers of knowledge intensive intermediate goods and capital equipment (e.g. food or chemical industry). Preliminary screening is recommended before including enterprises from such industries in regular R&D surveys. R&D data compilers typically take particular care in ensuring adequate coverage of R&D within industries that are critical for the country's economic performance, be it natural resource extractive activities or financial services to give some examples. The OECD Frascati Manual's

definitions and guidance place considerable emphasis in ensuring that R&D statistical production is not confined to a manufacturing-centred or patent protection-oriented view of R&D, taking into consideration R&D across all knowledge domains across the economy.

18. The very ongoing transformation of R&D activity and its apparent re-orientation towards work on developing new software that meets the definition of R&D may contribute to disruption in established weighting schema by industry and size bands. On the other hand, the growing and pervasive importance of general-purpose technologies such as software and AI also risks overstating the number of companies that declare to be doing R&D when in fact the reported activity might just relate to routine software development. This implies that one should treat indicative R&D markers with great caution until they can be verified in a probabilistic or deterministic fashion.

19. The **design and use of weighting factors** is usually important for inference about the population of R&D firms. These need to control at a minimum for business size bands and industry. But within these strata there is still considerable skew in distributions. Most OECD countries confirm that the use of weights based on business population counts is particularly problematic for estimating R&D expenditure totals and avoid it whenever possible. Although also imperfect, payroll indices are considered to perform significantly better than count-based weights and they are also deemed to outperform indicators like turnover or sales. R&D data compilers should be particularly attentive to what represents reasonable sampling coverages for different strata. The OECD does not provide any concrete guidance on what that figure might be but encourages R&D compilers to compare themselves with peers (e.g. countries with similar size in terms of GDP or R&D expenditure). Drawing on information available in national quality reports, Italy reports sampling 39,000 firms in each survey (this survey is a census of known performers), well over Germany with 30,000 targeted firms, Spain (R&D survey combined with innovation survey) with 18,000, France close to 12,000, and the United Kingdom with over 5,000. It is worth noting that in most countries smaller firms tend to be presented with a simplified survey questionnaire to minimise burdens.

20. Changes in the nature of **survey participation requirements**, e.g. from voluntary to compulsory, can result in the capture of greater numbers of R&D performers and increases in volumes of R&D reported. Survey non-response can be a major driver on data uncertainty since it is difficult to establish whether unit non-response within a given stratum is related to unobserved factors that contribute to higher or lower levels of R&D performance. Overall, the tendency across the OECD on this domain is towards progressive harmonisation as business R&D surveys become compulsory by legal acts, but several countries such as Belgium, Chile and Germany are constrained to implementing voluntary participation models. While all countries have to **account for non-response** in their estimation procedures, this is more pronounced where participation is voluntary or compulsory but not truly enforceable.

21. Revisions have been identified in the OECD area arising as the outcome of unintended effects from survey re-design practices. For example, moving from a partial census to a full probabilistic sample, as countries attempt to combine different surveys (e.g. R&D and innovation or R&D and ICT usage) is a known source of problems. Since R&D is highly skewed and concentrated, this change of procedure can result in very large R&D performers being missed out in ways that imperfect estimation weights cannot correct for, with visible impacts on the aggregate statistics.

3.3. Survey questionnaire and question redesign

22. R&D performing firms, once surveyed, are guided by questionnaire instructions and questions on what information to provide, but they need to refer to internal records to provide any meaningful information instead of "guesstimates". First-time sampled companies are more likely to use heuristics or use other proxy indicators to provide responses. Responding to R&D surveys is very much a learning process.

23. The OECD has published indicative guidance on the types of questions that can be used in surveys, putting particular focus on helping identify over- or under-reporting of the relevant measurement concepts. The existence of administrative practices or accounting conventions that depart from these concepts require explicit attention to ensure that, among others, companies:

- do not report as R&D expenditure a range of innovation expenditures that do not qualify as R&D;
- do not report as their own R&D performance expenses for outsourced R&D, where the service provider is in charge of a self-contained R&D project or programme, for that represents R&D performance by the service provider;
- include rather than exclude the R&D they undertake on behalf of other companies or government.

24. There are precedents of surveys implemented in OECD countries that did not sufficiently account for this type of error. For instance, the temporary use of the SNA concept of R&D investment in some surveys initially suggested a very significant increase in Ireland's business R&D in a given year. While this was relevant for SNA R&D statistics, this was eventually corrected in BERD, as it was noted that the input variables also included acquisition of R&D knowledge assets corresponding to R&D that had been performed in other countries in previous years.

3.4. Revisions arising from changes from preliminary to final data

25. For completeness, it is also worth pointing to the existence of revisions for business R&D data previously flagged as preliminary. The provision of timely business R&D data is necessarily associated with the need for revisions once data collection and estimation processes are fully closed for a reference year. These revisions tend to be small in most cases and driven by the need to follow-up with survey non-respondents over extended periods of time.

26. For countries that collect and report additional information on R&D expenditure plans from business for the current data collection year (i.e. one year ahead of the reference year), it is common to have to revise such figures as the survey round in the following year confirms different values. There is a clear trade-off between accuracy and timeliness for such preliminary figures. It is important that NSOs understand and actively manage the potential drivers of biases arising from nowcasting procedures, as it is important for policy users and the public at large to have access to the most-timely available information on R&D trends while being aware of the uncertainty about the published "nowcasts".

4. What should users of OECD R&D statistics expect when sizeable revisions take place?

27. The OECD works to ensure that regular data submissions, and revisions in particular, are effectively justified and documented. The OECD is not obliged to accept

statistics as presented to it if it has found reasons to suspect major problems. The review process relies entirely on the willingness of countries to be forthcoming, timely and thorough in their communication.

28. It is also an utmost priority of the OECD to help ensure that national revisions are comprehensively implemented so that breaks within the latest available series are minimised or moved down into the past, since users of R&D statistics tend to ignore documented breaks in series and interpret them as actual changes in the indicator of interest. Very often countries lack the resources to undertake backward revisions to the data or even document the step change caused by the break.

29. The OECD provides under its own responsibility longitudinal estimates for the entire OECD area (OECD area aggregate) that account for missing information and a number of data breaks originating from individual level country data. Although a range of data users have requested this practice to be extended to country-level data in view of the abundance of data breaks, member countries have not yet agreed to such an approach.

30. In discussion with national bodies and contacts in charge of R&D statistics, and as part of its ongoing collaboration with them, the OECD may also spell out potential scenarios in which further revisions may be required if the revision procedure is deemed to be partial or incomplete.

5. Implications of revisions and recommendations for countries

31. Data revisions help improve our collective understanding of R&D investment patterns by correcting previous deficiencies and updating procedures that have ceased to be fit for purpose in light of structural or other changes. However, regardless of how appropriate these might be, they may paradoxically and unintendedly contribute to undermining trust in the national and international processes. This might occur since users may perceive that prior to such revisions, the reported R&D statistics have provided a potentially misleading picture to inform policy discussions for some time. While this challenge is not unique to R&D statistics, the complexity of R&D measurement calls for a collective assessment of what procedures should be improved going forward, ensuring that there are strong incentives to recognise problems and propose improvements as promptly as possible.

32. From the OECD experience of working with data revisions from countries, revisions provide an opportunity to communicate with its users several points and existing recommendations that emerge from its regular work on R&D statistics:

1. Given that R&D statistics do not have many effective benchmarks, the comparison with other statistical and administrative data sources should be an integral part, where possible, of the regular process of data quality checks. Some degree of data redundancy should be actively encouraged in all instances, with due caution, while taking into account the underlying conceptual and practical differences.
2. The realisation of data gaps should lead to exhaustive analysis and decompositions of observed differences to inform the most appropriate set of corrective actions. It should not stop at the level of conceptual considerations that may induce conformity and complacency with established procedures. Data stakeholders should not rush to reach conclusions about what data are correct and which data are not without a detailed understanding of the specific situation.
3. There should be broad recognition that there are complex mechanisms at play through which statistical survey-based indicators and administrative business R&D

data are interrelated, in terms of available business records, R&D reporting practices and actual R&D behaviour, and as mediated through data processing methods that feed on each other. The R&D statistical and policy communities need to exchange insights on these phenomena and the OECD provides a forum through NESTI to enable mutual learning across countries.

4. The revision of business R&D statistics is bound to result in a review of a country's own standing in comparative international statistics, but is unlikely to result in a wholesale upgrade of statistics for other countries. As indicated, revisions take place at the pace dictated by domestic resources and assessment, even if motivated by OECD-level comparisons and recommendations. When revisions are required and effectively implemented, countries should strive to undertake them in the most thorough possible manner and minimise the presence of contemporary breaks in the indicators that reduce their usefulness to the international R&D data user community. In other words, to the extent that it is methodologically and technically possible and where analytically appropriate, the past should also be thoroughly revised so that at least the trends for key indicators are longitudinally consistent. Experience shows that many data users fail to appreciate the existence of data breaks (documented in the metadata) and may ultimately draw misleading inferences when understanding policy impact studies.

5. The revision of business R&D statistics is also likely to contribute to a shift in inferences about the perceived effectiveness and additionality of government R&D policies. This will require careful analysis that might in most cases lie beyond the core mandate of statistical offices but that such statistics should effectively support. Statistical bodies should proactively engage with the domestic and international policy-making community to ensure that the economic and policy implications of data revisions can be analysed to the full, for example drawing upon the methods and findings of the OECD microBeRD project.