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The contribution of R&D specialist institutions to R&D performance: findings from the NESTI 2022 pilot data collection

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Long-standing policy interest in the role of organisations specialised in research and experimental development (R&D) raises questions about how these organisations are classified under different institutional sectors and contribute to R&D statistics. This paper reports on the findings of the pilot data collection conducted in 2022. The results show a diverse range of R&D specialist ecosystems as well as major reporting gaps. The ultimate aim of this exercise and its recommendations is to demonstrate how several OECD countries are able to provide meaningful statistical results using OECD guidance and promote the mainstreaming of reporting into future national and OECD R&D statistics.

Keywords: Research and development, innovation, institutions, R&D specialisation

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Executive summary

Long-standing policy interest in the role of organisations whose purpose is to conduct research and experimental development (R&D) as a service calls for accurate depictions of their footprint in sectoral-based statistical representations of national R&D systems. Motivations for policy interest in R&D specialist organisations are manifold, relating to the optimal institutional division of “labour” within systems and the sustainability of organisations that have R&D as its main function, fulfilling the expectations and requirements of other actors. OECD reviews of innovation policy and other targeted policy support initiatives dedicate considerable effort to investigating related issues of governance, ownership, financing and knowledge exchange.

This paper represents an initial attempt to fill the existing gap by demonstrating how several OECD countries are able to provide meaningful statistical results using the tools and guidance in the OECD Frascati Manual to characterise these institutions. The preliminary results of the data collection result in several substantive findings and methodological implications.

Lessons from the data collection process about R&D systems

The data collection conducted in 2022 under the aegis of the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) process has revealed significant interest. However, there are still many cases when participation or engagement in the analysis has been missing or just partial. The data collection process revealed ambiguities and gaps in terms of data availability and application of core “Frascati” guidance. For an informal data collection like this, the application of heuristics provided reasonably good approximations to the intended outcomes.

The diversity of types of R&D specialist organisations across and within sectors makes it difficult to draw general lessons about which economies are more prone to decouple R&D from other functions into separate types of units. Unfortunately, the data collected do not yet enable the derivation of data-based typologies of R&D systems along these lines for reasons that anticipate what might be the focus of future NESTI work.

- The number of economies for which information has been reported is very limited, with some major R&D performing countries entirely or partly missing from the exercise.
- There are idiosyncratic differences in the way in which countries implement the concept of statistical unit and collect separate data from R&D specialist units within broader organisational and oversight structures.
- There is still scope for collecting additional information on the nature of the R&D carried out by specialist organisations, i.e. basic and applied research versus experimental development; fields of R&D; or on the composition of government R&D funding (e.g. institutional or project-based).

Despite these limitations, the data collection has provided several insights on the R&D structure of pilot participants, highlighting those in which the R&D specialist sector plays a significant role.

This pilot exercise has shown the important role played by R&D specialist business enterprises that are affiliates of larger business groups, e.g. in Israel. Affiliated R&D units are by far the largest category of R&D specialist institution –not the type commentators have in mind when referring to “R&D institutes”. Independent R&D service providers, key actors in the market for “ideas”, appear to be somewhat less common. Their status may be transitory before sales of other goods and services exceed any income from R&D services, for instance in the case of R&D based start-ups.

In countries such as Norway and Spain, non-profit R&D specialist organisations serving businesses play an important role. Their status is often subject to special regulations and governments can play major roles as funders. Communication of statistics on business R&D should acknowledge the role of this subsector.

In the government sector, the results show how governmental institutions performing R&D are specialised or embedded into organisations with broader remits. The study provided insights on the connection between territorial decentralisation and government R&D institutes. The results put on the spot the variety of R&D that specialist R&D organisations undertake and the challenge of putting them all in the same “box”.

Methodological lessons

The data collection has also provided several insights on the way that R&D statistics are currently compiled around the world. This paper argues that classification, data collection and reporting practices that are sensitive to the degree of specialisation in R&D provision can help national statistical organisations provide statistical outputs that are easier to interpret and analyse by domestic and international users than it is currently the case.

The strengthening of statistical registers of R&D performing units across all sectors should be a priority for NSOs in charge of R&D statistics. Registers should be equipped with relevant classification information and surveys should help with updates. In the absence of “off the shelf” registers to draw upon, bodies in charge of producing R&D statistics should be empowered to make their own classification decisions in line with established guidance and subject those to an appropriate degree of external scrutiny, both domestic and international.

The data collection has also raised issues about practices on the definition of statistical units and reporting arrangements that lead to the following recommendations:

- In the government sector, government R&D surveys should effectively adopt the performer’s statistical unit perspective rather than collect all information from sponsoring agencies or ministries without breakdowns covering the diverse institutional and functional range of R&D performing organisations under their oversight.
- In the business sector, the correct interpretation of BERD statistics requires to distinguish the contribution of non-profit organisations under control of business enterprises from other for-profit business enterprises and their affiliates. Questionnaire design should be adapted to take into account these different types of business enterprises.
- R&D statistics should be sensitive to the emergence of mixed institutions - under control by institutions across different sectors or at different territorial level of government.

Furthermore, communication of statistical classification decisions in R&D statistics should draw on best practices on transparency from other statistical domains and international experience. Classification disclosure is unlikely to represent a confidentiality breach, especially outside the for-profit business enterprise sector. In the interest of international comparability and quality assurance, countries should disclose their classification decisions to the extent that provisions on statistical confidentiality allow them to do so.

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1. Introduction and background

Long-standing policy interest in the role of organisations¹ set up with the primary objective of conducting research and experimental development (R&D) has driven several enquiries on the way such organisations are captured and depicted in statistical representations of national science and innovation systems, particularly through institutional sector classifications for R&D. Institutional sector classifications provide a high level characterisation of R&D performers that follows the logic of generic economic and social statistics in the System of National Accounts, but enabled much richer characterisations. Unfortunately, statistical reporting parsimony and confidentiality requirements results in a great of information not being available for international comparisons. This paper represents an attempt to fill the existing gap by demonstrating how several OECD countries are able to provide meaningful statistical results using the tools and guidance in the OECD Frascati Manual and how this could and should be mainstreamed into regular reporting going forward.

Motivations for policy interest in R&D specialist organisations are manifold but ultimately boil down to questions about the optimal division of “labour” within STI systems across different types of organisations. These questions concern the extent to which organisations that have R&D as its main activity can operate sustainably, fulfilling the expectations and requirements of other actors in the system. Organisational specialisation in R&D performance can drive greater efficiency, but may come at the expense of missing potential synergies with other activities. Issues of governance, ownership and control, financing, knowledge exchange and products follow as a result in policy debates, fuelled by interest in the emergence of new types of organisations with novel combinations of the above elements. OECD reviews of innovation policy and other targeted policy support initiatives typically dedicate considerable effort to investigating such questions in country or even regional specific contexts.

As one might expect, much public policy interest is focused on public research organisations (PROs) loosely characterised as research-focused organisations that are public by nature or in which the government has an “influence” (Cruz-Castro et al, 2020)². The reference to “influence” stretches the more explicit SNA definition of effective control, as it may ultimately include any type of regulatory influence. Additional restrictions on the PRO concept typically exclude organisations in the university and enterprise spheres (Cruz-Castro et al, 2020). As noted by the authors, the focus is not limited to the “R” of research. OECD R&D policy work (e.g. OECD, 2011,³ and several innovation policy reviews) has drawn on the terminology of Arnold, Barker and Slipersæter (2010)⁴, which uses the generic term of ‘research institutes’ as encompassing three main types of R&D organisations according to their ‘principal mission’, namely “government laboratories”, academic institutes, and research and technology organisations (RTOs), each presumed to be focused on mission-oriented research, basic science or oriented and applied research (to service industry and innovation). A recent study by Larrue and Strauka (2022)⁵ analyses the evolution of the funding, governance and policy context of RTOs over the last ten years, and the implications of these changes on their ability to achieve their mission. It shows that their contribution to solving societal challenges is now tightly intertwined with their historical mission of supporting innovation in industry and public administrations.

Formal sectorisation practices within several national STI systems and policies often allude to a so called “research sector”, distinct from universities, business and at times even government. Legislation and studies often refer to “research bodies”, “research institutes” or “research organisations”, sometimes by reference to entities with a focus on “research” only or intending to cover both “research and development” as the focus of activity within such organisations. In several countries especially within Europe, the term “Research and technology organisation”

(RTO) is often used, drawing attention on the role played by specialist organisations on the active development of new products and processes, as well as on the provision of technology services to other entities. Also in Europe, state aid rules define “Research and knowledge dissemination organisations” (RKDOs) as entities pursuing predominantly non-commercial education knowledge dissemination objectives, while consultations on the revised state aid framework included the new concept of “technology infrastructures”. The terminological drift thus incorporates several additional features with specific policy purposes in mind that result in differential treatment of the organisations falling within the scope of a given definition. That makes this a somewhat evasive or “moving target” for statistical measurement. Such a situation goes a long way towards explaining why consensus on what to measure and how, and getting it done, has thus far been evasive.

Ultimately, the lack of visibility of an R&D sector within the top-level classification used by countries to report data in line with Frascati Manual recommendations represents a practical challenge in terms of conducting public policy discussions about R&D specialisation, particularly those of an international comparative nature. This paper argues, with new evidence, that classification, data collection and reporting practices that are sensitive to the degree of specialisation in R&D provision, can help national statistical organisations provide statistical outputs that are easier to interpret and analyse by domestic and international users than it is the case at present.

2. Measurement guidance

In the presence of several competing legal and informal definitions for the object of measurement interest, before attempting to test and institutionalise new definitions, it is considered best statistical practice to assess to what extent the existing measurement tools can approximate what policy and other stakeholders seek to see captured and reported. Chapter 3 of the 2015 Frascati Manual provides several elements under two main classifications for institutional units⁶ involved in performing R&D:

- The institutional headline classification, which is inspired by the System of National Accounts' set of institutional sectors, and is based on a taxonomy of elements that include the following differentiating elements:
 - The residence status of the institutional unit, distinguishing the economic territory from the rest of the world, which includes extra-territorial organisations by convention.
 - The market-based nature of activity by the unit, contrasting those that charge meaningful economic prices for their products (thus operating in the market) with those that do not.⁷
 - The existence of control by government of the institutional unit, thus distinguishing public from private institutions.
- The classification of institutional units by main economic activity, or in other words, what is the main product (good or service) of the statistical unit.

The headline institutional classification (HIC, thereafter for economy) used in the Frascati Manual comprises the mutually exclusive categories of Business enterprises, Government, Higher education (HE) institutions and (other) Private non-profit (PNP). The HE sector represents an ad hoc addition to the SNA classification present in the manual since its first edition of 1963. Institutions are allocated to a HIC sector using a decision tree that draws on the taxonomy mentioned above and that includes the distinctive criterion of whether the unit provides HE services⁸. This is the main basis on which countries report aggregated data on R&D domestically and to OECD.

This structure also shapes (and reflects) how different survey instruments are addressed to different statistical units, with all units in the same HIC in a country often receiving the same distinctive questionnaire from the NSO or agency in charge of R&D statistics production. In many countries, different agencies or bodies are in charge of collecting and reporting data for different sectors within a country, which can pose a challenge for exercises that attempt to provide economy-wide views of activities that transcend multiple institutional sectors or where boundaries may be porous due to changes in defining features.

In addition to this, the 2015 Frascati Manual edition indicated that the classification of units by main economic activity should be systematically applied to all statistical units and not only those in the Business enterprise (BE) sector given a) its broad applicability, b) the scope for improving survey design and implementation based on knowledge of the main economic activity, and c) the need to respond to a wider range of policy user questions, such as those having to do with a range of economic activities carried out in multiple institutional sectors.

it is recommended that countries should tag institutional units in all sectors according to their principal economic activity even if they choose not to report these figures on a systematic basis. (FM, 3.32)

A major focus of the economic activity classification of institutional units, in all institutional sectors, relates to the categories of R&D services, health and education. Units involved in these activities can potentially be part of any Frascati institutional sector. The complete presentation of R&D statistics on the basis of an economic activity may possibly reveal some potential differences for units engaged in education services with respect to the total reported for higher education, which can be due to a number of factors, including the distinction between primary and secondary activities. (FM 3.34)

This recommendation was also the edition's response to a number of stakeholder requests to increase⁹ the number of headline "institutional sectors" to also comprise a "research sector". This meant assigning equal standing in the HIC to an "R&D sector" on a par with the likes of "Higher education" and "Government". Since such move would have resulted in an unworkable HIC decision tree, the 2015 revision's compromise was to keep a stable and manageable number of HIC sectors characterised by socioeconomic roles, while committing to generating cross-cutting statistics based on the main activity information.

The OECD secretariat, with the explicit agreement of NESTI, accordingly implemented an additional data collection table within its international survey of R&D addressed to NESTI members and participants. The table requests a breakdown of total GERD by main economic activity of all resident R&D performing units. Nearly seven years since the publication of the 2015 manual, response to this particular table is rather poor making the result not suitable for publication with the established body of OECD R&D statistics. Discussions at OECD and Eurostat, which also strives to collect this information on a regular yet pilot basis, have revealed a mix of cases underpinning the response from countries that the "information is not readily available":

- Lack of readily available compiled indicators, but the underpinning information is actually available to NSOs. This situation reveals issues of priority and resources for indicator generation or issues of statistical confidentiality.
- Lack of classification information on main activity in registers available and used for data collection, and/or lack of information reported by reporting units, especially in non-business sectors. This element is often intertwined with unwillingness or lack of resources to undertake classification or adjust questionnaires to mitigate for missing register information.¹⁰

The diagnosis of the situation revealed that it was necessary for NESTI to undertake a focused *ad hoc* data collection in order to facilitate mutual learning across countries to show how the most relevant statistics could be more systematically produced and communicated to an international user community.

3. The 2022 ad hoc data collection exercise and its precedents

The concept of the “R&D specialist institutions” project was brought up for consideration at both the 2018 and 2019 NESTI meetings, based on a proposal originally made by representatives from Spain at the 2018 NESTI meeting. The aim was to undertake a comparative analysis of the classification of the so called “research institutes” at the country-level. NESTI agreed to undertake a pilot study in order to clarify how “boundary” institutions, and in particular “R&D institutes”, are classified in countries.

This initiative was effectively a revival of work done at NESTI in support of a project by the former OECD Working Party on Research Institutions and Human Resources (RIHR), a body whose mandate was eventually subsumed into that of the OECD Working Party on Innovation and Technology Policy (TIP). Results from that initiative were included in OECD (2011) and comprised *ad hoc* tabulations provided by Austria, Denmark, Finland, Luxembourg, Poland and the Russian Federation, as well as the Flanders region of Belgium, conducted in response to the RIHR policy interest. At the time of the 2018 proposal, there was significant interest from numerous countries, including: Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, France, Greece, Ireland, Korea, Norway, Portugal, Russia, the United Kingdom and the United States. A pilot questionnaire was presented at the 2019 NESTI meeting with a slightly broader, less normative perspective than conceived in the 2009-10 NESTI-RIHR exercise, which conflated aspects of R&D and other S&T goals as well as public ownership and funding (see **Box 1** for the 2009/2010 project operational definition of research institutions).

Box 1. Definition of “research institutions” used in the 2009-2010 OECD project

The project by the former OECD Working Party on Research Institutions and Human Resources (RIHR) defined “research institutions” as national entities, irrespective of their legal status (organised under public or private law):

- whose primary goals are to conduct fundamental research, industrial research, experimental development, training, consulting and service provision, and to disseminate their results by way of training, publication and technology transfer; and
- whose profits (if any) are reinvested in these activities, the dissemination of their results, or training; and
- which are either totally or to a substantial share publicly owned, and/or are funded primarily from public sources via base funding (block grants) or through contract-based research, and/or are regulated, so as to achieve primarily public missions.

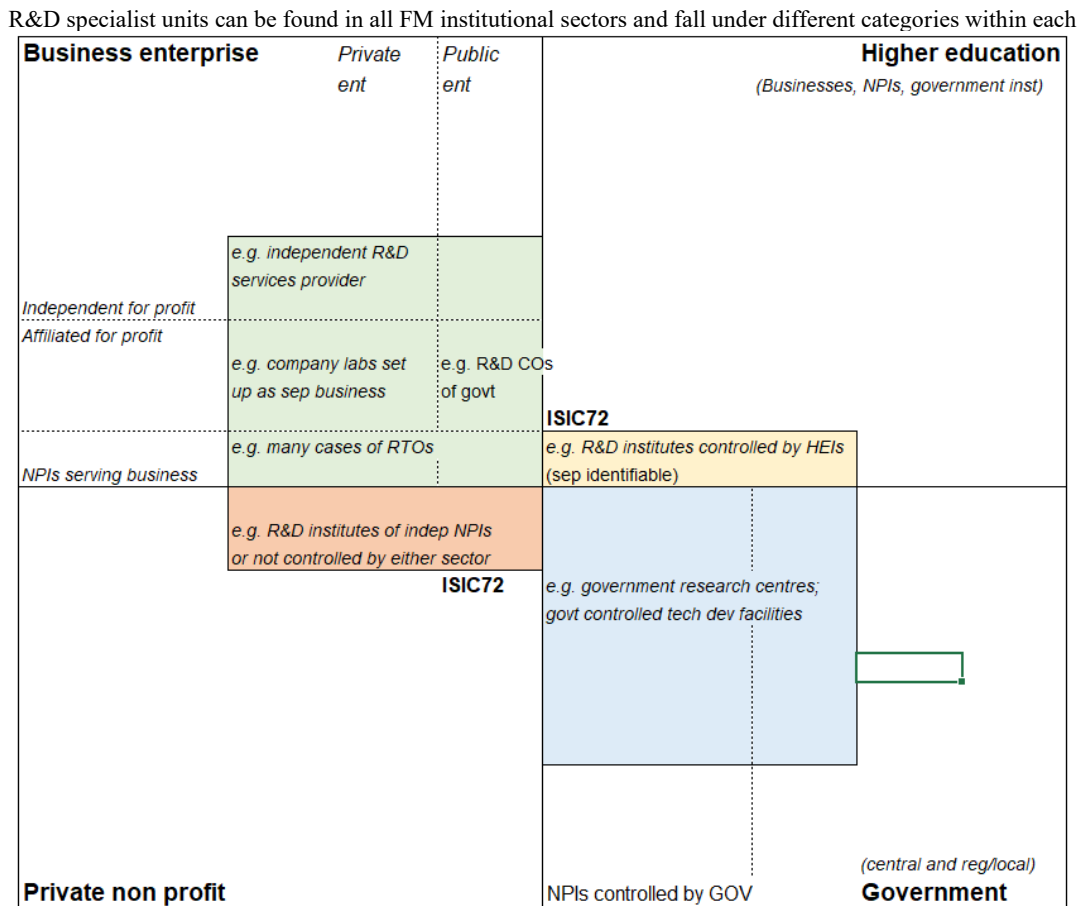
This definition thus combined R&D and related economic activity goals on one hand, a lack of profit motive, and a component of public funding, regulation and mission that was and is still not easy to operationalise, in particular since all economic activities are regulated to some extent to achieve public policy objectives. The ad hoc nature of this definition placed responsibility on national contacts to interpret the requirement, significantly detached from available statistical classifications. This was a judgement that few NSOs were willing or capable to make within the scope of the exercise, which was reflected in the low degree of participation.

Source: OECD, based on OECD (2011).

Following a hiatus in the project between 2019 and 2021, forced by the need to refocus NESTI resources during the COVID-19 crisis, discussions were resumed at the 2021 NESTI meeting. On that occasion, the secretariat proposed to resume the project on collecting data to determine the contribution of R&D specialist institutions to GERD as well as their sources of funding by means of a simplified questionnaire. The document argued that while sustained quality improvement and granular statistics by types of institutions requires effective sharing of entity names and statistical classifications applied, so that the criteria adopted can be probed by peers and the international community, this would require a significant agreement and substantial investment that at that time did not seem feasible to undertake. Setting that as possible medium to long-term ambition for the project, in the shorter term, the suggestion was to start work with the definitions and tools provided in the Frascati Manual 2015 to produce an initial picture of the ISIC72 industry in terms of its contribution to GERD, sectoral aggregates, and its sources of funding structure. It was posited as a working hypothesis that a “good enough” approximation to the RIHR research institutions framework can be pursued through some additional breakdowns based on established statistical definitions.

The questionnaire, including guidance provided to NESTI R&D contacts, is available under **Annex A**. A summary overview of the approach is available under Figure 1.

Figure 1. Visual representation of R&D specialist units (ISIC72) across the headline institutional classification in the Frascati Manual



Notes: NPI stands for Non-profit institution. GOV=government. COs=companies.
 Source: OECD, based on the Frascati Manual.

In March 2022, following several iterations to gather feedback from countries, the data request was sent to contacts from 46 economies (OECD members and non-members) engaged with OECD in the reporting of R&D statistics via NESTI. Twenty-five responded but only twenty submitted complete or near complete responses (see Table 1 for a summary of responses).

- Eight were able to provide data for all the sectors (Business enterprise, Higher education, Government and Private-non-profit).
- Eight provided data for three of the four sectors, either Business enterprise, Government and Private-non-profit or Business enterprise, Higher education and Government.
- Four provided data for both Business enterprise and Government sectors.
- Four were only able to provide data for the Business enterprise sector (effectively what has been systematically collected for decades for the business sector), and one country provided data for the Business enterprise sector and the PNP sector.
- Most countries provided data for the latest available year, with a majority providing data for 2020 or 2019. A few contacts provided time series data for several years.

Table 1. Inventory of responses to the OECD/NESTI ad hoc 2022 questionnaire

Availability of responses per economy under each of the survey components

| | Table 1 | | | | | | | | | Table 2 | |
|--------------------|-----------|-----------|-----------|----------|--------------|--------------|-----------|---------------|-----------|------------|--|
| | BERD | Private | Public | HERD | Private | Public | GOVERD | Central/local | PNPERD | SourceFund | |
| Australia | y | n | n | n | n | n | y | n | y | BE+GOV+PnP | |
| Austria | y | y | y | y | confidential | confidential | y | y | y | ALL | |
| Belgium | y | y | 0 | y | 0 | y | y | y | y | ALL | |
| Brazil | y | partial | y | n | n | n | n | n | n | BE | |
| Canada | y | y | 0 | n | n | n | n | n | y | BE+PnP | |
| Czech Republic | y | y | y | n | n | n | y | y | y | BE+GOV+PnP | |
| Germany | y | partial | n | n | n | n | n | n | n | BE | |
| Spain | y | y | y | y | y | y | y | y | y | ALL | |
| Estonia | y | n | n | n | n | n | y | n | y | BE+GOV+PnP | |
| Finland | y | y | y | 0 | n | n | y | y | y | ALL | |
| Greece | y | y | y | n | n | n | n | n | n | BE | |
| Israel | y | y | 0 | n | n | n | y | n | y | BE+GOV+PnP | |
| Italy | y | y | y | n | n | n | y | y | y | BE+GOV+PnP | |
| Japan | y | y | n | y | y | y | y | y | y | ALL | |
| Korea | y | y | 0 | n | y | n | y | n | y | ALL | |
| Lithuania | y | y | 0 | 0 | n | n | y | n | n | BE+GOV | |
| Netherlands | y | n | n | 0 | n | n | y | n | n | BE+GOV | |
| Norway | y | y | n | n | n | n | y | partial | n | BE+GOV | |
| Poland | y | y | y | y | 0 | y | n | partial | n | BE+HE+GOV | |
| Portugal | y | y | y | y | n | n | y | y | y | ALL | |
| Sweden | y | y | y | y | 0 | y | y | y | n | BE+HE+GOV | |
| Türkiye | y | n | n | n | n | n | n | n | n | BE | |
| Chinese Taipei | y | y | n | n | n | n | y | partial | y | BE+GOV+PnP | |
| United States | y | n | n | n | n | n | y | n | n | BE+GOV | |
| South Africa | y | y | y | y | y | y | y | y | y | ALL | |
| Total count | 25 | 18 | 11 | 8 | 4 | 6 | 19 | 10 | 15 | | |

Notes: y/n; not reported; 0=nil value. BE=business; GOV=government; HE=higher education; PnP=private non profit
Source: OECD, based on responses to OECD/NESTI data collection.

The data collection period since the launch of the questionnaire gave countries ample time to elaborate the GERD contribution and sources of funding indicators requested when underlying data were available. The 2-month timespan also allowed for some first order *ad hoc* classification work within countries. Several email exchanges took place over the collection period and beyond as some countries requested extensions or indicated reporting difficulties, particularly for the government sector. Very few among responding countries provided qualitative explanations about the types of domestic institutions included in the responses, with a few preferring to provide additional clarifications by email rather than within the questionnaire. A few edits were implemented following the discussions at the NESTI meeting held in September 2022.

4. Analysis of results from the data collection

This section examines the main findings from the NESTI pilot data collection, firstly on a sector-by-sector basis, concluding with an overview of the results across the entire economy for those instances where responses were sufficiently comprehensive.

4.1. R&D specialist units within the Government sector

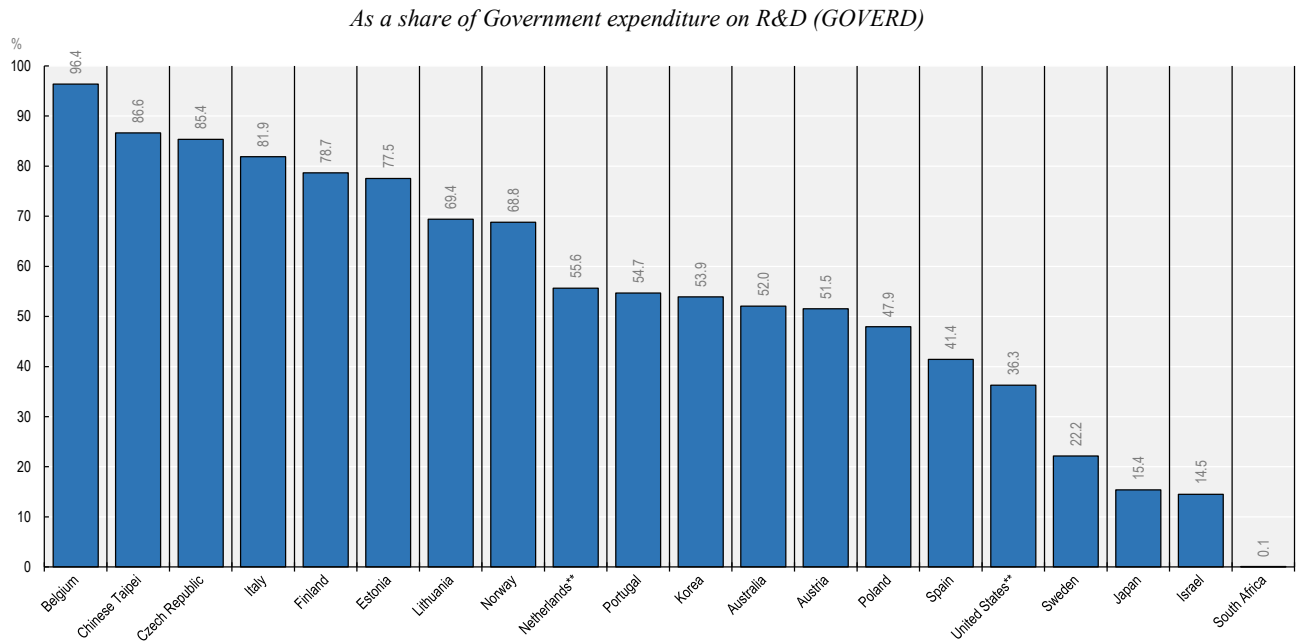
As indicated in the Frascati Manual (chapter 8), the Government sector consists of the following groups of resident institutional units:

- all units of central (federal), regional (state) or local (municipal) government, including social security funds, except those units that provide higher education services;
- all non-market non-profit institutions (NPIs) that are controlled by government units, which are not part of the Higher education sector.

Although Government expenditure on R&D (GOVERD) is too often identified with the R&D expenditures of research institutes whose staff are generally free from higher education tuition responsibilities, it effectively encompasses R&D performing government institutions across the entire R&D spectrum, from those focusing on basic research with scientific infrastructures that are too big for any given university to host, R&D facilities focusing on governmental priority areas such as energy or defence, through to technology development institutions that are controlled by government even if specialised in providing translational services, prototyping and testing facilities or other institutions assisting businesses. Also public hospitals can fall under the government sector's organisations performing R&D. Not all government institutions engaged in R&D have this activity as their main or even secondary function. This proved to be the most challenging reporting challenge for national contact points.

4.1.1. Contribution to GOVERD

From the questionnaire's outturn, data on Government R&D are available for 18 economies with the median value representing slightly over half of the domestic government sector's R&D (Figure 2). This indicator exhibits very large variability, from almost 100% in the case of Belgium¹¹ to less than a quarter for Sweden, Japan, Israel and South Africa. Such variability appears to reflect the extent to which government R&D performance is concentrated in specialised R&D establishments or is integrated into institutions fulfilling multiple other roles, such as public hospitals, R&D funding agencies or even government departments. Among respondents, the median share of specialist R&D units within total GOVERD is 55%. This high figure appears to indicate that there is a high degree of specialisation within government, although it is difficult to generalise this finding to the entire range of countries including those that have not responded as those may exhibit a greater tendency to have units that combine R&D and non-R&D functions.

Figure 2. R&D specialist institutions contribution to government R&D, latest available year

Note: ** For the Netherlands the Government sector includes the PNP sector. ** For the United States, the data for Government only includes Federally Funded Research and development Centres allocated to the government sector.
Source: OECD calculations based on ad hoc NESTI data collection and MSTI, August 2022.

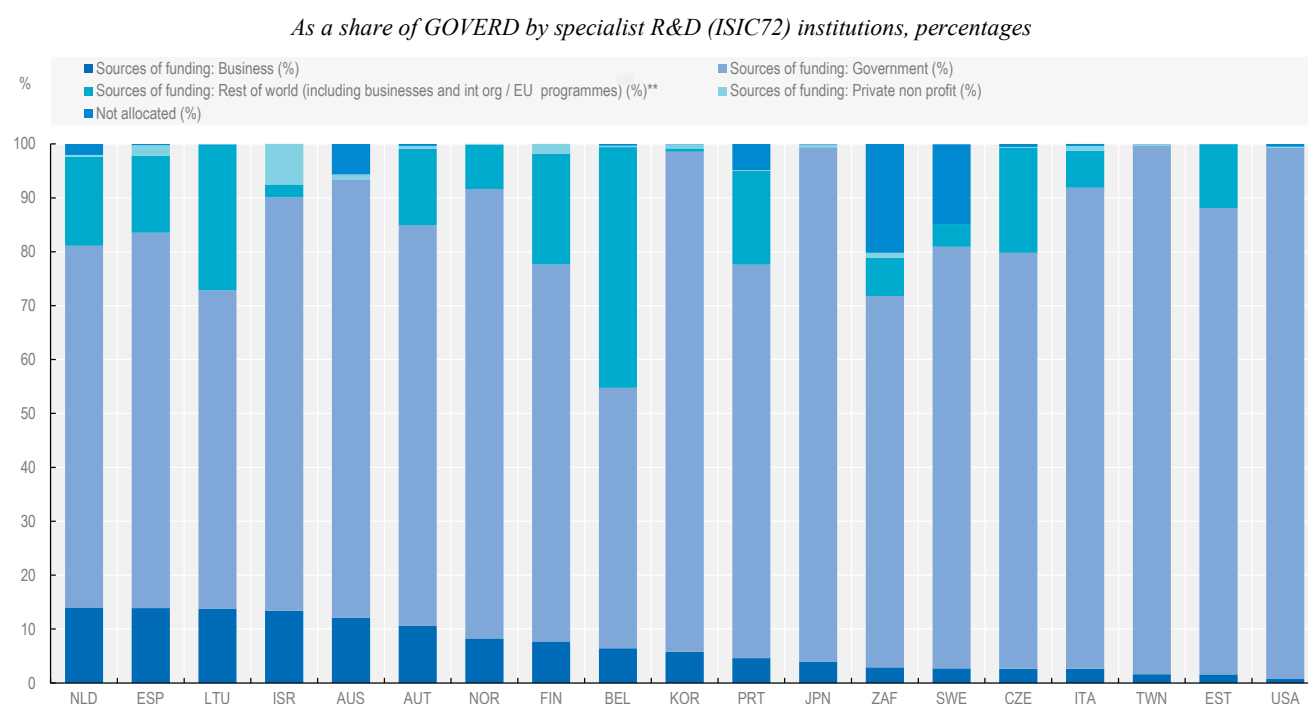
4.1.2. Levels of government

The NESTI questionnaire enquired on the distribution of such contribution between central and local (including regional) government. Most of the reported GOVERD under R&D specialist organisations appears to take place under the purview of the central government, with the exceptions of Japan, Belgium and Spain and where 77%, 76% and 75%, respectively, takes place within R&D institutions under the control of regional authorities. The percentage is 30% for Austria, the only other federal or quasi-federal country reporting this breakdown.¹²

4.1.3. Sources of funding

Funding for R&D specialist organisations in the government sector in all economies originates principally from government itself (Figure 3). Contributions from the business sector to the R&D of these organisations do not exceed 15% for any economy. In contrast, contributions from the rest of the world can be as large as over 40% in the case of Belgium. For several European economies, such contributions can be in the order of 20% and are presumed to originate in large part from EU programmes. Private non-profit funding is only appreciable in the case of Israel at slightly less than 10%.

Figure 3. Sources of funds for government R&D in specialist R&D institutions, latest available year



Note: See previous chart.

Source: OECD calculations based on ad hoc NESTI data collection, August 2022.

4.1.4. Reporting challenges

Identifying specialist R&D institutions within government was a key focus for the data collection in view of the policy interest and the previous feedback from NESTI delegates. The exercise confirmed that several countries have not yet implemented the recommendation to collect information within the sector on the basis of economic activity. The problem plays at the level of both registers and survey questionnaires.

- Many of the NSOs or bodies collecting GOVERD have poor access to generic statistical registers and have to develop their own registers when in principle data sharing arrangements and record linking should suffice. Besides, the available statistical registers are often focused on business enterprises, so GOVERD compilers have to implement ad hoc solutions often on the basis of limited information.
- The exercise also revealed a more substantive problem with data collection practice in many countries. For many, NSOs request data from institutions of government (authorities) who respond on behalf of all R&D performing institutions under their responsibility. Pooling returns under these authorities has the practical effect of making the government authorities the effective statistical unit, in departure from the OECD Frascati guidance to treat the separate institutional units that engage in R&D as the statistical units. The authorities can still act as reporting units (i.e. the entity from which the required statistics are collected) but NSOs need to provide these reporting units with the means and guidance to transmit the information about the underlying statistical units, including their main economic activity, for example by pointing to the need to report separately for each of them.

In the case of government institutions with both intramural R&D and significant provision for funding for R&D carried out externally, many NSOs have not explicitly addressed the question

of deciding what their main activity is and classifying such institutions accordingly. Thus, organisations like the National Institutes of Health in the United States might be classified as public administration service providers rather than R&D service providers (ISIC72). Similar instances may arise in the case of government institutions providing other scientific and technical services and R&D playing a relatively minor role, such as in the case of many geological or meteorological institutes. Such classification calls may appear unimportant and even fastidious at a domestic level, but postponing clearly presents a major roadblock for effective international comparisons.

The generalised lack of commentary from countries about which flagship institutions fall under GOVERNMENT is an additional challenge, because such information can help reveal similarities and differences of criterion as to what represents government control and non-market production, the two distinctive features of the government sector (alongside the higher education services features). For instance, the information contained OECD R&D Sources and Methods database clarifies that the Fraunhofer Society, in the case of Germany¹³, while principally serving business, is effectively controlled by the ensemble of federal and state level governments through an assessment of governance and funding arrangements. While this information is readily available in the OECD R&D Sources and Methods, it is not easy for less expert data users to take these into account when looking at the published data. Valuable time and resource are dedicated to provide ad hoc clarifications on request when a single, co-ordinated register could do the job.

4.2. R&D specialist units within the Business enterprise sector

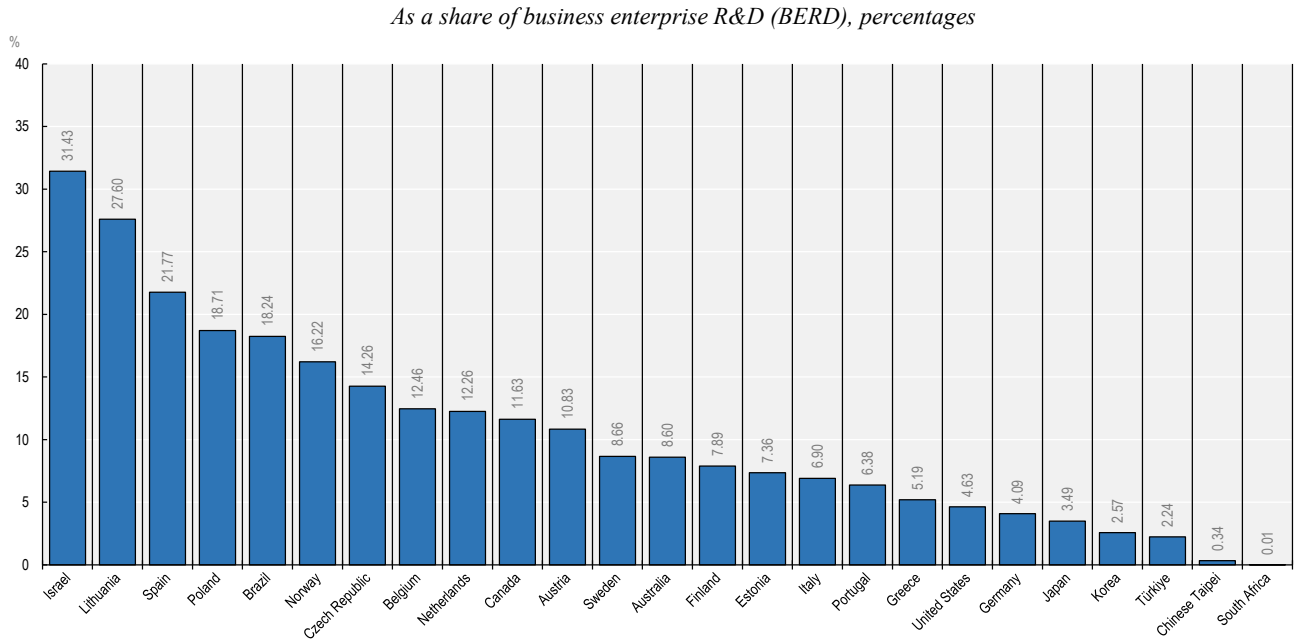
As stated in the Frascati Manual (chapter 7), the sector comprises:

- All resident corporations, including not only legally incorporated enterprises, regardless of the residence of their shareholders. This group also includes all other types of quasi-corporations, i.e. units capable of generating a profit or other financial gain for their owners that are recognised by law as separate legal entities from their owners and set up for purposes of engaging in market production at prices that are economically significant [...]
- All resident NPIs that are market producers of goods or services or serve business.

This definition comprises a heterogeneous group of institutions performing R&D which highlights the different contexts in which it is possible to find R&D specialist institutions.

Unsurprisingly, all respondents to the NESTI pilot questionnaire provided information on the contribution to BERD by statistical units under ISIC72. The classification by main economic activity is core to business R&D data collection and reporting. This information is already reported to and published by OECD in its R&D Statistics and further elaborated within the OECD ANBERD database. R&D specialist business enterprises account for the largest share of BERD within Israel, with nearly one third of total BERD, followed by Lithuania and Spain both with over 20% (Figure 4).

Figure 4. R&D specialist institutions contribution to business R&D, latest available year

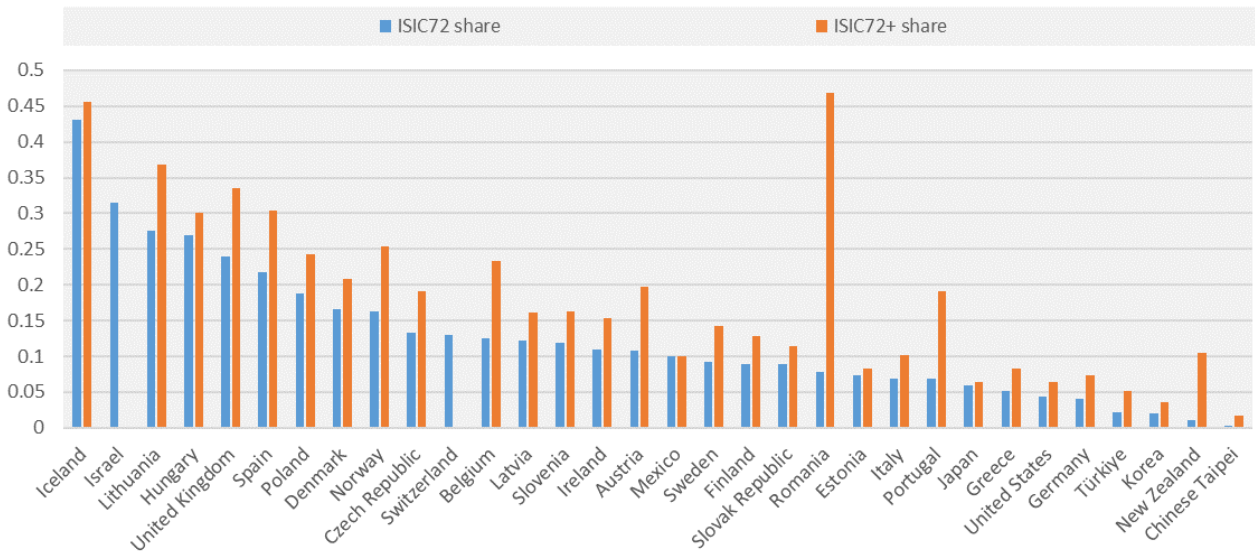


Source: OECD calculations based on ad hoc NESTI data collection and MSTI, August 2022.

The data on the share of BERD and other Professional, scientific and technical activities from the ANBERD database (Figure 5), mirrors the data collected in this exercise for those economies reporting on both. Israel, Lithuania and Spain are in the lead on this indicator.

Figure 5. Share of Business R&D accounted for by units with R&D (ISIC72) and with R&D and other Professional, scientific and technical activities as main activity (ISIC72+), ANBERD database, 2019

Estimates from ANBERD database, as a share of domestic BERD



Note: ISIC72+ comprises all Professional, scientific and technical activities, including Scientific R&D (ISIC72).
Source: OECD ANBERD database.

Breakdowns within ISIC72 BERD proved a bigger challenge and were not provided in all cases. Eighteen economies were able to separate between private and public (i.e. government controlled) enterprises, although only 11 reported any data for the latter.

4.2.1. R&D specialist public enterprises

Eleven countries were able to provide data for public enterprises. By and large, it appears that several countries do not systematically track the public or private status of enterprises. Without baseline data reported to OECD on public business R&D across sector it is hard to benchmark the information collected on this issue. Developing and transition economies appear to have larger levels of R&D accounted for by public enterprises, but this might appear to be connected with state-controlled industries, such as energy, utilities, etc. in such economies. The economies with the largest share of R&D by public enterprises among the business enterprise specialist sub-sector are Brazil (96%), South Africa (89%) and Poland (55%).

The public enterprise configuration appears not to be the standard set-up for R&D specialist organisations under government control since they may not always be designed or able to charge economically meaningful prices, turning into governments institutions when that happens. However, in some instances, extraordinary income sources e.g. on sales of IP, can drive reverse ad hoc classification decisions to identify a government unit specialising in R&D as a public enterprise.

4.2.2. Affiliated private enterprises

While most of the general policy discussion on specialist R&D institutions envisages these as independent R&D organisations, it is important to note that private business groups can organise their economic activity in ways that result in them having separate R&D specialist units under their direct control, typically tasked with serving the ultimate revenue raising activities of the entire group. For instance, an ISIC72-classified enterprise may be the affiliate R&D “lab” of another domestic or foreign-controlled business group operating predominantly in markets such as pharmaceuticals, pharma, ICT or any other. The information collected indicated that the majority of private enterprise R&D in the ISIC72 sector takes place within statistical units that are subsidiaries of other business entities thus indicating there can be a significant decoupling between R&D and other activities that the R&D is intended for.

- In Belgium, Israel, Italy and Sweden over 70% of ISIC72 private BERD is conducted within affiliated enterprise units.
- Relatively higher rates of independent (i.e. non-affiliated) specialist ISIC72 private BERD are found in Canada (64%), Greece (49%) and Poland (40%).

These results are not only influenced by globalisation and specialisation patterns, but are also extremely sensitive to the way in which statistical units are configured within countries and information collected. Higher levels of aggregation, e.g. into domestic groups, are bound to be associated with a smaller part of BERD being reported as carried out within ISIC72 units since the R&D is in such cases more likely to be allocated to the predominant activity or activities of the broader “served” business group.

4.2.3. Non-profit R&D institutions serving business

As indicated in the definition of the BE sector, it also comprises non-profit institutions that are market producers of goods or services or serve business. These types of institutions are rather common in the domain of R&D specialist organisations undertaking applied research and experimental development services for the benefit of business, especially in the same geographical area. While they may be government regulated and government institutions may play a significant

part in their governance and funding, if the latter don't have the ability to control key aspects of their activities vis à vis other stakeholders they cannot be characterised as part of the government or broader public sector. Many might operate under the oversight or form of membership-based organisations, funded through a mix of subscriptions, subsidies and payments for individualised services to member/customers.

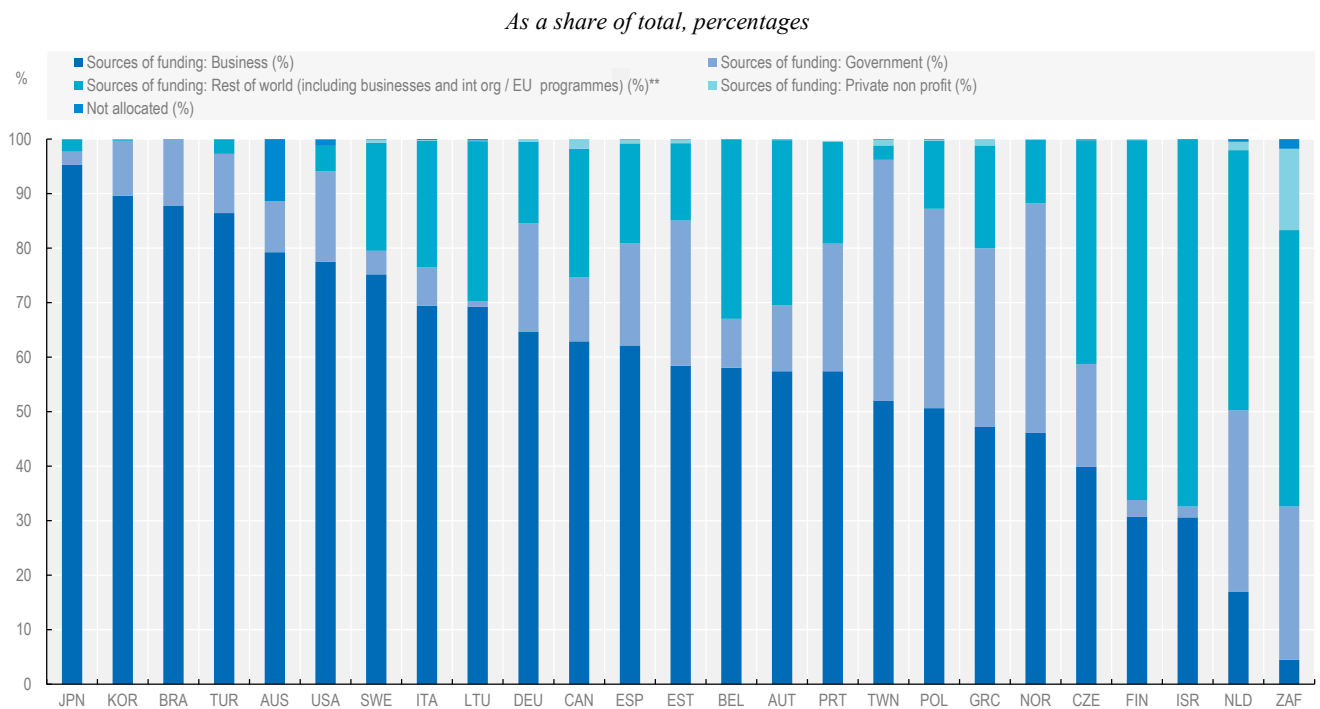
The role of these organisations in some innovation systems can be rather significant. In Norway, 80% of R&D specialist business R&D takes place within non-profit institutions, close to 13% of total BERD. In the case of Chinese Taipei it is 50% but out of a much smaller share of BERD in specialist business R&D units. In the case of Spain, the 34% non-profit share in R&D specialist BERD corresponds to 7% of total BERD, a rather significant component. One example provided by Spain's Statistical Institute of an organisation reported within BERD is the private-non-profit research and technology foundation Tecnalia. Its orientation to serve businesses implies it should not be classified as "Private non-profit", as an incomplete reading of the Frascati definition for BE might otherwise suggest.

Thus, in some economies, a significant part of business R&D is actually conducted by institutions that are not typically thought of as enterprises and have non-profit legal structures. This type of insight is very important when interpreting R&D statistics and conveying to the public what the figures actually represent. It implies that there should be a concerted quantification effort.

4.2.4. Sources of funding for business R&D in specialist organisations

The heterogeneity of specialist R&D organisations in the business enterprise sector is reflected in the profile of sources of funding by economy (Figure 6).

Figure 6. Business enterprise R&D specialist institution contributions, ISIC 72, by source of funds, latest available year



Source: OECD calculations based on OECD R&D specialist institutions ad hoc data collection, August 2022.

Business (domestic) funding is predominant, especially in the case of Japan and Korea where it is over 90%. Government funding is dominant in the case of Chinese Taipei and Norway. Funding from the rest of the world, which combines European Commission and international business funding, is dominant in the cases of Finland, Israel, the Netherlands, South Africa and the Czech Republic.

4.3. R&D specialist units within the Private non-profit sector

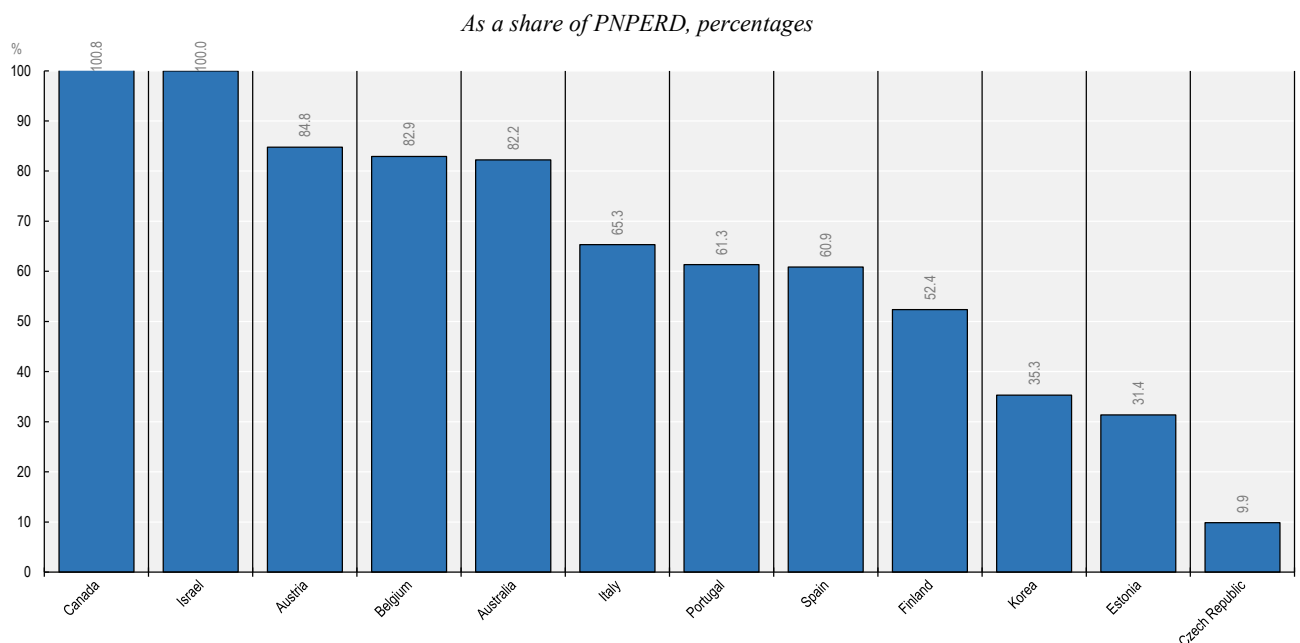
According to the FM's (chapter 10) definition of the PNP sector for R&D measurement purposes, it comprises:

- all non-profit institutions serving households (NPISH), as defined in the SNA2008, except those classified as part of the Higher education sector;
- for completeness of presentation, households and private individuals engaged or not engaged in market activities.

A total of 15 responses for the PNP sector R&D specialist units were collected. In this sector, it is common for surveys to collect information on the main activity of the organisation as recommended in the Frascati Manual. However, the challenge with this sector is the infrequent nature of dedicated surveys, a consequence of the traditional lower weight of this sector's contribution to total domestic R&D. The PNP sector is a residual sector in nature as it only includes non-profit institutions (NPIs) that do not fall neatly under either government, business or higher education sector unit's control.

The data collected show that the PNP R&D specialist contribution as a share of total PNPERD is over 50% for most countries. For Canada and Israel it constitutes 100% (Figure 7).

Figure 7. PNP R&D specialists contribution to total PNPERD, latest available year

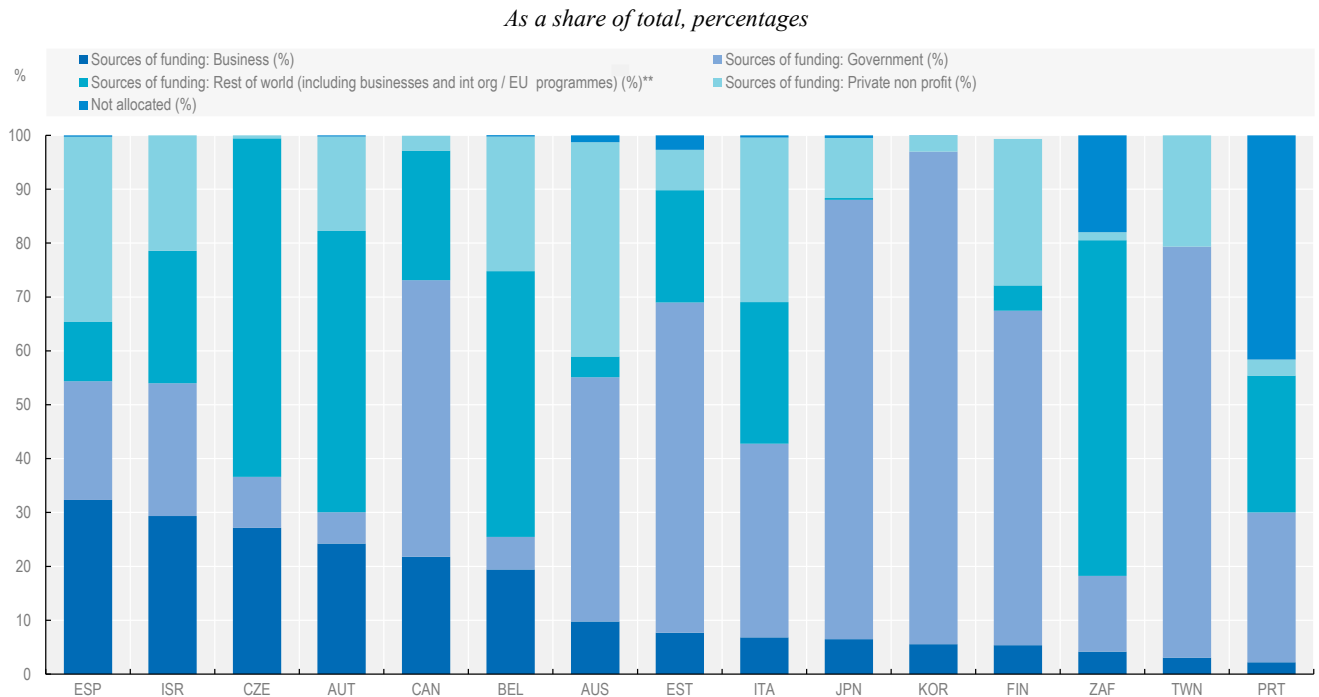


Source: OECD calculations based on OECD R&D specialist institutions ad hoc data collection, August 2022.

The sources of funding for the PNP specialist R&D subsector are varied. For several European economies that main source of funding is Rest of world, which includes EU programmes

(Figure 8). Only in the case of Spain the business enterprise sector appears as the principal funder. For Canada, Japan, Italy, Finland and Korea the principal source is the government sector. In Portugal the largest contributor is higher education sector (classified in not allocated).

Figure 8. PNP specialist institution contributions, ISIC 72, by source of funds, latest available year



Source: Calculations based on OECD R&D specialist institutions ad hoc data collection, August 2022.

4.4. R&D specialist units within the Higher education sector

As earlier alluded to, this headline institutional sector is a rather idiosyncratic feature of the Frascati Manual (chapter 9) for it introduces economic activity elements in its definition. This sector is composed of:

- all universities, colleges of technology and other institutions providing formal tertiary education programmes, whatever their source of finance or legal status;
- all research institutes, centres, experimental stations and clinics that have their R&D activities under the direct control of, or administered by, tertiary education institutions.

Higher education was the least reported sector in this pilot exercise. Eight countries provided data for it. Most responses coincide in pointing out that R&D institutes within the HE sector are not separate statistical units in relation to the HEI they are part of and as a result these cannot be identified.

Universities are major centres of research, and when countries have wished to expand their R&D in specific fields, universities have frequently been considered appropriate locations for new institutes and units. Many such units are principally government-financed and may be mission-oriented research units; others are financed by Private non-profit sector funds and by the Business enterprise sector. Examples can be units established to meet national priorities regarding environment, life sciences, medicine or science and engineering; often they have a time-limited horizon. When they are set up to be managed by universities or university departments, these can be considered as

belonging to the Higher education sector. Whatever the choice, it is important to report on the institutions that are included in the sector.

The second bullet point of the definition of the HE sector proved somewhat challenging to reach consensus during the Frascati Manual revision and its interpretation, in an already expansively defined sector, has to be contained to some degree. For instance, spin-offs from universities that may be run by individual academics or the HEI's technology transfer offices should not be considered as part of HE but components of the business sector since they pursue an entirely different economic function. While this is the presumed practice, further confirmation from NSOs is required.

For the countries that separately identified R&D institutes within HE, the contributions to HERD are relatively small, with a median of just over 2%.

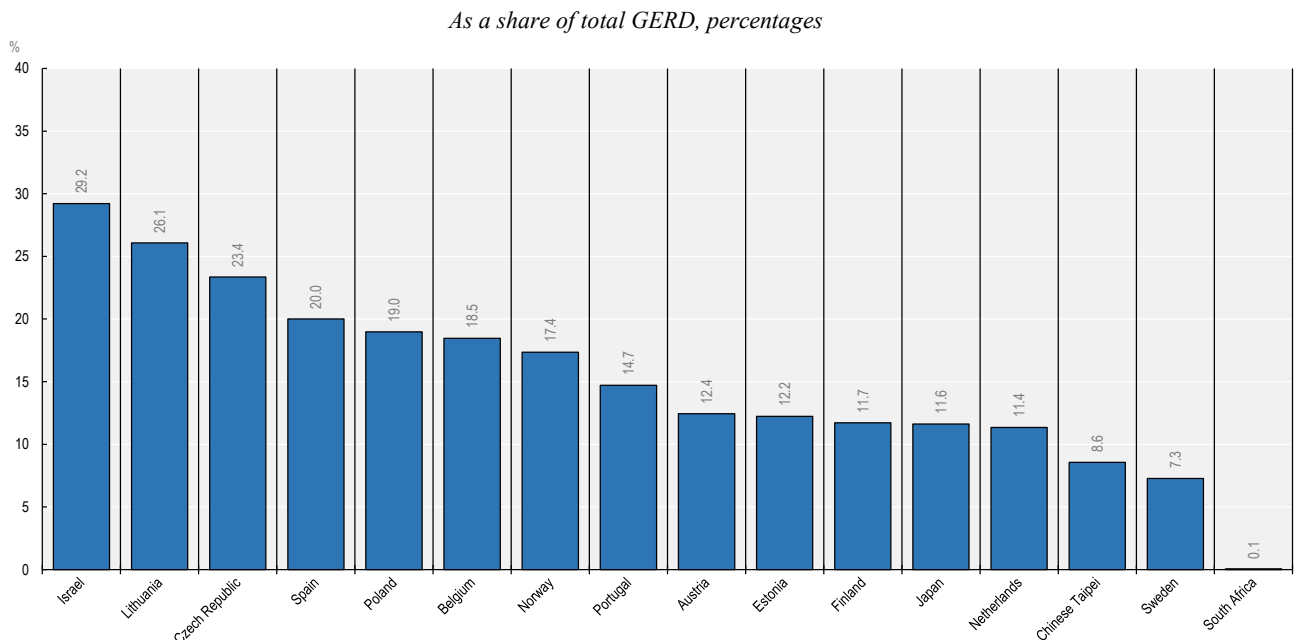
The data collection inquired about the public versus private nature of these organisations within HE but only two countries provided such a breakdown.

Eight countries reported on the sources of funding for HERD in R&D specialist institutions. Government funding dominates with small contributions from domestic businesses and the rest of the world.

4.5. The broad picture on R&D specialist organisations

For the economies with a reasonably complete picture within this exercise it is possible to attempt to assess to what extent the highly diverse group of R&D specialist organisations play a central role in R&D performance (Figure 9). With 29% of all GERD accounted for by these organisations across all sectors, Israel emerges as the economy with the greatest degree of R&D specialisation, with Sweden at the other extreme at 7%.

Figure 9. R&D specialist institutions contributions to domestic R&D (GERD), latest available year

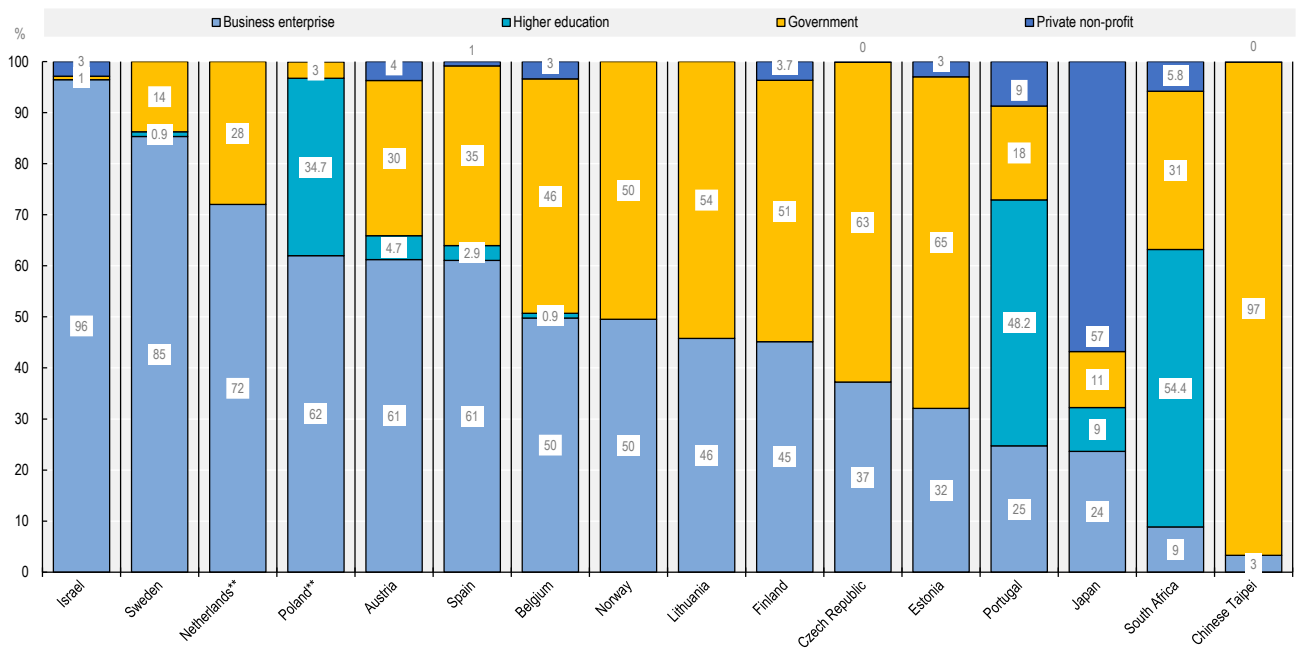


Source: Calculations based on OECD R&D specialist institutions ad hoc data collection and March 2022, MSTI, August 2022.

Israel's position is explained by the contributions to BERD by business affiliates of other enterprises as well as independent for-profit companies. Next in line, Lithuania, the Czech Republic and Spain combine high shares of R&D specialist contributions to both BERD and GOVERD, with the contributions to BERD passing in large measure through non-profit institutions serving business.

The distribution of identified specialist R&D organisations' GERD contributions across sectors is depicted in Figure 10. Overall, R&D specialists' contribution to GERD comes mostly from within the business sector and not inside the government as often implied in references to "R&D institutes".

Figure 10. R&D specialist institutions expenditure distribution by sector, percentages, latest available year



Note: ** For the Netherlands the Government sector includes the PNP sector. ** For the Poland, Government is only central government.

Source: Calculations based on OECD R&D specialist institutions ad hoc data collection, August 2022.

A tentative depiction of the economies that participated in the data collection with the largest non-profit R&D institutes (in absolute terms) is available in Table 2.

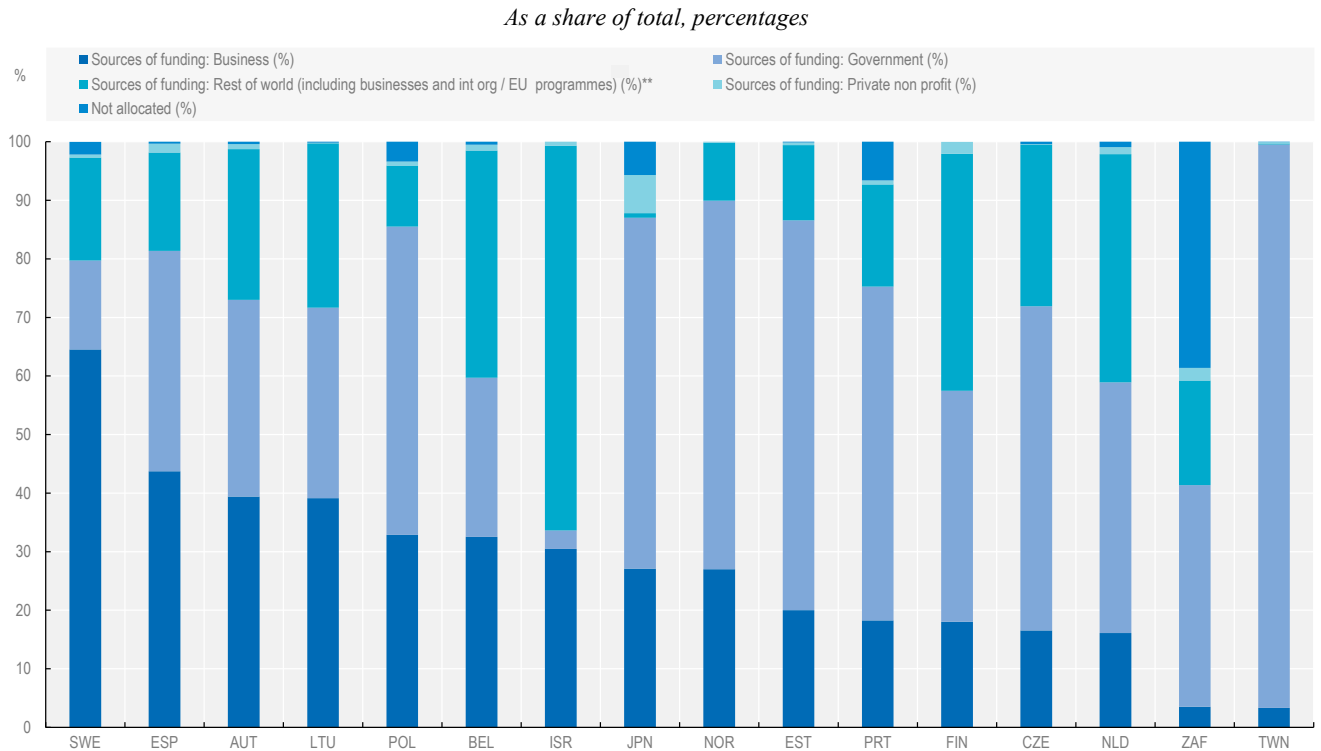
Table 2. Contribution to GERD by R&D specialists in government, public enterprises and non-profits serving business

| Economy | Value (USD PPP) | Comment |
|----------------|-----------------|---|
| United States | 23 514 | Only FFRDCs accounted for |
| Korea | 6 152 | Only government reported |
| Italy | 4 103 | Total public enterprises +government |
| Chinese Taipei | 4 031 | Non-profit org serving bus, + government |
| Spain | 2 887 | Non-profit org serving bus, public enterprises + government |
| Brazil | 2 102 | Total public enterprises |
| Belgium | 1 891 | Non-profit org serving bus, + government |
| Czech Republic | 1 428 | Total public enterprises +government |
| Norway | 1 206 | Non-profit org serving bus, + government |
| Australia | 1 187 | Only government reported |

Note: HE NPIs not included. FFRDCs= Federally Funded Research and Development Centers.
 Source: Calculations based on OECD R&D specialist institutions ad hoc data collection, August 2022.

The contribution to total sources of funding is closely related to the nature of the R&D specialist mix. Figure 11 shows that the government sector is largest contributor in over half the economies. In four economies the largest contributor is the business enterprise sector, Sweden, Spain, Austria and Lithuania. For two economies, it’s the rest of world, Israel (66%) and Finland (41%).

Figure 11. Total R&D specialist institution contributions, ISIC 72, by source of funds, latest available year



Source: Calculations based on OECD R&D specialist institutions ad hoc data collection, August 2022.

5. Conclusions and next steps

5.1. Lessons from the data collection process about R&D systems

The data collection conducted in 2022 under the aegis of the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) process has confirmed the widespread interest in this issue among countries. However, there are still many economies, large and small, whose R&D statistical representatives have chosen or not been able to participate or engage in some of the more demanding data processing required to submit results.

The data collection process revealed some ambiguities and knowledge gaps in terms of data availability and application of core Frascati guidance. On several occasions the secretariat had to point out metadata features, domestic reports, and possible practical solutions to address some of the challenges identified by the national contacts. For an informal data collection such as this, some heuristics can provide reasonably good approximations to the intended outcomes.

The diversity of types of R&D specialist organisations across and within sectors makes it difficult to draw general lessons about the extent to which some economies are more prone than others to decouple R&D from other functions into separate types of units. Unfortunately, the data collected do not yet enable the derivation of data-based typologies of R&D systems along these lines for reasons that anticipate what might be the focus of future NESTI work with more decisive support from policy and stakeholders to National Statistical Organisations (NSOs) in charge.

- The number of economies for which information has been reported is still very limited, with some major R&D performing countries missing from the exercise or some of its key elements.
- There are idiosyncratic differences in the way in which countries implement the concept of statistical unit and therefore collect separate data from R&D specialist units within broader organisational structures.
- The pilot data collection did not set out to capture additional information on the nature of the R&D carried out by specialist organisations, anticipating that countries would be reluctant to provide information by types of R&D (basic and applied research and experimental development); fields of R&D; or on the composition of government R&D funding (e.g. institutional or project-based).

Despite these limitations, the data collection has provided several insights on the R&D structure of participating countries, highlighting those in which the R&D specialist sector plays a significant role as well as its composition.

- This pilot exercise has shown in the case of the business enterprise sector R&D (BERD) the important role played by R&D specialist enterprises that are affiliates of larger business groups in countries such as Israel. This is by far the largest category of R&D specialist institution - not the type that most commentary allude to when referring to “R&D institutes”. Independent R&D specialists in the business sector are less common and their status may be in part transitory before their sales of other goods and services comes to dominate the income from R&D services, for instance in the case of R&D based start-ups.
- In a few countries such as Norway and Spain, the results show the importance of non-profit R&D specialist organisations serving businesses and drawing on multiple sources of funding. Their status tends to be subject to special regulations and governments can also provide significant levels of funding. This type of business enterprise unit is typically

not thought about in most commentary about business R&D statistics but should be explicitly considered.

- When it comes to the government sector, the results show the varying extent to which governmental institutions performing R&D are specialised or embedded into organisations with broader remits. The study provided some insights too on the connection between political decentralisation and government R&D institutes. These results put on the spot the variety of R&D, from basic research to experimental development through applied research, that specialist R&D organisations undertake and the difficulty of putting them all in the same “box”.

5.2. Methodological lessons

The data collection has also provided several insights on the way that R&D are and can be collected in countries. This paper has argued, with new evidence, that classification, data collection and reporting practices that are sensitive to the degree of specialisation in R&D provision, can help national statistical organisations provide statistical outputs that are easier to interpret and analyse by domestic and international users than it is the case at present.

The strengthening of statistical registers of R&D performing units across all institutional sectors should continue to be a priority for NSOs in charge of R&D statistics data collection and reporting. Registers should be equipped with relevant classification information and surveys should help update such information. In the absence of “off the shelf” registers with the necessary information, those in charge of producing R&D statistics should be empowered to make their own classification decisions and should be encouraged to subjecting those calls to a larger degree of external scrutiny, both domestic and international.

The data collection has also raised issues about the shaping of statistical units and reporting arrangements that lead to the following conclusions:

- In the government sector, government R&D surveys should effectively adopt the performer’s statistical unit perspective rather than collect all information combined from sponsoring agencies or ministries without attention to the diverse range of R&D performing organisations under their policy oversight.
- In the business sector, it is of paramount information for the interpretation of BERD statistics to separately itemise the contribution of non-profit organisations under control of business enterprises from other business enterprises. Questionnaire design should be adapted to take into account the broader nature of the business enterprise concept.

R&D statistics production should be more sensitive to issues caused by the emergence of mixed institutions under control by institutions across different sectors or jointly by central and subnational governments.

Furthermore, it is pertinent for the international community and NSOs in charge to discuss potential limits to certain confidentiality restrictions when it comes to classification. Statistical classification in the domain of R&D statistics should apply best practices on transparency from other countries and other statistical domains. Classification disclosure is unlikely to represent a confidentiality breach, especially for statistical units outside the for-profit business enterprise sector. The following Frascati Manual recommendation should be more actively implemented:

It is proposed that, in the interest of international comparability and quality assurance, countries disclose their classification decisions to the extent that provisions on statistical confidentiality allow them to do so. This is expected to strongly facilitate a better understanding of data differences and to promote convergence towards increased comparability (FM 3.49)

Finally, the data collection has revealed a number of information gaps in the OECD R&D sources and methods database that countries could help update as a part of the regular annual reporting cycle.

5.3. Next steps

Several options are open but their pursuit depends on the actual interest of countries, at both policy and statistical level. The scope of the initial project proposal envisaged the conduct of collaborative work towards building transparent registers for R&D specialist organisations, as well as more systematic reporting within the core OECD R&D data collection. Stakeholders have also indicated an interest in exploring more detailed R&D funding questions and connections with topics of knowledge transfer and impact.

Subject to agreement by NESTI, the OECD will invite members and partners engaged in the reporting of R&D statistics with a view to obtaining a more comprehensive set of responses on a second survey round, i.e. striving for a) a greater coverage of OECD members and partner economies, b) greater coverage of R&D specialist institutions in all sectors for those, and c) potentially more information on the profile of R&D expenditures in those organisations by type, namely on basic, applied research and experimental development.

In the meantime, NSOs are invited, in consultation with their own domestic stakeholders, to take note of the findings and recommendations in this paper and work towards implementing its main recommendations so that they can report on the core indicators on GERD by Main economic activity, included in the regular OECD R&D data call that feeds into the OECD R&D Statistics database. Once a sufficiently large critical mass of responses has been achieved, the OECD will proceed to disseminate the relevant data table.

Annex A. Questionnaire

Introduction and guidance

What is this collection about?

This data collection is being carried out in line with the agreement at the NESTI December 2021 meeting. It is about making sense of the R&D expenditure in all types of organisations whose main economic activity is R&D performance. According to the accepted classifications, this is effectively the ISIC72 "industry".

R&D specialist organisations are the object of major policy and stakeholder interest, comparable to some extent with interest in universities as key R&D actors. Their contribution to GERD cannot be currently ascertained since they fall under different FM sectors depending on several factors, including government policies.

The broader objective is to help countries develop their data infrastructures to give a coherent description by economic activity of its total GERD, e.g. eventually considering also health services providers etc.

Initial challenge - lack of main activity data

Lack of industry (main activity) classification. Some countries may not classify institutions outside their FM business enterprise sector to a suitable industry classification.

This data request should therefore be an encouragement to apply such classification more broadly across all FM institutional sectors, since all institutional units undertake productive economic activities of some sort, including those in government.

It is preferable to adopt classifications already made by authoritative national sources, such as NSOs, when those classification decisions can be accessed by R&D stats compilers, e.g. via statistical registers.

Time is allowed to enable countries to identify the appropriate classification of non-classified units, in line with FM2015 recommendations, either by classifying ex novo or linking to existing sources.

Conceptual and sectoral specificities

Public sector. The cross-cutting definition relates to control by government. Control can be exerted in multiple ways.

Diversity of business sector. The common defining factor of this sector is that it operates in the market, serving businesses or charging meaningful prices for its activities.

The data collection wishes to draw attention to the fact that there are both private enterprises and public enterprises.

Among private enterprises, there are different types of units according to the FM:

- (Affiliate) Enterprises that specialise on R&D and depend on a parent, domestic or abroad, and for whom much of their R&D is carried out.
- Independent enterprises that specialise on R&D and provide services or license/sell their IP to others.

- Not for profit R&D organisations whose main purpose is to serve industry/business - under multiple funding arrangements - these are also classified in FM as enterprises (and in the SNA as corporations when legally incorporated)

Government sector. The government sector is defined by control by government, with the exclusion of public enterprises, as well as (following FM) public universities which are a self-standing FM institutional sector.

Differentiation of GOV units by territorial levels of government may be possible. There may be public R&D institutes that are 50% and 50% regionally and central government controlled.

Higher education sector. Universities etc contain in cases R&D specialised institutes, etc. Part of the aim of this collection is to identify whether countries data collection practices identify such institutions as standalone stat units of the HE sector ...or their activity is embedded in the data furnished by the parent HEI. In the latter case there would be no ISIC72 units in the HE sector.

The private / public distinction applies to these institutions when they are separately recorded.

Institutions resulting from cross-sectoral partnerships

Some R&D organisations recorded as individual institutional units can be the result of partnerships between organisations in different sectors (e.g. business-government or HE-government or... etc...). Their classification will depend on whether any sector can exert control over it.

Please provide clarifications if you cannot distinguish between central or local/regional government data. Also note that non-profit organisations controlled by the government sector should be included in the government sector. Lastly, we would be interested in knowing the size cut-off(s) for the reported data.

Why data on sources of funding?

Table 2 seeks to identify how R&D in R&D specialist organisations is funded. This information is only requested for the top level 1 (FM institutional sectors) of R&D specialists. Countries can provide more details, e.g. funding of non-profit institutions serving business may differ from funding of R&D affiliates.

In some cases, countries may also wish to provide further details on project versus institutional types of government funding.

Examples and clarifications on the most important R&D organisations

It is very important to provide concrete examples about how major R&D specialist organisations are classified.

Contributions to GERD and sectoral expenditure

Table A A.1. Types of R&D institutions and R&D performance in the economic territory

| Institutional sector (FM 2015) | ISIC Rev4 | Year | Subcategory – Level 1 FM sector – Level 2 Private/public sector | Subcategory | Number of institutional units in economy | GERD contribution | Explanatory notes – overwrite these notes to provide examples of institution in your country fitting the description, as appropriate - please also explain if category is left empty and reason for it (e.g. not applicable within country or not known) |
|---|-----------|------|---|--|--|-----------------------------|--|
| | | | | Level 3 - sector specific profiles | | (Million National Currency) | |
| Total | 72 | 2019 | Total | Total | xx | xx | |
| Business enterprise | 72 | 2019 | Total BE | Total BE | xx | xx | Please check / explain if this total does not match your reported BERD for ISIC72 |
| Business enterprise | 72 | 2019 | Private | Total – private enterprises | xx | xx | |
| Business enterprise | 72 | 2019 | Private | Subsidiary of another business entity* | xx | xx | e.g. R&D enterprises that are affiliated to other firms, domestic or abroad |
| Business enterprise | 72 | 2019 | Private | Independent for-profit business* | xx | xx | Independent R&D firms, for profit status |
| Business enterprise | 72 | 2019 | Private | Non-profit organisations serving business# | xx | xx | Private R&D institutes and centres set up to serve business |
| Business enterprise | 72 | 2019 | Public | Total – public enterprises | xx | xx | Government controlled enterprises primarily dedicated to R&D |
| Higher education | 72 | 2019 | Total HE | Total HE | xx | xx | R&D institutes ascribed to and controlled by HEIs - explain if category missing, e.g. HE R&D institutes note separated from |
| Higher education | 72 | 2019 | Private | | xx | xx | As above, private HEIs (non profit and for profit) |
| Higher education | 72 | 2019 | Public | | xx | xx | As above, HEIs part of the government sector |
| Government | 72 | 2019 | Total GOV | Total GOV | xx | xx | R&D institutes ascribed to and controlled by government sector, other than to public HEIs |
| Government | 72 | 2019 | Public | Central government | xx | xx | R&D inst part of central government sector |
| Government | 72 | 2019 | Public | Reg/local government | xx | xx | R&D inst part of regional/local government sector |
| Government | 72 | 2019 | Public | Not attributable to a single level of government | xx | xx | R&D institution under joint control of different levels of government |
| Private non profit | 72 | 2019 | Total PNP | Total PNP | xx | xx | |
| Rest of the world (international orgs only) | 72 | 2019 | International Public | International Public | xx | Not within scope of GERD | International orgs in territory, do not count as GERD (number of units only) |

Note: * These two categories may not be straightforward to differentiate without information on company ownership.

Category within BE sector that is most closely aligned to RIHR Research Institution definition. Priority for identification within private BE. See Contextual defs tab for definition.

MNC=Million national currency

Additional years may be provided for completeness by generating additional identical sheets and replacing the year value.

Source: OECD

Sources of funding for R&D specialists institutions

Table A A.2. Sources of funding for the R&D performance of ISIC 72 units

| Institutional sector (FM2015) | ISIC | Latest available year | Total | Sources of funding for total | | | Sources of funding: Rest of world (including businesses and int org / EU programmes) (MNC)** | Sources of funding: Private non profit (MNC) | Not allocated | Explanatory notes (Sum of sources of funding should add up to relevant intramural R&D in previous page) |
|--|------|-----------------------|--|------------------------------------|--------------------------------------|--------------------------|--|--|--|---|
| | | | GERD contribution* (Million National Currency - MNC) – from previous table | Sources of funding: Business (MNC) | Sources of funding: Government (MNC) | | | | | |
| Total | 72 | 2019 | xx | xx | xx | xx | xx | xx | | |
| Business enterprise | 72 | 2019 | xx | xx | xx | xx | xx | xx | | |
| Higher education | 72 | 2019 | xx | xx | xx | xx | xx | xx | | |
| Government | 72 | 2019 | xx | xx | xx | xx | xx | xx | | |
| Private non profit | 72 | 2019 | xx | xx | xx | xx | xx | xx | | |
| Rest of the world (international orgs) | 72 | 2019 | Not within scope of GERD | Not within scope of GERD | Not within scope of GERD | Not within scope of GERD | Not within scope of GERD | Not within scope of GERD | International orgs in territory, do not count as GERD, just report number of units | |
| Explanatory notes | | | | | | | | | | |

Note: * Total GERD contribution should add up to institutional sector totals in previous page. ** You may be able to separate between business and other international sources of funding. MNC Million National Currency
Source: OECD

Core and contextual definitions from other projects

Statistical definition of specialist R&D statistical units - ISIC72

ISIC72 - Scientific research and development [Include]

This division includes the activities of three types of research and development: 1) basic research: experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without particular application or use in view, 2) applied research: original investigation undertaken in order to acquire new knowledge, directed primarily towards a specific practical aim or objective and 3) experimental development: systematic work, drawing on existing knowledge gained from research and/or practical experience, directed to producing new materials, products and devices, to installing new processes, systems and services, and to improving substantially those already produced or installed. Research and experimental development activities in this division are subdivided into two categories: natural sciences and engineering; social sciences and the humanities. This division excludes market research (see class 7320).

ISIC711 - Architectural and engineering activities and related technical consultancy [Do not include, unless in combination with ISIC72]

This class includes the provision of architectural services, engineering services, drafting services, building inspection services and surveying and mapping services and the like.

This class includes:

—architectural consulting activities:

™ building design and drafting

™ town and city planning and landscape architecture

—engineering design (i.e. applying physical laws and principles of engineering in the design of machines, materials, instruments, structures, processes and systems) and consulting activities for:

™ machinery, industrial processes and industrial plant

™ projects involving civil engineering, hydraulic engineering, traffic engineering

™ water management projects

™ projects elaboration and realization relative to electrical and electronic engineering, mining engineering, chemical engineering, mechanical, industrial and systems engineering, safety engineering

™ project management activities related to construction

—elaboration of projects using air conditioning, refrigeration, sanitary and pollution control engineering, acoustical engineering etc.

—geophysical, geologic and seismic surveying

—geodetic surveying activities:

™ land and boundary surveying activities

™ hydrologic surveying activities

™ subsurface surveying activities

™ cartographic and spatial information activities"

Frascati Manual

3.4. General classifications applicable to all institutional units - Classification of units by main economic activity

Record-keeping practices for institutional classification (includes primary economic activity)

Definition of “research institutions” used in the 2009-2010 RIHR project:

The RIHR project defined “research institutions” as national entities, irrespective of their legal status (organised under public or private law):

- whose primary goals are to conduct fundamental research, industrial research, experimental development, training, consulting and service provision, and to disseminate their results by way of training, publication and technology transfer; and
- whose profits (if any) are reinvested in these activities, the dissemination of their results, or training; and

- which are either totally or to a substantial share publicly owned, and/or are funded primarily from public sources via base funding (block grants) or through contract-based research, and/or are regulated, so as to achieve primarily public missions.

This definition thus combined R&D and related economic activity goals on one hand, a lack of profit motive, and a component of public funding, regulation and mission that was and is still not easily operationalisable, in particular since all economic activities are regulated to some extent to achieve public policy objectives.

Sources: DSTI/EAS/STP/NESTI(2010)13; DSTI/STP/RIHR(2009)5

EARTO definition

EARTO, the European trade association representing RTOs, defines them as organisations “which as their predominant activity provide research and development, technology and innovation services to enterprises, governments and other clients ...”.

This definition distinguishes RTOs from universities, the predominant activity of which is education, and from enterprises, the predominant activity of which is the production and sale of goods and services. The EARTO definition has been challenged because it “also includes fully privately owned for-profit contract research organisations”¹. The observation is correct, as is in part the attendant comment that “though their activities may be similar, the governance structure of such companies and hence the driving forces for change are very different”. A recent study of RTOs used this definition: “RTOs are organisations with significant core government funding (25% or greater) which supply services to firms individually or collectively in support of scientific and technological innovation and which devote much of their capability (50% or more of their labour) to remaining integrated with the science base”².

Source: https://www.earto.eu/wp-content/uploads/RTOs_and_the_Evolving_European_Research_Area_WhitePaperFinal.pdf

EU State aid definitions

research and knowledge dissemination organisation' or 'research organisation' means an entity (such as universities or research institutes, technology transfer agencies, innovation intermediaries, research-oriented physical or virtual collaborative entities), irrespective of its legal status (organised under public or private law) or way of financing, whose primary goal is to independently conduct fundamental research, industrial research or experimental development or to widely disseminate the results of such activities by way of teaching, publication or knowledge transfer.

research infrastructure means facilities, resources and related services that are used by the scientific community to conduct research in their respective fields and covers scientific equipment or set of instruments, knowledge-based resources such as collections, archives or structured scientific information, enabling information and communication technology-based infrastructures such as grid, computing, software and communication, or any other entity of a unique nature essential to conduct research. Such infrastructures may be 'single-sited' or 'distributed' (an organised network of resources)

'technology infrastructure' means facilities, equipment, capabilities and related support services required to develop, test and upscale technology to advance through industrial research and experimental development activities from validation in a laboratory to a validation representative of the operational environment, and the users of which are mainly industrial players, including SMEs, which seek support to develop and integrate innovative technologies to develop new products, processes and services, whilst ensuring feasibility and regulatory compliance

Source: https://www.earto.eu/wp-content/uploads/draft_RDIF_communication_en.pdf

Annex B. Additional detailed tables

Table 3. R&D expenditure by R&D specialised institutions, USD PPPs, latest available year

| | | Total | Total Business enterprise | Total – private enterprises | Subsidiary of another business | Independent for profit bus | Non-profit organisation serving bus. | Total – public enterprises | Total Higher edu. | Private | Public | Total Gov. | Central gov. | Reg/ local gov. | Not attributable single level | Total PNP |
|-------|------|----------|---------------------------|-----------------------------|--------------------------------|----------------------------|--------------------------------------|----------------------------|-------------------|---------|---------|------------|--------------|-----------------|-------------------------------|-----------|
| AUS | 2019 | .. | 1,054.1 | .. | .. | .. | .. | conf | .. | .. | .. | 1,187.8 | conf | conf | .. | 739.3 |
| AUT | 2019 | 2,008.3 | 1,229.2 | 1,024.9 | .. | .. | 175.9 | 204.3 | 94.4 | conf | conf | 610.6 | 429.3 | 108.2 | 73.1 | 74.1 |
| BEL | 2019 | 3,637.3 | 1,810.0 | 1,810.0 | 1,443.7 | 146.6 | 219.7 | 0.0 | 33.7 | 0.0 | 33.7 | 1,670.8 | 400.6 | 1,270.2 | 0.0 | 122.8 |
| BRA | 2017 | .. | 2,187.0 | .. | .. | 84.2 | .. | 2,102.8 | .. | .. | .. | .. | .. | .. | .. | .. |
| CAN | 2019 | .. | 1,736.4 | 1,736.4 | 487.6 | 1,105.2 | 143.6 | 0.0 | .. | .. | .. | .. | .. | .. | .. | 116.4 |
| CZE | 2020 | 2,069.6 | 770.3 | 638.6 | .. | .. | .. | 131.7 | .. | .. | .. | 1,296.7 | 1,296.7 | .. | .. | 2.6 |
| DEU | 2019 | .. | 4,126.8 | .. | .. | .. | 418.1 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ESP | 2019 | 4,922.1 | 3,004.8 | 2,876.0 | 1,470.6 | 380.1 | 1,025.4 | 128.8 | 143.7 | 81.6 | 62.1 | 1,733.2 | 428.7 | 1,304.5 | .. | 40.4 |
| EST | 2019 | 100.4 | 32.2 | .. | .. | .. | .. | .. | .. | .. | .. | 65.2 | 0.0 | 0.0 | 0.0 | 3.0 |
| FIN | 2020 | 961.0 | 433.9 | 418.4 | 291.0 | 127.2 | .. | 15.5 | 0.0 | .. | .. | 492.2 | 492.2 | 0.0 | 0.0 | 35.3 |
| GRC | 2019 | .. | 99.4 | 87.3 | 44.9 | 42.4 | .. | conf | .. | .. | .. | .. | .. | .. | .. | .. |
| ISR | 2019 | 5,438.4 | 5,245.7 | 5,245.7 | 3,977.5 | 1,268.2 | 0.0 | 0.0 | .. | .. | .. | 37.1 | .. | .. | 37.1 | 155.6 |
| ITA | 2019 | .. | 1,689.6 | 1,581.3 | 1,445.4 | 135.9 | .. | 108.2 | .. | .. | .. | 3,994.8 | 3,729.9 | 266.3 | 0.0 | 449.2 |
| JPN** | 2021 | 20,215.3 | 4,782.6 | 4,782.6 | .. | .. | .. | .. | 1,733.3 | 206.0 | 1,527.3 | 2,216.9 | 504.4 | 1,712.6 | .. | 11,482.5 |
| KOR | 2020 | .. | 2,295.4 | 2,295.4 | .. | .. | .. | .. | .. | .. | .. | 6,152.6 | 6,152.6 | 0.0 | 0.0 | 732.6 |
| LTU | 2019 | 279.3 | 127.8 | 126.9 | .. | .. | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 151.5 | 151.5 | .. | .. | 0.0 |
| NLD** | 2019 | 2,537.4 | 1,827.5 | .. | .. | .. | .. | .. | 0.0 | 0.0 | 0.0 | 710.0 | .. | .. | .. | .. |
| NOR | 2019 | 1,336.4 | 661.9 | 129.9 | .. | .. | 532.0 | .. | .. | .. | .. | 674.5 | 674.5 | .. | .. | .. |
| POL | 2019 | 3,214.8 | 1,992.6 | 904.9 | 545.7 | 359.2 | .. | 1,087.8 | 1,117.0 | 0.0 | 1,117.0 | .. | 103.1 | conf | .. | conf |
| PRT | 2020 | 837.0 | 207.0 | 193.6 | 88.0 | 55.7 | 49.8 | 13.4 | 403.4 | 0.0 | 0.0 | 153.9 | 120.0 | 4.0 | 30.0 | 72.7 |
| SWE | 2019 | 1,383.4 | 1,180.3 | 1,171.5 | 1,055.7 | 103.4 | 12.4 | 8.8 | 13.0 | 0.0 | 13.0 | 190.0 | 165.0 | 0.0 | 28.8 | .. |
| TUR | 2019 | .. | 342.7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| TWN | 2020 | 4,099.4 | 135.5 | 66.0 | .. | .. | 69.5 | .. | .. | .. | .. | 3,961.6 | 3,961.6 | .. | .. | 2.3 |
| USA** | 2019 | .. | 23,551.0 | .. | .. | .. | .. | .. | .. | .. | .. | 23,514.2 | .. | .. | .. | .. |
| ZAF | 2017 | 3.9 | 0.34 | 0.04 | 0.00 | 0.00 | 0.00 | 0.31 | 2.12 | 0.01 | 2.11 | 1.21 | 0.99 | 0.21 | 0.00 | 0.23 |

Note: ** For the Netherlands the Government sector includes the PNP sector. ** For the United States, the data for Government is underestimated. ** For Japan, PNP data is provisional.
Source: Calculations based on OECD R&D specialist institutions ad hoc data collection, Table 1, August 2022.

Table 4. Number of R&D specialised institutions, units, latest available year

| Units | | Total | Total Business enterprise | Total – private enterprises | Subsidiary of another business entity | Independent for profit business | Non-profit organisation serving business | Total – public enterprises | Total Higher edu. | Private | Public | Total Gov. | Central gov. | Reg/ local gov. | Not attributable to a single level of gov. | Total Private non-profit |
|-------|------|-------|---------------------------|-----------------------------|---------------------------------------|---------------------------------|--|----------------------------|-------------------|---------|--------|------------|--------------|-----------------|--|--------------------------|
| AUT | 2019 | 561 | 366 | 340 | .. | .. | 15 | 26 | 6 | 2 | 4 | 146 | 61 | 12 | 73 | 43 |
| BEL | 2019 | 558 | 498 | 497 | 321 | 136 | 40 | 1 | 10 | 0 | 10 | 41 | 23 | 18 | 0 | 9 |
| BRA | 2017 | .. | 23 | .. | .. | 16 | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. |
| CAN | 2019 | .. | 1,074 | 1,074 | 53 | 986 | 35 | 0 | .. | .. | .. | .. | .. | .. | .. | 41 |
| CZE | 2020 | 261 | 159 | 153 | .. | .. | .. | 6 | - | - | - | 98 | 98 | .. | .. | 4 |
| DEU | 2019 | .. | 1,044 | .. | .. | .. | 126 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ESP | 2019 | 1,478 | 1,281 | 1,256 | 329 | 758 | 169 | 26 | 30 | 21 | 9 | 129 | 19 | 110 | .. | 38 |
| EST | 2019 | 110 | 70 | .. | .. | .. | .. | .. | .. | .. | .. | 11 | 0 | 0 | 0 | 34 |
| FIN | 2020 | .. | .. | .. | .. | .. | .. | .. | 0 | .. | .. | 10 | 10 | 0 | 0 | 21 |
| GRC | 2019 | .. | 153 | 151 | 5 | 146 | .. | conf | .. | .. | .. | .. | .. | .. | .. | .. |
| ISR | 2019 | .. | 831 | 831 | 275 | 556 | 0 | 0 | .. | .. | .. | 17 | .. | .. | 17 | 105 |
| ITA | 2019 | .. | 812 | 775 | 307 | 468 | - | 37 | .. | .. | .. | 61 | 25 | 36 | 0 | 175 |
| JPN** | 2021 | 1,665 | 817 | 817 | .. | .. | .. | .. | 281 | 184 | 97 | 344 | 20 | 324 | .. | 223 |
| KOR | 2020 | .. | 954 | 954 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 50 | 50 | 0 | 0 | 16 |
| LTU | 2019 | 227 | 209 | 182 | - | - | 27 | 0 | 0 | 0 | 0 | 18 | 18 | - | - | 0 |
| NOR | 2019 | 133 | 89 | 75 | 0 | 0 | 14 | - | - | - | - | 44 | 44 | - | .. | - |
| POL | 2019 | 713 | 606 | 519 | 60 | 459 | - | 87 | 79 | 0 | 79 | 25 | . | . | - | 3 |
| PRT | 2020 | 321 | 230 | 223 | 34 | 181 | 8 | 7 | 42 | 0 | 0 | 9 | 6 | 2 | 1 | 40 |
| SWE | 2019 | 245 | 208 | 190 | 150 | 37 | 3 | 18 | 1 | 0 | 1 | 36 | 12 | 0 | 24 | .. |
| TUR | 2019 | .. | 578 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| TWN | 2020 | 147 | 40 | 27 | .. | .. | 13 | .. | .. | .. | .. | 97 | 97 | .. | .. | 10 |
| USA** | 2019 | .. | 9,900 | .. | .. | .. | .. | .. | .. | .. | .. | 42 | .. | .. | .. | .. |
| ZAF | 2017 | 246 | 55 | 39 | .. | .. | .. | 16 | 30 | 6 | 24 | 105 | .. | .. | .. | 56 |

Note: ** For the United States, the data for Government is underestimated. *** For Japan, PNP data is provisional.

Source: Based on OECD R&D specialist institutions ad hoc data collection, Table 1, August 2022.

Table 5. Sources of funding of R&D in R&D specialised institutions

| | | | GERD contribution (USD PPPs) | Sources of funding: Business (%) | Sources of funding: Government (%) | Sources of funding: Rest of world (including businesses and int org / EU programmes) (%)** | Sources of funding: Private non-profit (%) | Not allocated (%) |
|-----|------|---------------------|------------------------------|----------------------------------|------------------------------------|--|--|-------------------|
| AUS | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 1,054.1 | 79.2 | 9.4 | .. | 0.0 | .. |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | 1,187.8 | 12.1 | 81.4 | .. | 1.0 | .. |
| | | Private non profit | 739.3 | 9.8 | 45.3 | 3.8 | 39.8 | 1.3 |
| AUT | 2019 | Total | 2,008.3 | 39.4 | 33.6 | 25.7 | 0.9 | 0.4 |
| | | Business enterprise | 1,229.2 | 57.4 | 12.1 | 30.3 | 0.1 | 0.1 |
| | | Higher education | 94.4 | 2.6 | 72.8 | 19.9 | 0.0 | 4.7 |
| | | Government | 610.6 | 10.6 | 74.3 | 14.2 | 0.6 | 0.3 |
| | | Private non profit | 74.1 | 24.2 | 5.8 | 52.2 | 17.5 | 0.2 |
| BEL | 2019 | Total | 3,637.3 | 32.5 | 27.2 | 38.8 | 1.0 | 0.5 |
| | | Business enterprise | 1,810.0 | 58.0 | 9.0 | 32.9 | 0.0 | 0.0 |
| | | Higher education | 33.7 | 4.3 | 31.1 | 24.2 | 1.9 | 38.5 |
| | | Government | 1,670.8 | 6.4 | 48.3 | 44.7 | 0.3 | 0.3 |
| | | Private non profit | 122.8 | 19.4 | 6.0 | 49.3 | 25.0 | 0.3 |
| BRA | 2017 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 2,187.0 | 87.8 | 12.1 | 0.1 | .. | .. |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | .. | .. | .. | .. | .. | .. |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| CAN | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 1,736.4 | 62.9 | 11.8 | 23.6 | 1.8 | 0.0 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | .. | .. | .. | .. | .. | .. |
| | | Private non profit | 116.4 | 21.8 | 51.3 | 24.1 | 2.8 | 0.0 |

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| | | | GERD contribution (USD PPPs) | Sources of funding: Business (%) | Sources of funding: Government (%) | Sources of funding: Rest of world (including businesses and int org / EU programmes) (%)** | Sources of funding: Private non-profit (%) | Not allocated (%) |
|-----|------|---------------------|------------------------------|----------------------------------|------------------------------------|--|--|-------------------|
| CZE | 2020 | Total | 2,069.6 | 16.5 | 55.4 | 27.6 | 0.1 | 0.4 |
| | | Business enterprise | 770.3 | 39.9 | 18.8 | 41.1 | 0.1 | 0.1 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | 1,296.7 | 2.6 | 77.2 | 19.5 | 0.1 | 0.6 |
| | | Private non profit | 2.6 | 27.1 | 9.5 | 62.8 | 0.6 | 0.0 |
| DEU | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 4,126.8 | 64.7 | 19.9 | 15.0 | 0.4 | 0.0 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | .. | .. | .. | .. | .. | .. |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| ESP | 2019 | Total | 4,922.1 | 43.7 | 37.6 | 16.8 | 1.5 | 0.3 |
| | | Business enterprise | 3,004.8 | 62.2 | 18.8 | 18.3 | 0.7 | 0.1 |
| | | Higher education | 143.7 | 21.7 | 50.2 | 17.6 | 3.7 | 6.8 |
| | | Government | 1,733.2 | 13.9 | 69.6 | 14.3 | 2.0 | 0.2 |
| | | Private non profit | 40.4 | 32.3 | 22.0 | 11.0 | 34.4 | 0.2 |
| EST | 2019 | Total | 100.4 | 20.0 | 66.6 | 12.8 | 0.4 | 0.1 |
| | | Business enterprise | 32.2 | 58.4 | 26.6 | 14.2 | 0.7 | 0.1 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | 65.2 | 1.6 | 86.6 | 11.8 | 0.0 | 0.1 |
| | | Private non profit | 3.0 | 7.7 | 61.3 | 20.8 | 7.5 | 2.7 |
| FIN | 2020 | Total | 961.0 | 18.0 | 39.4 | 40.5 | 2.0 | .. |
| | | Business enterprise | 433.9 | 30.8 | 3.0 | 66.0 | 0.2 | .. |
| | | Higher education | 0.0 | .. | .. | .. | .. | .. |
| | | Government | 492.2 | 7.7 | 69.9 | 20.5 | 1.9 | .. |
| | | Private non profit | 35.3 | 5.4 | 62.1 | 4.7 | 27.2 | .. |

THE CONTRIBUTION OF R&D SPECIALIST INSTITUTIONS TO R&D PERFORMANCE | 43

| | | | GERD contribution (USD PPPs) | Sources of funding: Business (%) | Sources of funding: Government (%) | Sources of funding: Rest of world (including businesses and int org / EU programmes) (%)** | Sources of funding: Private non-profit (%) | Not allocated (%) |
|-----|------|----------------------|------------------------------|----------------------------------|------------------------------------|--|--|-------------------|
| GRC | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 99.4 | 47.2 | 32.8 | 18.9 | 1.1 | 0.0 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | .. | .. | .. | .. | .. | .. |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| ISR | 2019 | Total | 5,438.4 | 30.5 | 3.1 | 65.7 | 0.7 | 0.0 |
| | | Business enterprise | 5,245.7 | 30.6 | 2.0 | 67.4 | 0.0 | 0.0 |
| | | Higher education | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Government | 37.1 | 13.4 | 76.7 | 2.4 | 7.5 | 0.0 |
| | | Private non profit | 155.6 | 29.3 | 24.6 | 24.6 | 21.5 | 0.0 |
| ITA | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 1,689.6 | 69.5 | 7.1 | 23.2 | 0.1 | 0.2 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | 3,994.8 | 2.6 | 89.3 | 6.8 | 0.9 | 0.4 |
| | | Private non profit | 449.2 | 6.8 | 35.9 | 26.3 | 30.5 | 0.4 |
| JPN | 2021 | Total | 20,215.3 | 27.1 | 59.9 | 0.8 | 6.5 | 5.7 |
| | | Business enterprise | 4,782.6 | 95.3 | 2.5 | 2.2 | 0.0 | 0.0 |
| | | Higher education | 1,733.3 | 5.4 | 29.8 | 0.4 | 1.5 | 62.8 |
| | | Government | 2,216.9 | 4.0 | 95.4 | 0.0 | 0.5 | 0.1 |
| | | Private non profit** | 11,482.5 | 6.5 | 81.5 | 0.4 | 11.1 | 0.5 |
| KOR | 2020 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 2,295.4 | 89.6 | 10.0 | 0.2 | 0.1 | 0.1 |
| | | Higher education | 0.1 | .. | .. | .. | .. | .. |
| | | Government | 6,152.6 | 5.8 | 92.8 | 0.6 | 0.8 | 0.1 |
| | | Private non profit | 732.6 | 5.5 | 91.4 | 0.0 | 3.0 | 0.0 |

44 | THE CONTRIBUTION OF R&D SPECIALIST INSTITUTIONS TO R&D PERFORMANCE

| | | | GERD contribution (USD PPPs) | Sources of funding: Business (%) | Sources of funding: Government (%) | Sources of funding: Rest of world (including businesses and int org / EU programmes) (%)** | Sources of funding: Private non-profit (%) | Not allocated (%) |
|-----|------|---------------------|------------------------------|----------------------------------|------------------------------------|--|--|-------------------|
| LTU | 2019 | Total | 279.3 | 39.1 | 32.5 | 28.1 | 0.1 | 0.1 |
| | | Business enterprise | 127.8 | 69.2 | 1.0 | 29.4 | 0.1 | 0.3 |
| | | Higher education | 0.0 | .. | .. | .. | .. | .. |
| | | Government | 151.5 | 13.7 | 59.1 | 27.0 | 0.1 | 0.1 |
| | | Private non profit | 0.0 | .. | .. | .. | .. | .. |
| NLD | 2019 | Total | 2,537.4 | 16.1 | 42.8 | 39.0 | 1.2 | 0.9 |
| | | Business enterprise | 1,827.5 | 16.9 | 33.3 | 47.7 | 1.5 | 0.5 |
| | | Higher education | 0.0 | .. | .. | .. | .. | .. |
| | | Government** | 710.0 | 14.0 | 67.1 | 16.5 | 0.4 | 2.0 |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| NOR | 2019 | Total | 1,336.4 | 27.0 | 62.9 | 9.9 | 0.2 | 0.0 |
| | | Business enterprise | 661.9 | 46.1 | 42.1 | 11.6 | 0.1 | 0.0 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | 674.5 | 8.3 | 83.4 | 8.2 | 0.2 | 0.0 |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| POL | 2019 | Total | 3,214.8 | 32.8 | 52.7 | 10.4 | 0.7 | 3.4 |
| | | Business enterprise | 1,992.6 | 50.6 | 36.6 | 12.4 | 0.2 | 0.1 |
| | | Higher education | 1,117.0 | 3.6 | 77.9 | 7.5 | 1.5 | 9.5 |
| | | Government | .. | .. | .. | .. | .. | .. |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| PRT | 2020 | Total | 837.0 | 18.3 | 57.0 | 17.5 | 0.7 | 6.6 |
| | | Business enterprise | 207.0 | 57.4 | 23.4 | 18.7 | 0.1 | 0.4 |
| | | Higher education | 403.4 | 6.3 | 73.4 | 15.4 | 0.8 | 4.1 |
| | | Government | 153.9 | 4.6 | 73.0 | 17.4 | 0.2 | 4.8 |
| | | Private non profit | 72.7 | 2.2 | 27.8 | 25.4 | 3.0 | 41.6 |

THE CONTRIBUTION OF R&D SPECIALIST INSTITUTIONS TO R&D PERFORMANCE | 45

| | | | GERD contribution (USD PPPs) | Sources of funding: Business (%) | Sources of funding: Government (%) | Sources of funding: Rest of world (including businesses and int org / EU programmes) (%)** | Sources of funding: Private non-profit (%) | Not allocated (%) |
|-----|------|---------------------|------------------------------|----------------------------------|------------------------------------|--|--|-------------------|
| SWE | 2019 | Total | 1,383.4 | 64.6 | 15.2 | 17.6 | 0.5 | 2.2 |
| | | Business enterprise | 1,180.3 | 75.2 | 4.3 | 19.8 | 0.5 | 0.1 |
| | | Higher education | 13.0 | 0.9 | 80.3 | 12.0 | 2.6 | 3.4 |
| | | Government | 190.0 | 2.7 | 78.2 | 4.2 | 0.0 | 14.8 |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| TUR | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 342.7 | 86.5 | 10.8 | 2.6 | 0.0 | 0.1 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | .. | .. | .. | .. | .. | .. |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| TWN | 2020 | Total | 4,099.4 | 3.3 | 96.2 | 0.1 | 0.3 | 0.0 |
| | | Business enterprise | 135.5 | 52.0 | 44.2 | 2.6 | 1.1 | 0.1 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government | 3,961.6 | 1.6 | 98.0 | 0.1 | 0.2 | 0.0 |
| | | Private non profit | 2.3 | 3.0 | 76.3 | 0.0 | 20.7 | 0.0 |
| USA | 2019 | Total | .. | .. | .. | .. | .. | .. |
| | | Business enterprise | 23,551.0 | 77.5 | 16.6 | 4.7 | .. | 1.2 |
| | | Higher education | .. | .. | .. | .. | .. | .. |
| | | Government** | 23,514.2 | 0.7 | 98.6 | .. | 0.2 | 0.5 |
| | | Private non profit | .. | .. | .. | .. | .. | .. |
| ZAF | 2019 | Total | 3.9 | 3.5 | 37.8 | 17.9 | 2.1 | 38.6 |
| | | Business enterprise | 0.3 | 4.5 | 28.1 | 50.7 | 15.0 | 1.7 |
| | | Higher education | 2.1 | 3.7 | 24.2 | 14.0 | 0.8 | 57.4 |
| | | Government | 1.2 | 2.9 | 68.9 | 7.1 | 0.9 | 20.2 |
| | | Private non profit | 0.2 | 4.2 | 14.1 | 62.3 | 1.5 | 18.0 |

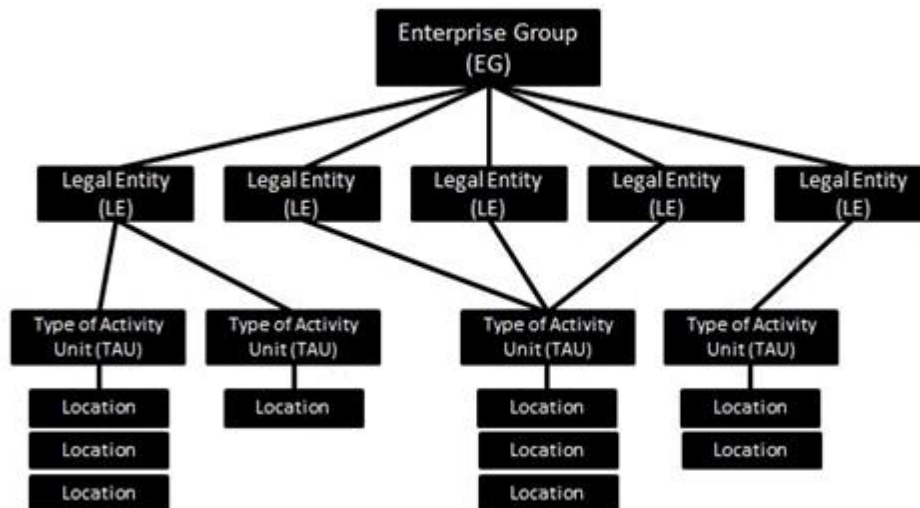
Note: ** For the Netherlands the Government sector includes the PNP sector. ** For the United States, the data for Government is underestimated. ** For Japan, PNP data is provisional.
Source: Calculations based on OECD R&D specialist institutions ad hoc data collection, Table 2, August 2022.

Annex C. Economy notes

Australia. No data available for Higher Education. These institutions are classified under ISIC 85 in Australia.

The Australian Bureau of Statistics uses the ABS Economic Units Model. An example of the hierarchy of this model can be seen in the diagram below.

Diagram 1: ABS Economic Units Model



Definitions

The Legal Entity (LE) statistical unit is defined as a unit covering all the operations in Australia of an entity which possesses some or all of the rights and obligations of individual persons or corporations, or which behaves as such in respect of those matters of concern for economic statistics. Examples of legal entities include companies, partnerships, trusts, sole (business) proprietorships, government departments and statutory authorities. Legal entities are institutional units.

The Enterprise Group (EG) is an institutional unit covering all the operations within Australia's economic territory of legal entities under common control. Control is defined in Corporations legislation. Majority ownership is not required for control to be exercised.

The Type of Activity Unit (TAU) is a producing unit comprising one or more legal entities, sub-entities or branches of a legal entity that can report productive and employment activities via a minimum set of data items. Only a small number of data items are required to be available on a quarterly basis.

The activity of the unit should be as homogeneous as possible. If accounts sufficient to approximate Industry Value Added (IVA) are available at the ANZSIC Subdivision level, a TAU will be formed.

All of the surveys used to compile the ISIC 72 data sample at the Type of Activity Unit level.

Austria. "Not allocated" refers to funding from HES only. HES data cannot be split into "public" and "private" due to confidentiality reasons.

In Austrian R&D statistics, the „Institutes sub-sector“ („kooperativer Bereich“) is a separate (small) sub-sector within the Business enterprise sector (38 R&D performing units out of 3,872 R&D enterprises altogether in the BES 2019). It reflects in principal very closely the group which is at the focal interest of this exercise.

This sub-sector consists of 2 types of institutes:

- COMET – Competence Centers for Excellent Technologies: Wikipedia describes these centres as follows: „The centers receive about 50% of their budget from public funding, and the other 50% have to be acquired from companies. 5% are expected as in-kind contributions from the scientific partners. The COMET program stimulates academic scientists and industrial researchers and developers to work together on strategic and translational research projects, closer to industry than university groups would typically work on, however concentrating on prototype research and not on products ready for the market.“
- Members of the Austrian Cooperative Research (ACR): Those are private research institutes offering applied R&D for companies, especially for SMEs.

In our national publications R&D figures of this „Institutes sub-sector“ are separately presented as part of the BES and units included are considered as units „of the same kind“, operating either under the COMET or the ACR umbrella. For the data presented here, however, it is important to note that most of the institutions in the „Institutes sub-sector“ are classified into NACE 72, but not all (31 out of 38 are ISIC 72, 7 belong to other ISIC classes) - classification of the units for R&D statistics is taken from SBS or, if not available, from the business register. Some of them are also classified as public enterprise, and not in the private sector (15 out of 38). For this exercise we have restricted the analysis to those units that are classified into ISIC 72 and done the classification between private/public according to the SNA information in the business register. Therefore the „Institutes sector“, as published nationally, is not visible in the tables.

Belgium. Data initially reported for Belgium was revised after the September 2022 NESTI meeting. In the data, presented in this updated paper, only organisations where R&D is the main activity of the organisation as a whole were selected.

Most institutes affiliated to universities and university colleges have been excluded, because of the primary education function of the reporting organisation. However, data for the Walloon region’s research centres linked to HES institutions have been included because the institutes are separate administrative entities. This is not the case in Flanders, where universities include any research centres in their reporting.

The different statistical unit approaches in the two different parts of the country constitute an administrative issue. Having separate research centres makes it possible for the Walloon region to fund research in the HES, which strictly speaking falls under the authority of the French Community and can only be funded by it.

From communication with contacts from Belgium, the close to 100% share of specialist organisations in GOVERD appears to be due to the fact that the data collection process targets directly R&D departments within government institutions, e.g. the R&D department of the central bank. Many of these units do not appear to have the requirements of standalone institutional units (e.g. lack legal identity and independent accounts), so the reported 100% likely represents an overestimate of the target measurement concept for the data collection.

As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Brazil. The values considered as 'Business funding' comprise Firm's own funding + other Brazilian firms' funding (State firms+private firms). In both cases, firms' own funding represents more than 99% of the value.

Czech Republic. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

For the breakdown of private enterprises we use different categories, because we don't have data for affiliated domestic firms, but only for foreign affiliates. In respect of domestic (national) firms, we don't know if they are affiliated to other domestic firms or independent.

Spain. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Non-profit organisations serving business includes Private non-profit organisations identified by Tax Identification Card, whose definition is close to Research Institution.

Estonia. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Finland. HES units are included in the data of universities and other HES organisations and thereby classified into industry education (NACE 85420).

Enterprises in the business register with NACE code 72, total R&D.

GOV units with NACE code 72 in the business register.

PNP units with NACE 72 in the business register.

Greece. Regarding the figures for the HES, GOV, PNP, we would like to mention that the breakdown of the total R&D expenditure in each sector of performance by ISIC is not available for the reference year 2019. However, starting from 2020 we have included this breakdown in the national questionnaires and we plan to include the ISIC breakdown in our national results for 2020 and onwards.

Israel. The size cut-off for the reported data in the business sector is above 5 employs, and for less than 5 employs if there is a specific indication for R&D activity from external sources.

Italy. Non-profit organisations serving business are not surveyed.

HE R&D institutes are not separately reported from Universities.

As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated. This includes funds from public and private universities.

Japan. In the "Survey of Research and Development" in Japan (hereinafter, "RDS"), all of the higher education institutions are classified into "O Education, Learning support".

In the Japan Standard Industrial Classification, Rev.13, which can be regarded as corresponding to "P Education" in the International Standard Industrial Classification, Rev. 4. However, in this exercise, tables are provided under the premise that the Higher Education sector of ISIC 72 units comprises of research institutes attached to universities.

In the RDS, no public institution and non-profit organisation is classified into any economic activity. For this reason, in this exercise, tables are provided under the premise that the Private Non-Profit sector of ISIC 72 units comprises of organisations performing R&D as a main activity in the non-profit institutions.

Corresponding items

| Sources of funding | Sources of funds of “intramural R&D expenditures” in the RDS |
|--|--|
| Business (MNC) | “Companies” and “Public corporations and enterprises, which are based on self-supporting accounting systems” (as well as internal funds of “Companies” and “Public corporations and enterprises, which are based on self-supporting accounting systems”) |
| Government (MNC) | “Central Government”, “Local governments”, “National and public research institutions and independent administrative institutions”, and “Others in the ‘Public institutions’” (as well as internal funds of “Central Government”, “Local governments”, “National and public research institutions and independent administrative institutions”, and “Others in the ‘Public institutions’”) |
| Rest of world (including businesses and int org / EU programmes) (MNC)** | “Companies ‘abroad’”, “Universities ‘abroad’” and “Others ‘abroad’” |
| Private non profit (MNC) | “Non-profit institutions” (as well as internal funds of “Non-profit institutions”) |
| Not allocated | “National and public universities and colleges” and “Private universities and colleges” (and internal funds of “National and public universities and colleges” and “Private universities and colleges”) |

The amounts of “internal funds” in the sources of funds are calculated by subtracting amounts for intramural R&D performance in the R&D funds received from the total amounts of intramural R&D expenditures.

Korea. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Lithuania. Since 2010 R&D institutes controlled by HEI's connected to universities lost the status of a separate legal entity.

Netherlands. By definition higher education is included in ISIC 85, not 72.

Government includes the PNP sector.

Norway. In Norway around 90% of R&D expenditure in ISIC 72 is in non-profit research organisations. In our domestic R&D statistics these units are all categorized in «the institute sector».

When we report internationally our domestic institute sector is split; institutes that primarily serve business are reported in Business enterprise (BE), whereas all other institutes, regardless of their legal status, are put in Government (GOV). In other words we do not use the SNA for distribution on institutional sectors. This has always been the case for Norway.

Forty-four percent of the R&D expenditure in the non-profit ISIC 72 entities took place in units that we classify in BE, whereas 56 percent applied in units classified in GOV. The distribution of the non-profit units is however one of the most difficult issues we face. The main challenges are mentioned below.

All the research institutes classified in BE receive basic public funding provided by the Research Council of Norway. Most of them also have extensive other funding from public sources. In most cases board members are appointed by government agencies. From this point of view one might say that BE institutes are controlled by the government.

Poland. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Portugal. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Sweden. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

Chinese Taipei. As HES as a funding source is not present in the Table 2, HES sources were included in Not allocated.

United States. Data for the Government sector is underestimated, as only Federally Funded R&D Centers counted for GOVERD are included. See <https://www.nsf.gov/statistics/ffrdclist/>.

Endnotes

¹ In this document, the terms organisation and institution are used indistinctively without presumption of any features, such as whether they are public or private.

² See Laura Cruz-Castro, Catalina Martínez, Cristina Peñasco, Luis Sanz-Menéndez, The classification of public research organizations: Taxonomical explorations, *Research Evaluation*, Volume 29, Issue 4, October 2020, Pages 377–391, <https://doi.org/10.1093/reseval/rvaa013>

³ OECD (2011) *Public Research Institutions: Mapping Sector Trends*. Paris: OECD. <https://doi.org/10.1787/9789264119505-en>.

⁴ Arnold E., Barker K., Slipersæter S. (2010) *Research Institutes in the ERA*. Brussels: EC. <http://ec.europa.eu/research/era/docs/en/research-institutes-in-the-era.pdf>.

⁵ See Larrue, P. and O. Strauka (2022), "The contribution of RTOs to socio-economic recovery, resilience and transitions", *OECD Science, Technology and Industry Policy Papers*, No. 129, OECD Publishing, Paris, <https://doi.org/10.1787/ae93dc1d-en>.

⁶ In addition to these, there are functional classifications for the R&D carried out in the institutional units.

⁷ An additional element within the SNA that helps differentiate households from non profit institutions serving households (NPISH) is the extent to which the unit's main economic function is production of goods and services or consumption. In the Frascati Manual, households are pooled together with NPISH as Private non profit for completeness and economy because of the very limited role played by households in modern economies as performers of formal and systemic R&D activities.

⁸ Higher education is an economic activity that the FM has traditionally singled out and assigned HIC status. HE institutions can fall under any of the SNA institutional sectors.

⁹ Conversely, there were also requests from parts of the mainstream statistical community to remove the Higher Education sector in order to fully align with the SNA institutional classification but this proposal was dismissed on the grounds that it would be particularly disruptive for STI policy users of R&D data to implement such an adjustment after decades of established practice. NSOs have established mechanisms for compiling existing Frascati R&D data on the SNA institutional classification basis for the purposes of official statistics on R&D capital formation and output in the National Accounts.

¹⁰ The OECD source and methods database, which is completed with information provided by national R&D contacts to the NESTI secretariat, contains at present no entries with any information on the classification by main economic activity for units the government sector.

¹¹ From communication with contacts from Belgium, this appears to be due to the fact that the data collection process targets directly R&D departments within government institutions, e.g. the R&D department of the central bank. Many of these units do not appear to have the requirements of standalone institutional units (e.g. lack legal identity and independent accounts), so the reported 100% likely represents an overestimate of the target measurement concept for the data collection.

¹² In the case of the United States, the measured central (federal) share is 100% because only the R&D of Federally funded research centres contributing to GERD have been reported.

¹³ Germany's entry on government's institutional coverage in the OECD R&D Sources and Methods database states "Research institutes of federal, Länder (federal states) and local governments e.g. the national research centres, the Max Planck and the Fraunhofer societies, Blue List institutions, scientific museums and libraries. Private non profit organisations working in science, research and development as long as they receive more than EUR 160,000 from the government."