

## Chapter 4

# Measurement of R&D expenditures: Performance and sources of funds

*This chapter discusses the measurement of expenditure on the performance of research and experimental development (R&D), the sources of funds for the performance of R&D and expenditures for R&D performed in other statistical units. The measurement of gross domestic expenditure on R&D (GERD), which covers all expenditures for R&D performed in the economy during a specific reference period is the principal R&D indicator at country level. GERD, and the GERD/GDP ratio, are used for international comparisons. The chapter discusses the measurement of expenditures and flows in each of the four sectors of the manual where R&D is performed, Business enterprise, Government, Higher education and Private non-profit, and the flow of funds from the Rest of the world sector for the performance of R&D in the other four sectors. With the decision to treat the expenditure on the performance of R&D as a capital investment in the System of National Accounts (SNA), and the need for better statistics on the globalisation of R&D, more information is needed and guidance is provided on what to collect. There is also discussion of the use of the statistics, of which the GERD/GDP ratio is an example, as is the estimation of the capital investment in R&D in the SNA. There is also the need to be able to analyse data at the level of the individual statistical unit in order to have a better understanding of the dynamics of R&D performance and funding.*

## 4.1. Introduction

### ***Why measure R&D expenditures?***

4.1 The amount of money spent on research and experimental development (R&D expenditure) is of considerable interest to national and international policy makers. In particular, statistics on R&D expenditure are used to measure who conducts and who funds R&D and where it takes place, the level and purpose of such activities, and interactions and collaborations between institutions and sectors. Expenditure statistics are used to inform the development of fiscal and financial incentives to stimulate R&D activities, and to understand how R&D contributes to economic growth, defence and societal well-being.

4.2 As detailed in Chapter 1, a major change in the 2008 revision of the System of National Accounts (SNA) was the explicit treatment of R&D as capital formation, that is, “investment” (EC et al., 2009). This change resulted in attendant demands for more detailed breakdowns on R&D expenditures, which are noted throughout the chapter. This chapter also includes guidance for collecting detailed data on the sources and flows of R&D funds and on types of R&D transactions. In particular, additional and more extensive information is needed to help measure R&D sales and purchases.

4.3 Although the chapter focuses on the requirements necessary to produce internationally comparable statistics at different levels of aggregation, it is equally important to ensure that the data for individual statistical units can support analysis at the micro level. The guidelines presented here are therefore intended to address a multiplicity of statistical data needs and nuances.

### ***Data collection and compilation overview***

#### ***Basic terms***

4.4 It may be helpful first to introduce the basic concepts used to structure the collection of R&D statistics. For the purposes of this manual:

- Expenditures on intramural R&D represent the amount of money spent on R&D that is performed within a reporting unit; expenditures on (the funding of) extramural R&D) represent the amount of money spent on R&D that is performed outside a reporting unit.
- Internal R&D funds are the amount of money spent on R&D that originates within the control of a reporting unit; external R&D funds are the amount of money spent on R&D that originates outside the control of a reporting unit.

- Exchange R&D funds are funds that flow between statistical units with a compensatory return flow of R&D; transfer R&D funds are funds that flow between statistical units without a compensatory return flow of R&D.

4.5 These terms, their interrelationships and the measurement challenges are more precisely defined and discussed throughout the remainder of the chapter.

### **Basic collection approach**

4.6 A statistical unit may have expenditures for performing R&D and for funding R&D. It might fund R&D but not perform R&D – as is sometimes the situation for businesses that occasionally need to purchase R&D. Or it might perform R&D but not fund R&D – a somewhat uncommon occurrence, although this would be the case for a small business unit that has its R&D funded totally by a government grant. Finally, a statistical unit might both perform R&D and fund R&D. Funding may be for R&D undertaken either within the reporting unit (intramural) or outside the reporting unit (extramural). The step-by-step approach for measuring these expenditures is as follows:

- Identify the amount of intramural expenditures on R&D performed within each statistical unit (see Section 4.2).
- Identify the sources of funds for these intramural R&D expenditures as reported by the performer (see Section 4.3).
- Identify the amount of funding for extramural R&D provided by each statistical unit (see Section 4.3). Both R&D-performing units and non-R&D-performing units may provide funding for R&D performed outside of the unit.
- Identify the amount of funding flows between statistical units that is made with and without a compensatory return flow of R&D from the performer (see Section 4.3).
- Aggregate the data by sectors of performance and sources of funds to derive totals for the entire economy. Other classifications and distributions are then compiled within this framework (see Sections 4.3 and 4.5).

### **Gross domestic expenditure on R&D (GERD) – a country’s principal R&D indicator**

4.7 GERD is total intramural expenditure on R&D performed in the national territory during a specific reference period.

4.8 GERD is the main aggregate statistic used to describe a country’s R&D activities and covers all expenditures for R&D performed in the economy. Thus, GERD includes domestically performed R&D that is financed from abroad (i.e. from the “Rest of the world”) but excludes funding for R&D performed abroad. See Chapter 3, Section 3.3 on the concept of “residence” and Section 4.2 in this chapter for conventions related to reporting intramural R&D that takes place

outside of the national territory. GERD is the primary indicator for international comparisons of R&D activity.

4.9 A country may have statistical units that perform R&D in each of the main sectors covered in this manual: Business enterprise, Government, Higher education and Private non-profit. Overall classification definitions are provided in Chapter 3, and specific definitions and characteristics of these four sectors are covered in Chapters 7, 8, 9 and 10, respectively. Intramural R&D expenditure totals should be compiled for each of the main sectors. GERD is constructed by summing those sector totals to a national total. For each performing sector, the sources of funds from each sector should be compiled: Business enterprise sector, Government sector, Higher education sector, Private non-profit sector, and Rest of the world. Definitions and characteristics for Rest of the world are covered in Chapter 11. To the extent possible, and to reduce the possibility of double counting, GERD should be based on performer reports and not on information from the source of R&D funds. The performer is in the best position to identify:

- how the funds were effectively used (e.g. whether an expenditure is for an R&D or non-R&D activity, the nature of the R&D, the cost elements that comprise the R&D, etc.)
- the year in which the R&D activity actually took place
- the immediate source of the funds used for R&D.

## 4.2. Intramural R&D expenditures (Performance of R&D)

### Definition

4.10 Intramural R&D expenditures are all current expenditures plus gross fixed capital expenditures for R&D performed within a statistical unit during a specific reference period, whatever the source of funds.

4.11 Intramural R&D expenditure is synonymous with the performance of R&D within a statistical unit. The aggregation of intramural R&D for all units within a sector is synonymous with the performance of R&D within a sector of the economy; the summation of intramural R&D for all sectors is synonymous with the performance of R&D for the entire economy (GERD).

4.12 Funding for, or expenditure on, extramural R&D (that is, R&D performed outside the statistical unit) is not included in intramural R&D performance totals. Such funding for R&D received from others should be reported as a separate category in order to have full information on each unit's access to R&D. Such funds would also be reported in the receiving units' R&D intramural performance total, and therefore the exclusion of funding for extramural R&D is to avoid double counting. It is not always easy to differentiate expenditures for intramural R&D from extramural R&D; several examples are provided in this chapter to help clarify these categorisation decisions.

4.13 Expenditures for non-R&D purchases made outside the statistical unit or sector but in support of intramural R&D (e.g. purchase of supplies or of general services for the R&D activity) are included in intramural R&D totals.

4.14 Both current and capital expenditures are included in intramural R&D totals, although separately reported.

### **Current R&D expenditures**

4.15 Current expenditures are composed of labour costs of R&D personnel and other current costs used in R&D. Services and items (including equipment) used and consumed within one year are current expenditures. Annual fees or rents for the use of fixed assets should be included in current expenditures.

### **Labour costs of R&D personnel**

4.16 Labour costs comprise compensation for employed R&D personnel (called “internal R&D personnel” in this manual), such as annual wages and salaries and all associated costs or fringe benefits, such as bonus payments, stock options and holiday pay, in addition to contributions to pension funds and other social security payments, payroll taxes, etc. It is important to include only labour costs for employed persons when they make a direct contribution to intramural R&D, especially if such persons do not work full-time on R&D activities. Just because a person is employed in an R&D unit, for example, it cannot be assumed that all of their labour costs are for R&D activities. See Chapter 5 for further guidance.

4.17 Labour costs are generally the largest component of current costs. Countries may find it useful to collect or otherwise estimate labour costs by type of R&D personnel (for example, researchers, technicians and equivalent staff, other supporting staff). These additional breakdowns may be helpful in constructing cost indices for R&D expenditures.

4.18 The labour costs of a statistical unit’s employed persons who provide ancillary services and who are not included in the R&D personnel data (such as security, canteen, cleaning and maintenance personnel; the staff of central computer departments and libraries; and the staff of central finance or personnel offices directly involved in supporting the R&D effort) should not be included in labour costs, but should be included in other current costs.

4.19 The costs associated with engaging persons not employed in the statistical unit but who provide direct services that are an integral part of the statistical unit’s R&D projects or activities should not be included in labour costs. Costs for such personnel should be reported in other current costs (as defined below). The distinction between internal R&D personnel in the statistical unit (labour costs) and self-employed persons working on R&D in the same statistical unit (other current costs) may in some cases be blurred. Normally, the statistical unit pays self-employed persons for the total services specified in a contract,

rather than paying them only wages and salaries. See Chapter 5 for further clarifications on R&D personnel.

4.20 The calculation of wages and salaries for doctoral or master's students may sometimes seem problematic. As noted in Chapter 5, only those students who are employed by the statistical unit and who are engaged in the statistical unit's R&D projects or activities (e.g. as researchers or research assistants) should be included in the totals. Sometimes they receive less money for their work than they would at "market value". Nonetheless, only actual salaries and associated labour costs for such students should be reported in the R&D statistics. No inflated values should be derived.

4.21 Labour costs include actual or imputed contributions to pension funds and other social security payments for R&D personnel. They need not be visible in the statistical unit's bookkeeping accounts; they may often involve transactions within or between sectors. Even when no transactions are involved, an attempt should be made to estimate these costs. To avoid double counting, labour costs do not include pension payments to former R&D employees.

4.22 Labour costs of R&D personnel should include employer payroll and related taxes, net of general subsidies/rebates on this workforce. However, some countries provide automatic incentives for hiring R&D personnel that are implemented through various payroll tax instruments. To ensure that reported R&D expenditures are not impacted by the choice of tax support instrument, it is recommended that any such R&D specific payroll incentives are not adjusted for when estimating labour costs.

→ For example, if country A uses a hiring tax incentive offered through reduced payroll taxes (where a researcher costs "100" currency units comprising normal taxes less a "10" unit assumed wage tax subsidy), and country B uses an equivalent "10" unit hiring tax subsidy recovered separately through the corporate tax system, without this rule the measure of performed R&D for the first year that the researcher was hired would incorrectly appear smaller in country A (90) than in country B (100). In both cases the labour costs should be recorded as 100.

### **Other current R&D costs**

4.23 These costs comprise non-capital purchases of materials, supplies, equipment and services to support R&D performed by the statistical unit in the reference year. Examples are water and fuel (including gas and electricity); books, journals, reference materials, and subscriptions to libraries and scientific societies, etc.; imputed or actual costs of small prototypes or models made outside the statistical unit; and materials for laboratories (e.g. chemicals, animals, etc.). Other current costs include royalties or licences for the use of patents and other intellectual property rights, the lease of capital goods (machinery and equipment, etc.) and the rental of buildings to support R&D performed by the statistical unit in the reference year.

4.24 The distinction between purchasing R&D (extramurally performed R&D not to be included as intramural R&D expenditure) and acquiring services to support intramural R&D in the statistical unit may in some cases be blurred. See the text below on “Exclusion of acquired R&D” for further guidance.

4.25 The category of other current R&D costs includes costs for computer software that is used in the performance of R&D for one year or less. It includes licences for or the acquisition of separately identifiable computer software, including program descriptions and supporting materials for both systems and applications software. The production costs (e.g. labour and materials) of internally produced software should be reported. Software from external vendors may be obtained through the outright purchase of rights or licences to use. Software used or licenced for more than one year should be reported under capital expenditures (see “Capitalised computer software” text below).

4.26 The costs associated with engaging persons who are not employed in the statistical unit but provide direct services that are integrated into the statistical unit’s R&D activities should be included in other current costs. Such persons include all on-site consultants and researchers from external organisations, research institutes, enterprises, etc., and the self-employed. Such persons also include technicians and other supporting staff employed by and hired through external statistical units, as long as they are contributing directly to the statistical unit’s intramural R&D performance. By convention for this manual, these R&D personnel are termed “external R&D personnel” to reflect that they are not receiving wages and salaries from the R&D-performing statistical unit, as contrasted with the statistical unit’s internal personnel who are receiving wages and salaries from the R&D-performing statistical unit. Such costs should be separately identified in other current costs as “external R&D personnel” costs. The distinction between purchasing R&D (extramural R&D) and acquiring consultancy services to support intramural R&D in the statistical unit (other current costs) may in some cases be blurred. See below, “Distinguishing between intramural and extramural costs related to labour”, for classification guidance.

4.27 The distinction between acquiring external personnel services to support intramural R&D in the statistical unit (other current costs, external personnel subcategory) and acquiring general services to support intramural R&D in the statistical unit (other current costs, but not part of the external personnel subcategory) can in some cases be difficult to establish. How such current costs are reported will depend primarily on the details available from the statistical unit’s internal R&D financial accounts; regardless, the reporting of such R&D cost data should be consistent with how R&D personnel data are reported. See Chapter 5, Section 5.2, for their treatment in R&D personnel data.

4.28 As noted in Chapter 5, the costs for doctoral and master’s students who are engaged in the statistical unit’s R&D projects or activities but are

not employed by the statistical unit should be included in the other current costs (external R&D personnel) totals. These costs include research grants or scholarships that are tracked by or through the statistical unit.

4.29 Administrative and other overhead costs (e.g. office, information and telecommunications, utilities, insurance) should also be included in other current costs, prorated if necessary to exclude non-R&D activities within the same statistical unit. Such prorated costs for indirect or ancillary services should be included here, whether carried out within the statistical unit or hired or purchased from outside suppliers. Examples include security; storage; the use, cleaning, repair and maintenance of buildings and equipment; computer services; and the printing of R&D reports. Prorated costs should be included for staff of central computer departments and libraries and for staff of central finance or personnel offices. Interest charges should be excluded.

4.30 Statistical units that both perform intramural R&D and fund extramural R&D may include the administrative cost for preparing and monitoring extramural R&D contracts as part of R&D other current costs, but not as labour costs. The raising, management and distribution of funds for R&D grants to performers by ministries, research agencies, foundations or charities should not be included as R&D.

4.31 For the purpose of measuring R&D for the SNA, expenditures for the purchases of materials and for the purchases of services should be separately identified. However, consideration should be given to data quality issues and to whether the response burden would be greatly increased.

### ***Allocated R&D costs within an enterprise group***

4.32 Consistent with international accounting standards, some enterprises that are part of an enterprise group (especially MNEs) record large R&D payments to other members in the same group (especially foreign parents) as support for R&D within the enterprise group without actually receiving any R&D in return. Such “transfers” should be excluded from the intramural expenditure totals of the paying member and reported as funding for extramural R&D. From the perspective of the R&D-performing member that is the recipient of such group R&D payments (e.g. foreign parent), if it gets allocations from its members without having to deliver R&D in return, those funds are part of its intramural R&D expenditures and should be categorised as external sources of funds. It is acknowledged, however, that based on practical considerations the bookkeeping accounts of the receiving unit of such inter-company allocations may not identify the funds as an external source of funds for intramural R&D, but rather treat them as internal funds (similar to using retained earnings to fund its R&D). See also Chapter 11 on R&D globalisation.



### ***Indirectly paid current costs***

4.33 R&D activities may incur costs that are often not paid by the sector but borne by institutions classified in other sectors of the economy, usually the Government sector. Two examples are discussed below.

→ Example 1. Rents for research facilities

4.34 In many countries, responsibility for “housing” public institutions (including universities) lies with a central agency that may not be an R&D performer and therefore may not be surveyed. Or, if surveyed as part of the Government sector, its accounts may not reflect the functional breakdown between R&D and other activities. This situation is particularly relevant for the Higher education sector.

4.35 In some cases, such facilities are available to institutions free of charge and are not accounted for in the institutions’ books. In other cases, the institutions pay a rent to the owner of the facilities. To obtain a realistic cost of R&D, all fees and rents associated with R&D should in principle be included in expenditure data. Where the fee or rent is charged to a unit, this is easily done. If, however, there is no such charge, it may still be desirable to calculate an amount that represents the user cost of the facilities or the “market value”. This may be included in other current costs. Care must be taken to avoid the double counting of costs between the suppliers and recipients of these services.

→ Example 2. Operations and maintenance of research facilities

4.36 There are examples where the government owns and maintains special facilities that are used solely for R&D activities. Such facilities are used both by government (including the agency that owns the facility and other government agencies) and non-government (generally business) performers for approved R&D projects. When used by other government or non-government performers, user charges – which might include operation and maintenance (O&M) costs – that are paid to the facilities owner are part of the current costs reported by the R&D performer using the facilities. Such O&M costs that are recovered in user charges should be excluded from reports from the government agency that owns the facilities in order to avoid the double counting of such expenditures.

4.37 However, if the facilities are in use only a couple of times per year, the owner may have ongoing and continual O&M costs in order to keep the R&D facilities ready for use. If the owner did not pay those costs, the R&D facilities could not be used by the government owner or anyone else for an R&D project. If such ongoing costs are not included in user charges (or in any other indirect charges) paid by government and non-government performers, then they may be included as intramural expenditure, in other current costs, by the government unit that owns the facility.

### ***Depreciation and amortisation costs (excluded from intramural R&D totals)***

4.38 The depreciation costs of physical assets used in R&D should not be included in the intramural R&D expenditure totals. Similarly, the amortisation costs of intangible assets used in R&D should not be included in the intramural R&D expenditure totals. However, it is often the case that such costs of fixed capital used for R&D are included in the reporting unit's internal R&D financial accounts; they tend to be included under their other current cost category.

4.39 To avoid misreporting on R&D surveys, it is recommended to collect combined depreciation/ amortisation costs as an item separate from the R&D cost categories, or at least to state clearly that these costs should be excluded from intramural R&D expenditure totals.

### ***Principle of valuation for R&D expenditure: Purchasers' prices***

4.40 R&D expenditure totals should be collected and reported at purchasers' prices. Purchasers' prices are the amounts paid by the purchasers, excluding the deductible part of value-added taxes (VAT) and similar taxes. Purchasers' prices reflect the actual costs to the users. This means that the valuation of current and capital expenditures on goods and services for R&D is the total price paid by the reporting unit including any taxes on products, which act to increase the price paid, and the price-reducing effect of any subsidies on the products purchased.

→ For example, an enterprise buys "100 (currency units)" worth of materials to be used for R&D. "60" are for material A taxed at 10% and "40" are for material B which is subsidised at 4%. In addition, there is a fully deductible VAT tax of 15%. In this case, the relevant measure of R&D cost is 100 plus  $(60 \times 10\%)$  minus  $(40 \times 4\%)$ , or  $(100 + 6 - 1.6) = 104.4$ . The 15% reclaimable VAT does not contribute to the measure of R&D costs.

### ***Deductible value-added tax (excluded from intramural R&D totals)***

4.41 Statistical offices should be careful to ensure that deductible taxes on products, such as some instances of VAT, are not included in the reported estimates. A market producer is able to recover the costs of any deductible VAT payable on their purchases by reducing the amount of their own VAT liability (to government) with respect to the VAT invoiced to its own customers. In line with the SNA and for purposes of international comparison, a net system of recording VAT should be followed. Under the net system, VAT is recorded as being payable by purchasers, not sellers, and only by those purchasers who are not able to deduct it.

4.42 For the Business enterprise sector, the separate recording of VAT payable on inputs is part of standard accounting procedures by firms and is deductible if offset against any VAT charged on output sold in the market. This rule should equally apply to firms whose turnover may be temporarily

insufficient to recoup the paid VAT. Statistical units should be advised of these necessary adjustments in reporting their R&D expenditure totals. In the case of the Government sector, VAT payable on inputs is often deductible and therefore separately identifiable.

4.43 More difficulties may arise in the Higher education and the Private non-profit sectors where VAT included in goods and services purchased as part of an R&D project may not be deductible; it will therefore be regarded by the respondents as a legitimate part of their expenditures. Countries should make every effort to exclude deductible VAT from expenditure figures for these sectors. It is recommended that figures forwarded for international comparison should exclude deductible VAT.

### **Capital R&D expenditures**

4.44 Capital R&D expenditures are the annual gross amount paid for the acquisition of fixed assets that are used repeatedly or continuously in the performance of R&D for more than one year. They should be reported in full for the period when they took place, whether developed in-house or acquired, and should not be registered as an element of depreciation.

4.45 Such expenditures, which include purchases and other costs associated with the acquisition or formation of fixed assets, are termed “capital expenditures”. In general, fixed assets consist of both tangible (also called physical) fixed assets (such as buildings and structures, transport equipment, other machinery and equipment, etc.) and intangible fixed assets (such as computer software and mineral exploration rights).

4.46 The measurement of capital expenditures for R&D focuses on traceable transactions for capital used in R&D rather than the economic cost of owning and using assets for R&D. While the cost of using assets owned by third parties for intramural R&D is to be reported as “other current R&D costs”, capital R&D expenditures are a separate category to be reported on an “as acquired” basis. In order to avoid double counting capital costs, all depreciation and amortisation provisions for buildings, plant and equipment and other intangibles, whether real or imputed, should be excluded from the measurement of intramural R&D expenditures (see earlier text on Depreciation and amortisation costs).

### **Types of fixed assets used for R&D**

4.47 The most relevant types of assets used for R&D for which capital R&D expenditures should be compiled are:

- land and buildings
- machinery and equipment
- capitalised computer software
- other intellectual property products.

### ***Land and buildings***

4.48 This category includes land acquired for R&D use (e.g. testing grounds, sites for laboratories and pilot plants) and buildings constructed or purchased for R&D use, including major improvements, modifications and repairs. Since buildings are produced assets and land is a non-produced asset in National Accounts, R&D expenditures for land and for buildings should be separately identified whenever possible.

4.49 When a new building is purchased or constructed for mixed use, the R&D share of those capital expenditures is often difficult to quantify, and therefore the share element often is ignored in statistical compilations of R&D expenditure. See the text below on “Identifying the R&D use of capital expenditures” for suggestions on how to estimate the R&D content of capital expenditures.

4.50 The purchase of new research equipment often might be included in the cost of new buildings and not separately identifiable in the reporting unit’s accounting records. This could result in an underestimation of the “machinery and equipment” component in total capital R&D expenditures. Reporting units should be explicitly encouraged to separately identify and include such equipment purchases in the relevant fixed asset category.

### ***Machinery and equipment***

4.51 This category covers major (i.e. capitalised) machinery and equipment acquired for use in the performance of R&D. For the purpose of measuring R&D for National Accounts, expenditures on machinery and equipment should be identified by more detailed breakdowns, including “information and communications equipment” and “transportation equipment”. However, consideration should be given to data-quality issues and to whether the response burden would be greatly increased.

### ***Capitalised computer software***

4.52 This category includes the costs of computer software that is used in the performance of R&D for more than one year. It includes long-term licences or the acquisition of separately identifiable computer software, including program descriptions and supporting materials for both systems and applications software. The production costs (e.g. labour and materials) of internally produced software should be reported. Software from external vendors may be obtained through the outright purchase of rights or licences to use. Software used or licensed for one year or less should be reported under current expenditures (see earlier text on “Other current R&D costs”).

### ***Other intellectual property products***

4.53 This category includes the costs for purchased patents, long-term licences, or other intangible assets that are used in R&D and which are in use for more than one year. Other intangibles that can be reported in a unit’s internal

financial accounts, such as marketing assets or goodwill, should not be included (see text on “Comparisons with capital investment reported in SNA”).

### ***Conventions for distinguishing between current and capital items***

4.54 In measuring actual capital expenditure, small tools and instruments and minor repairs and improvements to existing buildings will normally be excluded: as in most accounting systems, these items are usually treated as current cost accounts. The boundary between “minor” and “major” items varies slightly across countries according to their taxation practices and across different businesses and institutions in the same country according to their accounting practices. These differences are rarely significant, and it is neither necessary nor practical to insist on any rigid standard. Thus, national conventions will govern allocations to current or to capital expenditures. Nevertheless, in those countries where expenditures on very expensive prototypes (e.g. aircraft) or equipment with a limited life (e.g. launching rockets) are considered current costs, such conventions should always be made explicit.

4.55 Although payments for current purchases of books, periodicals and annuals should be assigned to other current costs, expenditure for the purchase of complete libraries or large collections of books, periodicals, specimens, etc. should be included in the totals under expenditures on major equipment, especially if made when equipping a new institution.

### ***Identifying the R&D use of capital expenditures***

4.56 Occasionally, the R&D share of a fixed asset may be known at the time of acquisition. In this case, the appropriate portion of the expenditure for the acquisition of the asset should be attributed to R&D capital expenditures. More often, when the R&D share of the asset is not known and a fixed asset will be used for more than one activity and neither the R&D nor any of the non-R&D activities predominates (e.g. computers and associated facilities; laboratories used for R&D, testing, and quality control), the costs should *in principle* be prorated between R&D and other activities. This proportion could be based on the number of R&D personnel using the facility, compared to total personnel, or on administrative calculations already made (e.g. the R&D budget may be charged a certain portion of the capital cost, or a certain proportion of time or floor space may be assigned to R&D).

4.57 Occasionally, a statistical unit (usually a government agency or large enterprise) may make major investments in large fixed assets that are considered to be “first of their kind” or offer previously unavailable capabilities. Because of their potential contribution to innovative activities, reporting units may be inclined to include all such construction costs as R&D. For international comparability, however, only the costs that are specifically identified as capital to be used for R&D should be included as intramural R&D. Generally, such costs should not be reported as current R&D expenditures, but should be reported as capital R&D expenditures.

### *Sale of capital assets used for R&D*

4.58 The sale or transfer of fixed assets originally acquired for R&D creates a problem. Their disposal could be considered as a disinvestment in R&D. However, no adjustment should be made to record capital expenditures, and the statistical unit's capital R&D expenditures should not be reduced accordingly, either currently or retrospectively (for the years in which the capital costs were recorded). Current revisions can cause anomalies such as negative intramural R&D expenditures. Retrospective revisions are difficult and confusing. Ideally, the purchase of the used R&D capital equipment by another domestic R&D performer should be excluded from measured R&D expenditures, in order to avoid double counting as R&D at different points in time. In some cases, the assets sold may be used for other purposes or transferred to an R&D performer abroad, in which case there would be no double counting of R&D.

4.59 Table 4.1 provides a summary of the cost categories described above. Individual country circumstances will determine the level of the optional details that are collected.

**Table 4.1. Summary of intramural R&D expenditure categories**

Total intramural costs <sup>1</sup>
Current costs
Labour costs for internal R&D personnel
Other current costs
External R&D personnel
Purchase of services, excluding external R&D personnel (optional breakdown)
Purchase of materials (optional breakdown)
Other, not elsewhere classified (e.g., general administration costs)
Capital costs
Land and buildings
Land (optional breakdown)
Buildings (optional breakdown)
Machinery and equipment
Information and communications equipment (optional breakdown)
Transportation equipment (optional breakdown)
Other machinery and equipment (optional breakdown)
Capitalised computer software
Other intellectual property products

1. Depreciation should not be included in intramural expenditure totals, but should be reported separately.

## **Topics and challenges in compiling intramural R&D totals**

### **Exclusion of acquired R&D**

4.60 The acquisition costs of R&D from other units or sectors should not be included in the intramural R&D expenditures of the reporting statistical unit or sector. For the acquisition of services closely related to intramural R&D activities, it may be difficult conceptually to differentiate costs for intramural R&D from costs for extramural R&D. If these services are separate R&D projects specified in a contract, without detailed specifications given by the project manager of the funding unit, the expenditures can in most cases be regarded as funding for extramural R&D. If they are certain tasks (not necessarily R&D as such) necessary for the intramural R&D of the unit but contracted out, they can generally be regarded as intramural R&D expenditure (other current costs).

4.61 It may be especially difficult for large enterprises to differentiate costs for intramural R&D from those for extramural R&D. Consistent with international accounting standards, their annual financial reports on R&D expenses often will combine internal funds for both intramural R&D and extramural R&D as long as the R&D performed is “for the benefit of” the reporting firm. Countries should provide explicit guidance to reporting units to minimise the possibility of any inconsistent differentiation of funds for intramural R&D and extramural R&D as recommended in this manual.

### **Distinguishing between intramural and extramural costs related to labour**

4.62 If external personnel (self-employed or employed through other statistical units) are fully integrated into the R&D activities of the reporting statistical unit, and their work is managed by this performing unit, the costs for these personnel should be included in intramural R&D as other current costs, preferably in a separate external R&D personnel subcategory. It is recommended to separately identify the number and related full-time equivalents (FTEs) of these “non-employees”, and not to include those totals with the number of employees in the performing unit (see Chapter 5). To avoid double counting, these totals should not be reported as R&D costs and R&D personnel by the delivering statistical unit where these external personnel are employed.

4.63 The costs for consultants who provide R&D in fulfilment of a specific order (acquisition), but not as an integrated part of the reporting unit’s R&D projects, should be treated as funding of extramural R&D by the reporting unit receiving the R&D. The delivering statistical unit where these consultants are employed should report this activity as intramural R&D expenditure.

4.64 A special case is personnel working remotely from abroad on a long-term basis. Their costs for such activity should usually be reported as funding for extramural R&D (performed in the Rest of the world) in the reporting domestic unit. In the foreign unit, those costs should be reported as part of intramural

R&D expenditure. This manual cannot recommend a precise definition of what constitutes a “long-term” assignment, and it may depend on the contractual or administrative arrangements with the hosting institution.

### ***Identifying intramural R&D performed outside the national territory***

4.65 The concept of intramural R&D expenditure is intended to measure the R&D performed within the statistical units that are resident in the national territory of the compiling country. Some of the expenditures may, however, have occurred off-premise and even abroad. For example, intramural R&D expenditures might include:

- costs for a floating ocean research vessel engaged in marine life studies
- costs for an MNE parent’s engineering staff assigned on a short-term basis to work in its foreign affiliate where the domestic parent continues to pay staff salary and expenses
- costs for maintaining and utilising a permanent research presence in Antarctica
- costs for a higher education researcher to undertake field work in a location outside of the compiling country.

4.66 In classifying “intramural” R&D that takes place outside of the national territory of the compiling country, priority should be given to the organisational structure of an activity rather than to the literal location of where the activity takes place. It is difficult to provide precise guidelines for such classification decisions, but at a minimum intramural R&D that has occurred abroad should include only R&D that is performed by a statistical unit to fulfil its own objectives and if the statistical unit has invested its own financial resources and R&D personnel in the activity. The R&D must take place under the responsibility of the reporting unit, and the reporting unit must meet the economic residence criterion described in Chapter 3 (Institutional Sectors and Classification).

### ***Incomplete and inaccurate coverage of intramural R&D***

4.67 All R&D activity carried out in the statistical unit should be reported. However, there are many reasons why there may be under-coverage of a statistical unit’s R&D activity. Several of the more common reasons for under-coverage are:

- the R&D occurs inside the statistical unit, but outside specific R&D departments, such as pilot testing or initial production preparation, or during general technology development activities
- the R&D is fully integrated in a development contract for a specified product (e.g. when a relatively small amount of R&D is included in a very large defence procurement for fighter planes)
- the R&D is financed by customers (contract research), but not recognised as R&D in the financial accounts of the performing units (but rather possibly as the costs of sales of technical services).



4.68 Finding effective solutions to these under-coverage problems can be challenging. One common solution used by statistical offices is active follow-up with respondents during data retrieval and data validation. A complicating factor for both respondents and statistical offices, however, is that the accounting systems of the statistical units may lack the detailed R&D expenditure information requested, or it is too burdensome for the respondents to dedicate the resources required to provide these detailed expenditures.

4.69 On the other hand, over-reporting of R&D can also occur for different reasons. Statistical units may record in their financial accounts innovation expenditures that extend beyond an R&D activity; for example, they may report all information technology costs or training costs for R&D personnel as R&D even if those costs are not actually related to R&D.

4.70 There are multiple possible sources of misreporting of R&D within enterprise groups, and particularly within a multinational enterprise group (MNE). For example, intercompany transfers and company-specific cost allocation requirements complicate the collection of accurate R&D expenditure totals. (See Chapter 11 on Globalisation for additional guidance on measuring R&D in MNEs.)

### ***Measuring capital expenditures as a service***

4.71 R&D is a service activity and the outcome a service product. As previously detailed, R&D performance is derived by summing the R&D costs (intramural expenditures) of a statistical unit. Those expenditures represent the amount of money spent during a specific reference period on labour and other non-capital items plus the gross amount paid during that same reference period for the acquisition of fixed assets that are used repeatedly in the performance of R&D. In the unusual situation where the only R&D-related activity of the statistical unit during the reference period is to pay for a new building that will be used in their future R&D activities, those capital expenditures effectively are being reported as a service activity (performance) in the current reference period. The use of the building for R&D in future periods will not be recorded as part of the intramural R&D in those future periods. Understanding these reporting conventions will assist in interpreting R&D expenditure totals and in making comparisons with other sources on aggregate R&D spending that are compiled differently, including R&D reported in National Accounts and undertaken within MNEs (see Chapter 11 on Globalisation).

### ***Comparisons with capital investment reported in the SNA***

4.72 The accounting for capital R&D expenditures in this manual differs from that in National Accounts. The 2008 edition of the SNA renamed the category of intangible fixed assets as “intellectual property products” and extended coverage of the produced asset boundary to include R&D. As a result, R&D is considered as a capital asset in the SNA, which uses measures of R&D production and investment based on adjustments to Frascati R&D intramural data. By comparison, the notion

of capital R&D used in this manual refers to the annual gross amount paid for physical and intangible assets to be used for R&D performance. This manual's R&D performance totals are conceptually close to the SNA concept of gross output of R&D, but these two measures differ, among other things, in the way in which the cost of capital used for R&D is treated (OECD, 2009).

4.73 Whereas capital expenditures are included in intramural expenditure totals in this manual (and depreciation costs are excluded), National Accounts deal separately with capital investment expenditures (capital account for the respective assets) but incorporate measures of the current user cost of existing capital. The user cost of existing capital comprises depreciation for obsolescence and wear and tear, in addition to a measure of the opportunity cost of funding the capital asset. Similar adjustments are not made by statistical offices compiling R&D performance measures (intramural R&D expenditures). More details on the linkages between the guidance for these two frameworks is to be found online in the annex guidance to this manual available at <http://oe.cd/frascati>.

### 4.3. Funding of R&D

4.74 R&D and the funds to cover the costs of R&D involve significant flows between units, sectors and countries. In order to respond to the needs of policy makers, analysts and national accountants charged with capitalising R&D, every effort should be made to trace the different flows of funds and the categories of funds for R&D, from their original source to their ultimate destination.

4.75 From the perspective of performance, R&D is conducted by the statistical unit with funds either *from* the statistical unit's own sources (internal) or *from* sources outside of the statistical unit (external). These concepts are further clarified in Section 4.3 on the Internal and external sources of funds.

4.76 From the perspective of funding, R&D funds pay for either the costs of R&D performance within the statistical unit (intramural) or the costs of R&D performance outside of the statistical unit (extramural).

4.77 There can be a flow of R&D funds between statistical units either with (exchange) or without (transfer) compensatory return flows of R&D from the performer. These concepts are further clarified in Section 4.3 on the Transfer and exchange categories of funds for R&D.

4.78 R&D activity often overlaps these discrete performer and funding categories, making it difficult at times to identify accurately the performers and sources of R&D funds. For example, a government research laboratory might provide funds for R&D under a contract to an aerospace firm, and that firm might use part of those funds to purchase R&D from another firm specialising in research services. The aerospace firm also might use some of its internal funds to purchase customised R&D from the research services firm as an integral input into a separate intramural project. The identification of the funder(s) and the performer(s) is complex. A further complication is that *all* extramural R&D for

the funding unit is some other performing unit's intramural R&D. It is important then to define clearly what each reporting category represents so as not to double or even triple count the R&D expenditures, nor miss them entirely.

### **Approaches to measuring flows of R&D funds**

4.79 R&D and R&D funding flows may be measured in two ways. One approach is performer-based reporting of the sums that a statistical unit or sector has received from another statistical unit or sector for the performance of intramural R&D during a specific reference period. The funds received for R&D performed during earlier periods or for R&D not yet started should be excluded from the sources of funds reported for the current reference period. The second approach is funder-based reporting of the sums that a statistical unit or sector reports having paid or committed itself to pay to another statistical unit or sector for the performance of R&D during a specific reference period.

4.80 Performer-based reporting is strongly recommended for the collection of R&D data. The performer is in the best position to know whether funds were actually used for R&D, the amount and sources of funds used, and the year in which the R&D activity took place. However, funder-based reporting may be helpful in obtaining R&D information about the intentions of the units funding the R&D.

4.81 Table 4.2 summarises the intersection of units performing R&D and the sources of R&D funds. The amounts reported in cell (i) plus cell (ii) represent total intramural R&D expenditures and the sources of those funds (as reported by the performer). Cell (iii) represents the amount of money paid/transferred to other units for extramural R&D performance (as reported by the funder).

**Table 4.2. Intersection of performing and funding R&D**

	R&D performance within the unit	R&D performance outside the unit
Internal sources of funds	(i) Intramural R&D performed with internal funds	(iii) Funding extramural R&D performance using internal funds
External sources of funds	(ii) Intramural R&D performed with external funds	(iv) Funding extramural R&D performance using external funds

4.82 Cell (iv) represents the amount of money received by one recipient unit from a second "originating" unit that is subsequently paid/transferred (that is, subcontracted/sub-awarded) to a third sub-recipient unit for extramural R&D performance. To avoid double counting, the sub-recipient unit should report the amount of (iv) as intramural R&D externally funded by the "originating" unit. The initial recipient of external funds should in principle not include the amount in any of its R&D totals. National statistical offices may need to include explicit questions in R&D surveys to identify, and eliminate, such "pass-through" R&D funds from reported totals.

### *Schematic presentation of R&D and R&D funding flows*

4.83 Figure 4.1 illustrates the various possible flows of R&D and funds used for R&D from the perspective of a survey respondent that is an R&D performer. These flows can be generalised to measure the R&D performance of a statistical unit, sector or country. It should be explicitly noted that flows of funds used for R&D are not identical to flows of R&D. Transfer funds require no compensatory flow of R&D.

4.84 From the perspective of a statistical unit performing R&D, areas 1 and 2 of Figure 4.1 are surveyed. The key question being answered, after having first determined how much R&D has been performed by the unit, is “where do the funds come from?” The sources of R&D funds are divided into two main categories: internal sources (area 1 of the figure) and external sources (area 2 of the figure). External sources, or funds received from outside the statistical unit, should be classified by R&D funding sector. See Section 4.3 (Source of funds, by institutional sector).

4.85 From the perspective of a statistical unit funding R&D, areas 1 and 3 of Figure 4.1 are surveyed. The key question being answered is “where do the funds go?” The recipients of R&D funds are classified into two main categories: own unit (area 1 of the figure) and external recipients (area 3 of the figure). External recipients, or extramural R&D funding provided, should be classified by R&D-performing sector. See Sections 4.3 on “Measurement of funds for extramural R&D” and “Sales and purchases of R&D”.

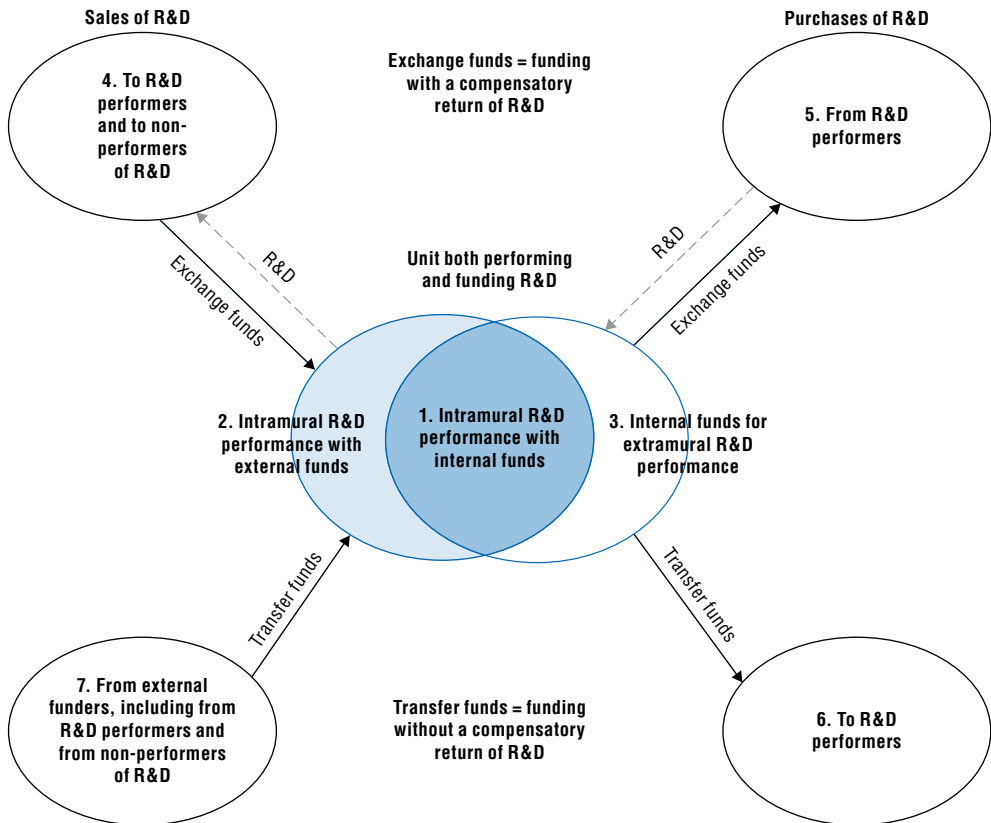
4.86 An interpretation of the graphed components follows:

R&D performed by the unit (total intramural R&D expenditures = performance):

- (1) = R&D performed by the unit and funded by the unit (with internal funds)
- (2) = R&D performed by the unit with funding from others (with external funds received)
- (4) = exchanges (e.g. perform R&D for sale)
- (7) = transfers (e.g. recipient of grants, grantee)

R&D funding by the unit:

- (1) = Funding by the unit for intramural R&D performance (i.e. performed by the unit)
- (3) = Funding by the unit for extramural R&D performance (i.e. performed by other units)
- (5) = exchanges (e.g. purchase of R&D)
- (6) = transfers (e.g. grants source, grantor)

Figure 4.1. **Funding flows from the perspective of an R&D performer**

4.87 In order to avoid double counting (either in terms of R&D performance or funding totals), it is important to determine that funding by the unit for R&D performance by others (extramural R&D performance) includes only the unit's internal funds. External funds that the unit receives and are subsequently passed through or subcontracted to others should not be included as R&D funding by the unit. This determination can be challenging.

4.88 For completeness, it is possible for an R&D performer to provide R&D to others without any compensatory flow of funds in return. For example, this occurs when an R&D performer provides free use of its R&D to the open-source community.

### **Internal and external sources of funds**

4.89 Funds to pay the costs of performing R&D may come from inside the unit (internal) or outside the unit (external).

### **Internal funds**

4.90 What is defined as internal sources of funds to support R&D depends on the sector of the reporting unit and, to some degree, on national considerations. Internal R&D funds represent the amount of money spent on R&D that originates within the control of and are used for R&D at the discretion of a reporting statistical unit. Internal R&D funds do not include R&D funds received from other statistical units explicitly for intramural R&D. The term “internal funds” is preferred over “own funds” since the latter may have a broader interpretation among some respondents. For example, research grantees may inaccurately (in terms of conventions used in this manual) consider public funds as their “own funds” once they have been awarded the research grant.

4.91 In the Business enterprise sector, internal funds include for instance, the reserve or retained earnings (i.e. profits that have not been redistributed as dividends), sales of the unit’s ordinary products (other than R&D), raising capital in the form of equity, debt or other hybrid instruments (e.g. funds raised on financial markets, loans from banks, venture capital, etc.). Deductions from income tax liability arising as a result of government incentives for R&D carried out in the past are also internal funds, as they need not be used to fund R&D in the current reference period (see Section 4.3 on “Tax incentives encouraging R&D”).

4.92 In the Higher education sector, internal funds include, for instance, receipts from student enrolment charges, income from endowments, and income from life-long learning and the provision of other services. The convention for international comparisons is that public general university funds (GUF), which is a type of government funding to higher education institutions, are not classified as internal funds (see Chapter 9).

4.93 As another example, a research institute may finance some of its work through receipts from royalties and profits from the sales of goods and services. Although these funds are received from other units and other sectors, they should not be considered as transactions for R&D but as “retained receipts” and therefore internal sources of funds of the performing unit itself, since the purchasers of the institutes’ goods and services did not intend to provide funds for R&D.

4.94 Note that “intramural” is not synonymous with “internal”. The dichotomy is made clear by noting that not all intramural performance is paid with internal funds (see Figure 4.1).

### **External funds**

4.95 External R&D funds refers to the amount of money spent on R&D that originates outside the control of a reporting unit.

4.96 Funds received from other statistical units for the funding of R&D performed during earlier periods, or for the funding of R&D not yet started, should not be included for the current reference period reports. They should be reported for the period during which the R&D they relate to is performed.

4.97 Funds from grants, gifts and philanthropy received explicitly for R&D are external funds. Even though the receiving statistical unit may have considerable leeway on how and when such funds are used in specific intramural R&D activities, the source of such funds is still external to the receiving unit. The amount should be reported for the period when expended on R&D (which may cover multiple reporting periods) and not when the grant/gift/philanthropy was received. R&D philanthropy from individual donors, particularly to address disease-specific research, is a rising phenomenon. As is detailed in Chapters 3 and 10, the Private non-profit sector, which includes individuals, should be reported as the external source of such funds. Gifts and philanthropy received with no requirement or expectation that any of the funds are necessarily to be used for R&D are classified as internal funds if used for R&D, at the discretion of the receiving statistical unit.

4.98 The convention for international comparisons is that GUF should be reported as external government funds (see Chapter 9).

4.99 The convention for international comparisons is that R&D funds received by a member of a business enterprise group from other members of the same business enterprise group should be reported as external funds (see Chapter 7, Section 7.7).

### ***Tax incentives for encouraging R&D***

4.100 Some governments, principally at the central/federal level but also sometimes at the regional/local level, provide dedicated forms of tax relief with the aim of encouraging the funding or performance of R&D, particularly in business enterprises. While such tax relief is a form of public financial support for R&D, the quantification of such support should not be included in the reported government source of funds for R&D performance totals. Guidance on the separate measurement of this type of support is provided in Chapter 13, while guidance on addressing the potential impact of R&D tax incentives on the reported labour costs of R&D personnel is provided in Section 4.2 of this chapter.

4.101 One major difficulty is that the forgone tax payments or potential direct transfers of funds to the enterprise or institution claiming support in a given period usually correspond to past R&D activity. At the time when deciding on R&D investments, the exact amount of any tax relief is generally not known precisely. Because of the practical difficulties in drawing an explicit link between tax support and R&D performance, it is recommended that the cost of R&D performance that is “funded” on the expectation of future revenue or forgone tax, or claims realised in the current period against past performance, should be reported as internal funds.

4.102 Separately from intramural R&D expenditure totals reported for the reference year, it may be useful to have information on both (i) the amount of future tax relief or future compensation that is expected from the R&D tax incentive system and (ii) the amount of tax refund or forgone tax received in

the survey reference period. Countries wishing to introduce questions on tax incentives in their R&D surveys should ensure that these questions do not distort the reported levels of intramural R&D and the breakdown of sources of funds that respondents are asked to report.

4.103 In countries where the provision of tax incentives is explicitly part of the government's budgetary policies to support R&D and this obeys predictable patterns of funding for R&D performance, surveys may include a separate item to identify the level of tax support received for reported R&D performance in the reference period. For the purposes of internal national reporting, some countries might classify these amounts as government funds. However, the convention for international comparisons is to exclude these amounts from government funding totals and to report them as internal funds. If such tax benefits are reported as government funds, the amounts should be identified separately to ensure the international consistency of reporting and to avoid double counting with tax expenditure figures reported under the guidance set out in Chapter 13.

### **Source of funds for R&D**

4.104 Table 4.3 identifies the funding source details that should be collected – if relevant and if practical to do so – on R&D surveys of institutions in each of the four main R&D-performing sectors: Business enterprise, Government, Higher education and Private non-profit. In broad terms, there are five main sources for R&D funding: Business enterprise, Government, Higher education, Private non-profit and the Rest of the world. Within each sector there are additional funding details that may be collected. The relative importance of various funding sources (and therefore the level of funding detail that is collected) will differ for each R&D-performing sector and may vary depending on country-specific circumstances.

4.105 Internal funds used for intramural R&D performance should be classified according to the sector of the statistical unit performing the R&D.

4.106 GUF funds in support of intramural R&D should be reported separately from other direct government funds for higher education R&D performance (see Chapter 9, Section 9.4).

4.107 For the Government sector, it may be useful to design separately tailored surveys for R&D performers in central/federal agencies and in provincial/state agencies.

4.108 Funding from the “Rest of the world” includes the category “international organisations”, which is defined to include supranational organisations. Different countries will identify different international organisations as relevant funding sources. For example, members of the European Union might include a funding category such as “European Union institutions and other bodies”.



**Table 4.3. Identifying which sources of funds should be collected on R&D performer surveys**

Sources of funding	Statistical unit performer being surveyed			
	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector
<b>Business enterprise sector</b>	X	X	X	X
Own enterprise (internal funds)	X	—	—	—
Other enterprises in the same group	X	—	—	—
Other unaffiliated enterprises	X	—	—	—
<b>Government sector</b>	X	X	X	X
Own agency/department/institution (internal funds)	—	X	—	—
Central or federal (excludes GUF)	X	X	X	X
Provincial or state (excludes GUF)	X	X	X	X
Public general university funds (GUF)	—	—	X	—
Other government sector bodies	X	X	X	X
<b>Higher education sector</b>	X	X	X	X
Own institution (internal funds)	—	—	X	—
Other higher education institutions	—	—	X	—
<b>Private non-profit sector</b>	X	X	X	X
Own institution (internal funds)	—	—	—	X
Other private non-profit institutions	—	—	—	X
<b>Rest of the world</b>	X	X	X	X
Business enterprise	X	X	X	—
Enterprises in the same group	X	—	—	—
Other unaffiliated enterprises	X	—	—	—
Government sector	X	X	X	X
Higher education sector	X	X	X	X
Foreign branch campuses	—	—	X	—
Other higher education institutions	—	—	X	—
Private non-profit sector	X	X	X	X
International organisations	X	X	X	X
<b>Total expenditures by performer</b>	X	X	X	X

Note: X = R&D funding from this source is to be collected and reported; — = not a relevant source of funding to collect from performers in this sector.

### ***Transfer and exchange categories of funds for R&D***

4.109 There can be a flow of R&D funds between statistical units either with (exchange) or without (transfer) an actual or expected compensatory return flow of R&D from the performer. To better satisfy policy-user requests and SNA statistical needs, it is recommended that countries report total intramural R&D performance that is funded from external sources in these two categories. Separate categories could be collected for each source of external funds if considerations of the response burden and the data quality permit doing so.

4.110 On R&D performer surveys, there will be less misunderstanding or misinterpretation when using examples of transfers and exchanges (e.g. grants and contracts, respectively) than when using the terms “transfer” and “exchange”.

### ***Transfer funds for R&D***

4.111 R&D transfer funds are funding flows from one statistical unit to another statistical unit to perform R&D that does not require any good or service in return and where the funder is not entitled to any significant rights on the outcome of the R&D it has funded. The unit that provides transfer funds for R&D may impose some conditions on the performer, such as periodic reporting, compliance with the activity or project description set out in the terms of the agreement, or even public dissemination of research outcomes. Examples of transfer funds include grants, debt forgiveness, philanthropy, crowdfunding (unless this entails discounted prices for a new product), personal transfers such as gifts and GUF (by convention for international comparisons). To be included as R&D transfer funds, the funds should be intended by the originating source to be used for R&D. Normally, the R&D performer will retain most rights to the outcomes of the R&D, which explains the transfer nature of this R&D funding transaction.

4.112 There are examples of where institutions will transfer laboratory equipment or materials used for R&D to institutions within and across sectors, located within and outside of the compiling country. A common example might involve a government or private non-profit institution providing such R&D equipment in the context of international aid efforts. Such “in-kind” transfers do not entail monetary flows and therefore should not be included in intramural R&D expenditure totals or in totals on extramural R&D. However, for national reporting and analytical purposes, countries might find it worthwhile to separately identify and compile performer-reported totals on the “market value” of such in-kind donations; as noted, however, for international comparability they should not be included in reported R&D totals.

### ***Exchange funds for R&D***

4.113 R&D exchange funds are funding flows from one statistical unit to another statistical unit in return for the performance of R&D and the delivery of relevant R&D outcomes. The unit funding the work incurs a delivery risk associated

with the uncertainty of the project. Examples of exchange funds activities include R&D purchases (sales from the perspective of the performer), R&D outsourcing and contributions in the context of collaborative R&D agreements.

4.114 The procurement of R&D is one of the most common forms of the provision of R&D exchange funds. It includes funds paid to research services firms or other units performing R&D under contract. From the perspective of the unit receiving the funds, they are part of the unit's intramural performance funded from external sources. It is possible that through a contract or procurement in some cases the unit funding the R&D may forgo some of its rights to the outcomes of the research. For example, a government agency may give the performer exclusive rights on the resulting intellectual property on the condition that the government retains the right to use the R&D outcomes for its own internal purposes. This case should also be considered as an instance of R&D exchange funds, even if there may be an implicit transfer element.

4.115 A government agency funding an R&D project through a procurement contract may wish to give away all rights on the outcome of the R&D that has been contracted to a performer. Since such a decision is the funder's prerogative, the transaction that funds the R&D activity should still be considered as R&D exchange funds. There is a separate transfer of R&D knowledge to society that is outside the scope of classifying intramural R&D.

4.116 Tracking exchange fund flows may help meet the needs of policy analysts and economic researchers interested in R&D outsourcing activities. Outsourcing refers to the total or partial movement of core or support business functions currently performed in-house to either non-affiliated external suppliers or affiliated enterprises located either domestically or abroad. International outsourcing is sometimes also termed "off-shoring".

4.117 In principle, the internal funds to support a unit's active participation in collaborative R&D projects should be recorded as part of a unit's intramural performance. Each participant reports R&D funding equal to the unit's contribution to the common project. If one unit has a dominant role in the project, the total R&D can be reported as intramural for this unit, while the other participants report their funding (such as milestone payments and payments made under cost-sharing arrangements) as support for extramural R&D paid to the dominant unit. However, if the consortium or partnership in charge of the collaborative project is a distinctive, separate legal entity, this will be a separate statistical unit and contributions made by all the partners should be considered as funding of extramural R&D.

### **Measurement of funds for extramural R&D**

#### **Importance of measuring extramural R&D**

4.118 To more fully understand the flows between R&D performers and R&D funders, it is suggested that countries collect from all units with intramural R&D data on the amount of funds for extramural R&D. To the extent practical,

countries should also collect the breakdown between funds for exchange and funds for transfer and identify the recipient sectors of the funds. These data collections could be accomplished by including one or several funding type questions on surveys of R&D performers. Those questions would address the information coverage represented by area 3 of Figure 4.1.

4.119 Summing individual statistical unit's intramural R&D plus funding for extramural R&D (areas 1 plus 2 plus 3 in Figure 4.1) allows a more complete picture of the unit's total R&D activities. However, because of double counting, it is not meaningful to sum total intramural R&D funds plus total extramural R&D funds for a sector or country. Extramural R&D for one statistical unit is, in principle, intramural R&D for another statistical unit.

### ***Measurement issues related to extramural R&D***

4.120 As is the case for recipients of exchange and transfer funds, there will be less misunderstanding or misinterpretation by funders responding to survey questions when using more familiar terminology for these funding concepts.

- From the perspective of a unit that is purchasing R&D, exchange funds are generally considered to be its "extramural R&D expenditures".
- From the perspective of a unit that is granting R&D, transfer funds are generally considered to be its "funding for extramural R&D performance".

4.121 For the Business enterprise sector, most funds for extramural R&D are expected to be exchange funds, that is, for the purchase and sale of R&D. For the Government sector, the relative importance of one category over the other will likely be a function of the mission of the government unit/agency and the type of policy instruments at its disposal.

4.122 The borderline between funds for intramural and extramural R&D is not always clear; hence, extramural R&D funding may be incorrectly included in intramural R&D reports. Surveys should specifically and clearly instruct respondents to exclude funding for extramural R&D performance from their reported intramural expenditures so as to avoid double counting.

4.123 The R&D funder is likely to know whether the funds it is providing are for an exchange or for a transfer (no R&D is expected in return). The R&D funder also is likely to know to which unit or sector (extramural performer) the funds are being directly provided. They are unlikely to know details about the types of costs that the recipient spends those funds on (e.g. labour, materials) or the amount of those funds that may be subcontracted or sub-awarded to other units or sectors.

4.124 It should not be necessary to specify from which source purchased R&D (exchange R&D) is funded, since normally this is funded from internal sources. However, the extensive – and increasing – use of sub-contracting, especially in the Business enterprise sector, is creating a number of challenges. If a business unit's external funds received from another business unit were

originally public funds, the subcontractor may not know that the payment they receive originated in public funding sources. They may therefore report the funds coming from the contractor. Similarly, the contractor may not easily be able to specify whether internal or external funds were used to pay the subcontractor.

4.125 R&D funding from external sources that is used to fund the purchase of R&D from another statistical unit should be excluded from intramural R&D.

4.126 The purchase of R&D should not be confused with the acquisition of licences or intellectual property resulting from previous R&D work. The latter is not funding of R&D.

4.127 Identifying flows of R&D and R&D funds among units in the same enterprise group is a particular challenge. Concerns for accuracy are compounded since the pricing of the R&D may not reflect “market pricing”, that is, the actual intramural costs. No specific guidance can be offered on how to correct for such misreporting except to emphasise that respondents should be encouraged to report actual costs.

### ***Measurement of funding extramural R&D by non-R&D performers***

4.128 An under-coverage problem arises when questions about funding flows to other units are included in surveys sent only to known or assumed R&D performers. The survey frames for R&D performers often cover only the units active in R&D. However, there are some units in each sector that fund extramural R&D without carrying out R&D themselves. Without undertaking a specific survey, these units are unlikely to be questioned, and the information on extramural funding collected from the R&D performer survey will be incomplete.

4.129 Before drawing conclusions as to the importance of a sector as a funder of R&D and possibly sending surveys to such units, preliminary investigatory steps are recommended. It is advisable that national statistical offices first estimate, perhaps through targeted sampling, the number of statistical units in the sector that fund extramural R&D without being active themselves in performing R&D. They also should estimate the relative size of such funding. If the number of units and the total funds are relatively low, the results obtained from adding funding questions to existing performer surveys (without changing the survey frame or sample) should be acceptable since the amount of “missed” funding from non-R&D performers likely would be small. Otherwise, for a comprehensive estimate of funding for extramural R&D, non-R&D performers need to be sampled.

### ***Sales and purchases of R&D***

4.130 The focus of this chapter is to provide guidance for the collection of statistics on R&D performance and on the sources of funds used to pay for the R&D performed. But as indicated earlier in this chapter (Measurement of funds

for extramural R&D), it also may be useful to collect supplementary information specifically on R&D sales and purchases, particularly from statistical units within the Business enterprise sector.

4.131 This manual can make no specific recommendations on how best to define “R&D sales” and “R&D purchases” except to note that the former is revenue from the delivery of R&D to others and the latter is payment for the delivery of R&D from others. In collecting such statistics, it should be made very clear that the totals reported for the purchase and sales of R&D may differ from their related intramural R&D expenditures. For example, the intramural R&D expenditure for R&D sold includes labour and “other current costs”. But when the performer sells the R&D, the sales price likely includes the accounting cost of depreciation of fixed capital and some element of profit. The cost to the purchaser includes the whole price paid for the R&D, including the elements covering depreciation costs, performer profit, delivery charges, etc.

4.132 Further, the reference period for when the R&D is performed may differ from the period when the R&D is actually purchased and sold. Even the apparent source of funds for the R&D may differ between the two concepts. For example, a unit may perform R&D with internal funds, but subsequently – without the original intention to do so – sell the R&D to a second unit. In terms of reported intramural R&D performance, the source of funds is the first unit. In terms of this specific extramural R&D exchange, the second unit is the source of funds.

### *Distribution by providers and recipients of extramural funds*

4.133 For the distribution of funding for exchange R&D (and/or separately for the purchase and sale of R&D), the following sector classification is recommended. This classification can also be used to account separately for R&D transfer funds.

Domestic:

- Business enterprise sector:
  - ❖ Enterprises in the same group
  - ❖ Other unaffiliated enterprises
- Government sector
- Higher education sector
- Private non-profit sector

Rest of the world:

- Business enterprise sector:
  - ❖ Enterprises in the same group
  - ❖ Other unaffiliated enterprises
- Government sector
- Higher education sector

- ❖ Foreign branch campuses
- ❖ Other higher education institutions
- Private non-profit sector
- International organisations.

4.134 The relative importance of various sectors as recipients of funds for extramural R&D may vary depending on country circumstances. Furthermore, only business enterprises can report R&D funds to (or make R&D purchases from) enterprises in the same group; only higher education institutions can report R&D funds to affiliated foreign campuses. See Chapter 9, Section 9.4 for a definition of these institutions.

### ***Problems in identifying for which sector funds are to be reported***

4.135 The concepts of “intramural” and “extramural” and “internal” and “external” may also be used at different aggregation levels other than those recommended by this manual for statistical units. For example, the content of what is “extramural performance” will differ from the perspective of enterprises, enterprise groups, institutional sectors or countries. In this chapter, the attributes of the institutional unit (and the sector of which it is a part) determine whether funds are to be treated as internal versus external sources and whether funding is for intramural versus extramural performance. As noted in Section 3.2, there are various possible types of statistical units, including enterprise groups, enterprises and establishments; the unit of interest for R&D statistics is the enterprise. In this manual (see Section 6.2) the term “institutional unit” is preferred over “enterprise”, with the latter being the term reserved for the Business enterprise sector.

4.136 It is sometimes unclear how to classify funds that flow from one unit to another, regardless of whether such units are in the same or different sectors. The recommended treatment and reporting of R&D funds is presented in the following sector-specific exemplars.

4.137 For the Business enterprise sector, the institutional unit of interest for such funds/funding classifications is the enterprise. Therefore, R&D funds received by one member of a business enterprise group from other members of the same business enterprise groups should be reported as external funds for their intramural R&D. For the member of a business enterprise group that provides (is the source of) those R&D funds, they are to be reported as funds for extramural performance.

4.138 For the Government sector, the institutional unit of interest for such funds/funding classifications is the units that comprise the individual government subsectors (i.e. central/federal, regional/state, municipal/local). Therefore, R&D funds received, for example, by a ministry Y of the central government from another central government ministry X should be reported as ministry Y’s internal funds for intramural R&D. For ministry X that provides

(is the source of) those R&D funds, they are not to be reported as either part of their internal funds or as funds for extramural performance. The rationale is that such transactions are among different parts of the same institutional unit of the central government, even if the statistical units are smaller entities such as ministries.

4.139 Transactions across different extra-budgetary units and other government-controlled non-profit institutions (NPIs) in the Government sector and between central or state governments should be reported as extramural funding, because these are separate institutions with their own accounts.

4.140 For example, R&D funds received by agency Z of a state government from a central government ministry X should be reported as external funds for agency Z's intramural R&D. For central government ministry X that provides (is the source of) those R&D funds, they are to be reported as funds for extramural performance.

4.141 For the Higher education sector, the institutional unit of interest for such funds/funding classifications is the type of institution (e.g. universities, research institutes, university hospitals, etc.). Therefore, R&D funds received, for example, by an economics department of university A from the engineering department of university A should be reported as the intramural R&D of the economics department of university A and should not be reported as funds for extramural R&D from the engineering department of university A. The source of the funds, for university A, is the originating source from which the engineering department received the funds.

### **Problems in tracking flows of R&D funds**

4.142 There are a number of potential difficulties in accurately collecting R&D funding flows, whether as a component of a unit's intramural R&D or as part of their funding totals for extramural R&D performance.

4.143 Problems may arise when funds pass through (flow within and across) several units before reaching the performer. This may occur when R&D is sub-contracted, as may happen particularly in the Business enterprise sector. This also may occur when an R&D grant has sub-awards and R&D funds are passed through to other recipients, as may happen particularly in the Higher education sector. The performer should report costs only for R&D projects actually conducted rather than as inputs into some other unit's R&D, and indicate, to the extent possible, the original source of the funds for R&D.

- For example, a large pharmaceuticals company (pharma) may engage the services of a biomedical contract research organisation (CRO) to undertake a phase 3 clinical trial for a new drug it has developed. The CRO provides funds to multiple hospitals for patient recruitment and testing in order to confirm the drug's effectiveness and monitor side effects. Although the hospital may provide technical reports on their clinical findings to the CRO, it is the CRO that measures the effectiveness of the drug and reports the results to the



pharma company. In this example, the funds provided by pharma are funds for extramural R&D paid to the CRO. All of the phase 3 costs are CRO's intramural R&D paid with external (pharma) funds. The amount paid to the hospitals should be reported by the CRO as other current costs (not purchased R&D). The hospitals should not report any of the payments for their part in the clinical trial as either intramural or extramural R&D.

- Similar tracking/reporting issues occur with European Union (EU) funding, as the funds first go to the main contractor and are then distributed among the other participants (sub-contractors). In some countries, intermediary non-performing institutions play an important role in the funding of R&D by distributing among performers grants that are received from several different sources but not “earmarked” for specific purposes. In such cases, while it is acceptable to regard these institutions as the source, it is nonetheless preferable to attempt to trace the funds to their original EU sources.

4.144 When the acquisition of R&D is closely related to intramural R&D performance, the borderline between funding for intramural and extramural performance is not always clear:

- Under-reporting may occur if an R&D performer outsources part of an R&D project. If the outsourcing activity is an R&D project in its own right, the funder may accurately report this as extramural R&D. However, if the unit in charge of undertaking the outsourced project does not identify the project as R&D, but as a service input into the funder's project, it will not report this as its own externally funded intramural R&D.
- Conversely, over-reporting may occur if both the funder and performer report the funds and R&D costs as their own intramural R&D. If the R&D outsourcing activity is a project in its own right, the intramural R&D should be attributed to the unit to which the work has been outsourced. If on the contrary, the outsourcing does not meet the intramural R&D performance criteria, it is the unit funding the work that should report the expenditures as other current intramural R&D expenditures, as a purchase of related services for its own R&D activity or project.

#### 4.4. Reconciling differences in performer-based and funder-based approaches

4.145 The estimated total of R&D expenditure within a country based on performer reports will likely differ from the total based on reports from those funding R&D owing to sampling difficulties and tracking/reporting differences.

4.146 Where estimates of GERD are obtained from sample surveys instead of surveys of the entire population, there is sampling error. Therefore performer-based and funder-based totals will likely differ.

4.147 Where estimates of GERD are obtained from administrative records, there may be coverage differences between units included in performer-based reports and those included in funder-based reports. See Chapter 6, Section 6.3.

4.148 Financing may be provided by an intermediary, making it difficult for the performer to know the original source of funds. A related problem is measuring funding that goes outside of the funding sector but comes back to the sector as externally funded R&D.

4.149 There may be instances where individuals directly receive funds from a third party (in the form of salaries or grants) to perform R&D at host units, but the host units are unable to track (do not have access to information on) these flows of R&D funds. This may apply for example in the case of government funding being provided to students or scholars to engage in R&D performance at other institutions without those institutions having direct control over the funding so that the individuals might be allowed to move freely from one institution to another. Although countries should neither impute nor ask the statistical unit to impute for the cost of these individuals' R&D performance at the level of the statistical unit, it may be possible to use aggregate funder data to address such triangular arrangement reporting gaps. For countries that collect and report statistics **from funding institutions** on the R&D performance of individuals at a sector level, such data might allow for a more complete accounting of overall R&D performance. If captured at all, these totals should be reported in "other current costs" but not as "other current costs-external R&D personnel". Caution is advised to avoid double counting with the amounts reported by the host unit for its intramural R&D performance.

4.150 The costs included in performer-based R&D and funder-based R&D may differ particularly in measuring exchange funds. In performer-based reporting, intramural R&D expenditures include labour and "other current costs". But when the performer sells the R&D, the sales price likely includes the accounting cost of depreciation of fixed capital and some element of profit. In funder-based reporting, the funder likely reports the whole price paid for the R&D, including the elements covering depreciation costs and performer profit.

4.151 The accounting records of funders and performers may incorporate varying interpretations of whether the work being performed meets the definition of R&D. For example, in the defence industry, funding of R&D within broad production and delivery contracts (such as those covering R&D and trial production of aircraft) sometimes results in larger estimates of government-funded R&D to business than what business defence contractors performing R&D track in their financial accounts as R&D.

4.152 Contracts for research often extend over more than one year, with the result that there may be timing differences between funder and performer reports.

4.153 There also may be differences between performer-reported data and government budget (GBARD) data, which are essentially government funder data (although they record appropriations rather than expenditures). In this case, the

lack of comparability may be due to the performance of a different amount of R&D than was expected at the appropriations stage. Differences may also result from imprecision in the budget appropriations that do not allow for the separate identification of appropriations that are specifically targeted to R&D. (For more information on GBARD methodology, see Chapter 12.)

4.154 It is also possible that respondents to funder and performer surveys may select different sectors when reporting the sector to which they provide extramural R&D funding and the sectors from which they receive external funds for intramural R&D. For example, if a statistical unit receives funds from a non-profit institution controlled by the government, it is possible that it might (incorrectly from the perspective of this manual) report the source of such funds as the Private non-profit sector. An R&D funder survey would classify the source as the Government sector (see Chapter 3).

4.155 To the extent possible, it is recommended that differences in R&D expenditure totals between those estimated from R&D funders and those estimated from R&D performers should be reported, and that causal factors for the differences, if known, should be identified. It should be recognised that such differences are not necessarily a result of inadequate or inaccurate measurement and that providing these data will aid analytical and statistical accuracy.

## 4.5. Compiling national R&D totals

### **Gross domestic expenditure on R&D (GERD)**

4.156 High-level aggregations of R&D performance, by performing sector and by funding source, are recommended for compiling internationally comparable GERD totals. GERD is constructed by summing the intramural R&D expenditure totals for the four main sectors covered in this manual: Business enterprise, Government, Higher education and Private non-profit. For reporting GERD, all levels of government performance are often combined. For each performing sector, the main sources of funding should be compiled: Business enterprise, Government, Higher education, Private non-profit and Rest of the world.

4.157 This manual provides guidance on defining, measuring and reporting R&D, including in this chapter the conventions and recommendations for compiling R&D expenditure data. The recommended summation of performer-reported intramural R&D expenditures represents a country's total R&D effort. There are, however, other compilations of R&D that may be confused with the GERD totals recommended here. Most notably, totals for R&D are now notionally available from SNA accounts. As detailed in Chapter 1 and online in annex guidance to this manual available at <http://oe.cd/frascati>, SNA R&D totals may differ substantially from GERD totals, one reason being the different treatments of software R&D in the totals. Therefore for analytical purposes, it may be useful to identify the amount of software R&D that is part of total GERD, or minimally the share of Business enterprise R&D that is software R&D. See Box 4.1.

#### Box 4.1. **Software R&D**

As noted in Chapter 1, a major change in the 2008 revision of the System of National Accounts (SNA) was to explicitly treat R&D as capital formation, that is, “investment”. For some countries, R&D totals derived from SNA accumulations may differ substantially from GERD. One possible major source of differences between these R&D totals stems from their treatment of software R&D (i.e. R&D devoted to software applications, including for both software products and software embedded in other products or projects, that are for both sale and own use). The 1993 SNA revision had previously treated software as capital formation; consequently, in implementing the 2008 SNA revision, estimates of R&D investment have so far excluded software R&D to avoid double counting. That is, software R&D was already part of software investment in SNA terms.

For countries in which software R&D accounts for a relatively large share of total R&D, the difference between R&D totals compiled using SNA conventions and those recommended in this manual may be substantial. Therefore it is recommended that R&D surveys (or at least surveys of the Business enterprise sector) include questions on the amount of software R&D undertaken. Such totals may be extremely useful for understanding any apparent differences between R&D collected according to the recommendations in this manual and SNA R&D totals.

4.158 GERD is commonly presented as a matrix of R&D performers by main sector arrayed against their sources of R&D funding by sector. See Table 4.4.

4.159 For the purpose of this manual, international organisations, including supranational organisations such as European Union bodies (as defined in Chapter 3, Section 3.5), should be treated as units that are part of the “Rest of the world”, regardless of the physical location of their offices or operations.

4.160 In the case of countries that collect and report statistics on the R&D performance of international organisations located in their domestic territory, for international comparisons this should not be included in GERD, but should be reported separately from GERD.

4.161 It would be useful to compile separate totals for defence and civil GERD in order to map how trends in these areas affect the level and structure of total GERD. This is particularly true for countries with significant defence R&D programmes. Similar breakdowns also are encouraged for other countries as a way to increase the international comparability of data on civil R&D.

4.162 As an indicator of the R&D intensity of a country’s economy, both over time and in comparison with other countries, GERD is often presented as a ratio of GERD divided by gross domestic product (GDP). Hence, GERD-to-GDP ratios are useful means for normalising large differences in countries’ aggregate R&D totals that might partially reflect simply large differences in the size of countries’ overall economies.

Table 4.4. **Gross domestic expenditure on research and development (GERD)**

Performing sector	Sector of performance				
	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	TOTAL
Business enterprise sector					1. Total domestic performance financed by the business enterprise sector
Government sector					2. Total domestic performance financed by the government sector
General university funds (GUF)					
Other than GUF					
Higher education sector					3. Total domestic performance financed by the higher education sector
Private non-profit sector					4. Total domestic performance financed by the private non-profit sector
Rest of the world					5. Total domestic performance financed by the rest of the world
Business enterprise sector					
Enterprises in the same group					
Other unaffiliated enterprises					
Government sector					
Higher education sector					
Private non-profit sector					
International organisations					
	Total domestic performance by the business enterprise sector (BERD)	Total domestic performance by the government sector (GOVERD)	Total domestic performance by the higher education sector (HERD)	Total domestic performance by the private non-profit sector (PNPRD)	GERD (sum of 1-5)

### **Regional distribution of R&D**

4.163 Countries may find it useful to compile the separate totals for the distribution of GERD by region. The choice of regional distribution is determined according to national and international needs. Guidance for distributing R&D by region is found in online annex guidance to this manual available at <http://oe.cd/frascati>.

4.164 Priority generally should be given to the organisational structure of an activity than to the literal location of where the activity takes place in classifying “intramural” R&D that takes place outside of the physical location of the statistical unit. It is difficult to provide precise guidelines for such distribution decisions. At a minimum, intramural R&D that is performed outside the physical location of the statistical unit but is included in the location (e.g. regional) totals of the unit should include only R&D that is performed by the unit to fulfil its own objectives and if the unit has invested its own financial resources and R&D personnel in the activity.

→ For example, a university researcher who is part of unit “A” located in region X within a country may occasionally perform short-term field work (as part of a unit “A” R&D project) physically in region Y within the same country. Unless there are countervailing reasons (for example, financing arrangements with a unit “B” located in the southern region), all of the intramural expenditure for that R&D may be reported as R&D for region X.

### **Gross national expenditure on R&D (GNERD)**

4.165 Other tabulations of R&D performance and funding totals can provide supplementary information on R&D relationships and interactions between statistical units across different sectors and national boundaries. Gross national expenditure on R&D (GNERD) comprises total expenditure on R&D financed by a country’s institutions regardless of where the R&D is performed. As such, it includes R&D performed in the “Rest of the world” that is financed by national institutions or residents; it excludes R&D performed within a country that is funded from institutions outside of the national territory (that is, from institutions that are part of the “Rest of the world”). GNERD is constructed by adding the domestically financed intramural expenditures of each performing sector plus the R&D performed in the “Rest of the world” that is financed by domestic funding sectors (see Table 4.5). The inclusion of those latter totals presumes that national statistical offices have compiled data on their domestic institutions’ financing of extramural R&D that is undertaken outside of the national territory (that is, performed in the “Rest of the world”).

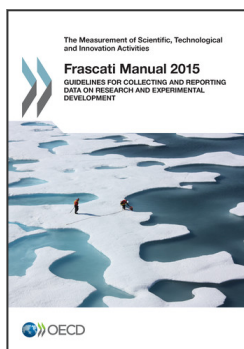
Table 4.5. Gross national expenditure on research and development (GNERD)

Funding sector	Sector of performance							TOTAL	
	Domestic economy			Rest of the world					
	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	Business enterprise sector	Other unaffiliated enterprises	Other sectors		International organisations
Business enterprise sector									Total national financing by the business enterprise sector
Government sector									Total national financing by the government sector
GUF Other than GUF									
Higher education sector									Total national financing by the higher education sector
Private non-profit sector									Total national financing by the private non-profit sector
	Total national financing of domestic performance by the business enterprise sector	Total national financing of domestic performance by the government sector	Total national financing of domestic performance by the higher education sector	Total national financing of domestic performance by the private non-profit sector	Total national financing of performance in the rest of the world by the business enterprises within the same group	Total national financing of performance in the rest of the world by unaffiliated business enterprises	Total national financing of performance in the rest of the world by institutions in other sectors	Total national financing of performance in the rest of the world by international organisations	GNERD

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