

## Chapter 11

# Measurement of R&D globalisation

*This chapter goes beyond previous discussions of ‘Abroad’, now referred to as the Rest of the world, which treated the sector primarily as a source of funds for domestic research and experimental development (R&D) performance (as in GERD), or as a destination for national sources of funds (as in GNERD). The chapter provides a definition of the Rest of the world consistent with the approach of the System of National Accounts (SNA). Globalisation in this chapter refers to the international integration of financing, factor supply, R&D, production and the trade in goods and services. In the Business enterprise sector, globalisation is associated with international trade and foreign direct investment (FDI), whereas public or private non-profit institutions (including government and higher education units) also engage in international activities such as R&D funding and collaboration. R&D globalisation is a subset of global activities involving the funding, performance, transfer and use of R&D. The chapter deals with indicators of R&D globalisation for both business and non-business sectors.*

## 11.1. Introduction

11.1 This manual explicitly recognises the concept of R&D globalisation. Prior editions of this manual have acknowledged the global aspects of R&D primarily as a source of funds for domestic R&D performance (as in the compilation of GERD) or as a destination for national sources of funds (as in the compilation of GNERD). Such sources previously were characterised as funds from/to “Abroad”. Consistent with the SNA, the preferred terminology of the current manual is the “Rest of the world”. The Rest of the world is defined on the basis of the non-residence status of the relevant units. The Rest of the world consists of all non-resident institutional units that enter into transactions with resident units, or have other economic links with resident units. The identification and measurement of non-domestic sources of and destinations for R&D funds continues to be an important dimension of R&D and is covered comprehensively in Chapters 3 and 4, and in the individual sector chapters. However, this current manual moves beyond flows of R&D funds and covers a more extensive list of measurement issues related to global R&D.

11.2 In broad terms, globalisation refers to the international integration of financing, factor supply, R&D, production, and the trade of goods and services. Globalisation in the Business enterprise sector is associated with international trade and foreign direct investment (FDI), whereas public or private non-profit institutions (including government and higher education units) also engage in international activities such as R&D funding and collaboration. In this manual the terms globalisation and internationalisation are used interchangeably. It may be noted that financial flows of FDI and operations that arise from FDI are separate indicators of globalisation (IMF, 2009, Chapter 6). Financial flows indicators of FDI are currently outside the scope of this manual. For details see the *Handbook on Economic Globalisation Indicators* (OECD, 2005, Chapter 2) and the *OECD Benchmark Definition of FDI* (OECD, 2009a).

11.3 R&D globalisation is a subset of global activities involving the funding, performance, transfer and use of R&D. This chapter first focuses on three measures of business R&D globalisation, followed by a summary of measurement issues related to non-business sectors.

## 11.2. Measuring business R&D globalisation

### **Statistical framework for measuring business R&D globalisation**

11.4 Three types of statistical measures of business R&D globalisation are covered here:

- cross border R&D funding flows (see Section 11.3)
- current costs and personnel for R&D performed by members of multinational enterprises (MNEs) within the compiling countries and abroad (see Section 11.4)
- international trade in R&D services (see Section 11.5).

11.5 The first of these measures is an extension of traditional R&D statistics recommended to be collected from resident business enterprises to/from the Rest of the world (see Chapter 7, Section 7.6). Both MNEs and non-MNEs may have such activities, although this chapter focuses on MNE reporting. The second of these three measures concerns only the activities of MNEs. The third measure is constructed in the context of service trade statistics, based on the receipts from and payments to non-resident units in exchange for R&D.

11.6 Most measurement recommended in this manual is limited to characterising R&D performed within the reference year. In particular, cross-border R&D funding flows are associated with the intramural R&D of a specific reference period, as are measures of R&D performance and funding by MNE status. On the other hand, international trade in R&D services may capture transactions involving the rights to outcomes of R&D that may have been performed in prior years. As such, trade in R&D services is a function of cumulative R&D expenditures (in the compiling country for exports and in trading partner countries for imports), and not only of current year R&D funding or production. The latter are measured at market prices, consistent with balance of payments (BOP) concepts and collected in existing services trade surveys, as discussed later in this chapter. Therefore, each measure serves different purposes and represents partial but complementary aspects of complex, underlying arrangements for the performance of R&D across different global locations. For example, trade in R&D services is used for adjusting domestic stocks of R&D for capitalisation purposes as discussed later in this chapter, consistent with guidance in the *OECD Handbook on Deriving Capital Measures of Intellectual Property Products* (OECD, 2009b). Another major difference between measures of cross-border R&D funding flows and trade in R&D services is that cross-border R&D funding includes transfers (such as grants, see below) and all sectors; the statistics for trade in R&D services typically do not include R&D grants, and coverage outside the business sector, for practical reasons, may be limited.

11.7 Statistical measures of R&D globalisation related to the R&D performed or funded by MNEs are anchored not only in national statistics on R&D, but also in wider international economic statistics on global production, direct investment, employment, financing and trade. The multiplicity of reference sources presents particular challenges to statistical offices, survey respondents,

and users of R&D and related globalisation statistics. Yet given the complexity of R&D globalisation issues, no single reference is likely to cover all relevant measurement concepts. Therefore the guidance in this chapter attempts to use terminology consistent both with the terms defined elsewhere in this manual and with the globalisation statistical manuals specifically referenced in this chapter (which in the future may be described in detail online in annex guidance to this manual available at <http://oe.cd/frascati>).

11.8 More generally, globalisation has two major implications for the activity and measurement of R&D. First, R&D is part of complex global value chains that involve dispersed suppliers and fragmented production processes of goods and services. Secondly, R&D itself increasingly involves organisations and personnel that are dispersed across different countries, reflecting broadening globalisation trends. Given this complexity, no single survey instrument is likely to cover all R&D globalisation data needs. This situation presents opportunities for collaboration on data development and/or collection among R&D surveys and other surveys, in particular, BERD, FDI/MNE, and the services trade surveys discussed herein. Thus, this chapter summarises R&D material in various globalisation manuals and relates this information to Frascati concepts.

11.9 Although the focus of this chapter is on the cross-border ownership linkages and financial aspects of global R&D activities (e.g. expenditure, costs, funding flows), the globalisation of R&D is also reflected in the mobility of R&D personnel. Therefore identifying and tracking the flow of R&D personnel within and across MNEs is encouraged. However, the ability of R&D surveys to gather information on the human resource aspects of R&D globalisation is somewhat limited compared with surveys of individual researchers or highly educated individuals.

### **Relevant multinational enterprise (MNE) definitions**

11.10 The accurate collection and compilation of business R&D globalisation statistics depend on a consistent understanding and application of the necessary business globalisation terminology. Relying on extensive material available from existing globalisation and related manuals, the key terms are defined below. See Box 11.1 for a summary of the various reference manuals that provide the statistical framework and underlying terminology adopted in this chapter.

11.11 **Foreign direct investment (FDI)** reflects the objective of obtaining a lasting interest by an enterprise resident in one economy (an **MNE parent** or “direct investor”) in an enterprise resident in another economy (a **foreign affiliate** or “direct investment enterprise”). For official statistical purposes, a **lasting interest** is deemed to exist by direct or indirect ownership of 10% or more of the ordinary shares or voting power of an incorporated enterprise, or the equivalent of an unincorporated enterprise. The 10% voting power criterion also establishes the existence of a **direct investment relationship** between an affiliate and its MNE parent.

11.12 For the purposes of this manual, the statistical focus is on R&D and related activities involving **majority-owned or controlled affiliates**. Majority ownership or control refers to ownership of more than 50% of the ordinary

shares or voting power of an incorporated enterprise or the equivalent of an unincorporated enterprise. Examples of majority-owned or controlled affiliates include subsidiaries (incorporated enterprises) and branches (unincorporated enterprises).

11.13 From the perspective of the compiling country, where the MNE parent is resident, this **MNE parent company** is measured as the fully consolidated enterprise group within that compiling country and includes all units resident in the compiling country that are majority-owned by the company (for a summary of consolidation issues involving MNE members, see OECD, 2005). This excludes its majority-owned affiliates located abroad.

11.14 From the perspective of the compiling country, an **MNE refers to a parent company** resident in the country **and its** majority-owned affiliates located abroad, labelled **controlled affiliates abroad (CAA)**. Thus, CAAs are the majority-owned affiliates located abroad of a parent company resident in the compiling country. MNEs are also referred to as global enterprise groups (EC, 2010).

#### Box 11.1. International statistical manuals related to business R&D globalisation

**System of National Accounts 2008** (EC et al., 2009). The SNA provides guidance on measures of economic activity within an economic territory in an integrated system of accounts. It also covers economic flows between a compiling country and the rest of the world. The definition of R&D in the 2008 SNA (SNA 10.103) is essentially consistent with the 2002 *Frascati Manual*. However, the SNA also contemplates the measurement of economic transactions on R&D-based assets (also called R&D), which may have been developed in previous years.

**Handbook on Economic Globalisation Indicators** (OECD, 2005). This manual describes a framework for statistics and derived indicators on globalisation including FDI financial flows and stocks (positions) and the activity or operations of MNEs.

**Benchmark Definition of FDI** (OECD, 2009a). This manual describes in detail definitions of FDI and related flows consistent with the 6th edition of the *Balance of Payments Manual*. It also covers statistics on the activity of MNEs (AMNE).

**Balance of Payments and International Investment Position Manual**, 6<sup>th</sup> edition (IMF, 2009). This manual covers accounting and statistical standards to compile the balance of payments (BOP) between residents and non-residents during a specific time period, along with the external balance sheet, accumulated assets and liabilities (or positions) as a result of transactions with the external sector. It is the source for definitions on international transactions, economic territory, residence and related definitions. Its definition of “R&D” in R&D services includes but goes beyond the Frascati definition by including testing services that give rise to patents.

**Box 11.1. International statistical manuals related to business R&D globalisation (cont.)**

**Manual on Statistics of International Trade in Services 2010** (UN et al., 2011). This manual covers statistics on the international supply of services, including R&D services in two major forms: conventional cross-border trade in services and the supply of services locally by foreign-owned subsidiaries. The latter are covered in foreign affiliates (FATS) statistics (EC, 2012). Its definition of “R&D” in R&D services includes but goes beyond the Frascati definition by including testing services that give rise to patents, but its subcategories are formulated in order to facilitate comparisons. A compiler’s guide for this manual was published in 2014 (UN et al., 2014).

**Handbook on Deriving Capital Measures of Intellectual Property Products** (OECD, 2009b). This handbook describes statistical procedures to develop market-value measures of R&D and other Intellectual Property Products (IPP) for purposes of incorporating these assets in national and international economic accounts, in line with SNA 2008. It describes domestic R&D output for measurement purposes in terms of three components consistent with both the SNA and Frascati: own-account R&D (R&D conducted and used internally regardless of funding source); custom R&D (R&D conducted for, and funded by, another unit); and speculative or non-customised R&D. It describes different forms of recording the international transfer, use or sale of R&D and other IPPs: sale or licensing agreements, transfers (provision without a fee, especially within MNEs), and changes in value of company assets or investment income that include (but not separately identified) R&D flows. This manual also describes how the domestic supply of R&D is obtained by adjusting domestic R&D output by adding imports and subtracting exports using statistics on trade in R&D services. This allows for the calculation of capital formation (investment) in R&D and the estimation of capital stocks of R&D.

**The Impact of Globalisation on National Accounts** (UNECE/Eurostat/OECD, 2011). This guide focuses on the difficulties brought by MNE activity for the measurement of national production and trade, including R&D. The guide further develops statistical guidance for internationally comparable measures of IPP production and trade in its Chapter 7. The manual also discusses measurement issues such as transfer prices and the implications for national and international statistics.

**Guide to Measuring Global Production** (UNECE/OECD, 2015). This manual extends guidance from the previous two manuals by focusing on global value chains, supply chains, and arrangements for the production of goods and services, including R&D inputs.

11.15 From the perspective of the compiling country, **foreign-controlled affiliates (FCA)** are the fully consolidated enterprise group within the compiling country that are majority-owned members of foreign MNEs (thus majority-owned by their foreign parent companies). The activities of FCAs are a consequence of **inward FDI**, whereas the activities of CAAs relate to **outward FDI**. For a summary of consolidation issues involving FCAs, see OECD (2005).

11.16 **Fellow enterprises abroad** are identified from the point of view of a foreign-controlled affiliate resident in the compiling economy. The term refers to enterprises located outside the compiling country that are under the control or influence of the same foreign parent company as the foreign-controlled affiliate. For the purposes of this manual, fellow enterprises abroad are of interest as sources or destinations of R&D funds involving foreign-controlled affiliates.

11.17 For inward investment, the **immediate parent company of an FCA** is the first foreign investor outside the compiling country that exercises control over the foreign affiliate. The **investor of ultimate control** of an FCA (also called the “ultimate controlling institutional unit”) is the head of a chain of companies or affiliates that controls all the enterprises in the chain without itself being controlled by any other company.

11.18 **Non-MNEs** refer to companies located in the compiling country that are not members of any MNE (domestic or foreign) and thus do not engage in any form of FDI (OECD, 2005, Box 3.3). Non-MNEs may engage in other forms of global activities such as international R&D funding, collaboration, contracting and trade.

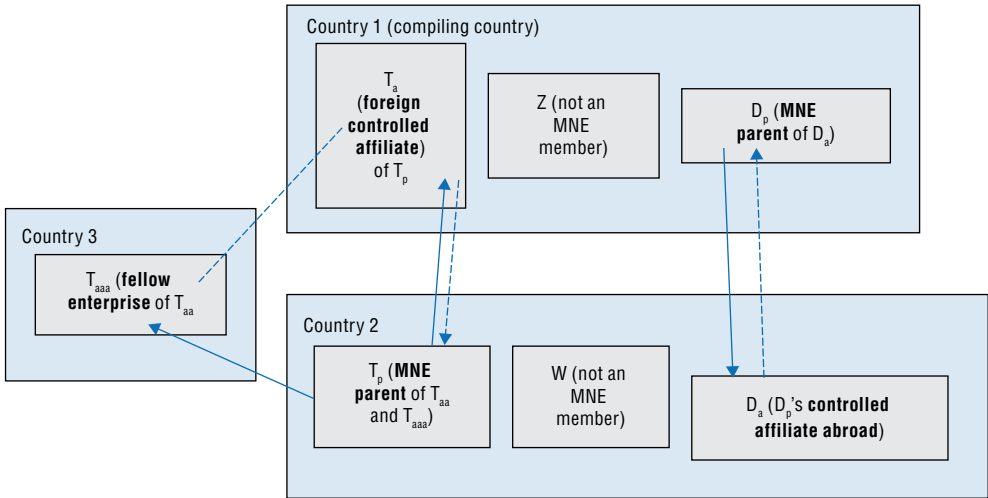
11.19 Figure 11.1 presents an illustrative example of MNE concepts and terms defined from the perspective of “Compiling country 1” (so that countries 2 and 3 constitute the “Rest of the world”). Arrows run from parent to affiliate and show majority ownership in direct investment relationships. Section 11.2 addresses R&D funding flows among MNE members and others, and Section 11.3 provides guidance on compiling cross-tabulations of current costs for R&D performance and R&D funding sources for MNEs and non-MNEs.

### 11.3. International R&D funding involving MNEs

#### **Rest of the world**

11.20 International or cross-border R&D funding involves non-resident units as sources or destinations of funds. As detailed in Chapter 3, Section 3.3, the Rest of the world is defined on the basis of the non-residence status of the relevant units; transactions with the Rest of the world are recorded as if it is a *de facto* sector. This sector consists of all non-resident institutional units that

Figure 11.1. **Illustrative example of MNE member ownership relationships and corresponding terminology**



Note:  $D_p$  is the parent company of  $D_a$ .  $T_p$  is the parent company of  $T_{aa}$  and  $T_{aaa}$ .

- ▶ Parent to affiliate link
- - -▶ Affiliate to parent link
- · - · -▶ Fellow affiliation link

enter into transactions with resident units, or have other economic links with resident units. For regular BERD reporting purposes (Section 7.6), the sources of R&D funds from the Rest of the world are:

- 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

### MNE international R&D funding flows

11.21 This section discusses MNEs in the context of cross-border funding flows, the first of the three types of statistical measures of business R&D globalisation identified in Section 11.1. It supplements guidance on identifying BERD sources of funds from the Rest of the world.

11.22 Business units abroad can be sources or recipients of R&D funding. MNE members (as defined in this chapter and illustrated in Figure 11.1) typically are involved in cross-border funding flows within their global operations and



with other companies and organisations. These flows reflect different global arrangements to acquire or provide R&D. An important distinction is affiliated vs. unaffiliated source of funds within business enterprises. Affiliated units include MNE parent companies and fellow enterprises abroad (if foreign-owned) and controlled affiliates abroad (if an MNE parent). To obtain finer granularity in non-resident sources of R&D funds, R&D surveys of MNEs could ask for the following funding source details within the Rest of the world (see Figure 11.2).

- Affiliated units (enterprises within the same group)
  - ❖ controlled affiliates abroad (CAA)
  - ❖ foreign parents (if respondent is foreign-owned)
  - ❖ fellow enterprises abroad (if respondent is foreign-owned).
- Unaffiliated units – other enterprises abroad (any company that is not part of the MNE group of the respondent).

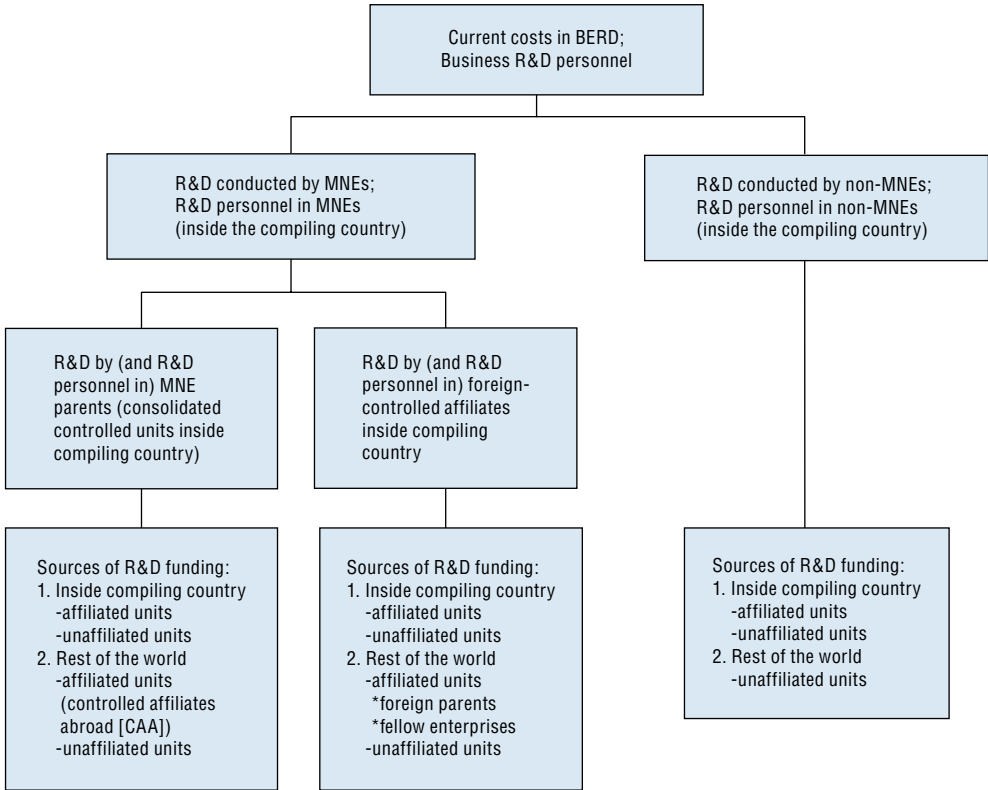
11.23 Building on the definitions presented in Chapter 4, a transfer of cash or in-kind is a transaction where the provider receives nothing in return (i.e. the flow of money is not required with a compensatory flow of goods or services). Cross-border or international transfers are transfer transactions between a resident and a non-resident. R&D funding to/from the Rest of the world should separately identify transfers from exchanges. This information may facilitate distinguishing between cross-border R&D funding flows and trade in R&D services that typically excludes transfers. Further, intra-MNE flows that are closer to transfers than to exchanges may not be recorded in services trade surveys but may appear in R&D funding items in R&D surveys, as described below.

## 11.4 Developing, compiling and publishing MNE R&D aggregate statistics

### **General approach for compiling MNE R&D aggregate statistics**

11.24 This section discusses the collection of current costs for R&D performed by members of MNEs within compiling countries and abroad, the second of the three types of statistical measures of business R&D globalisation identified in Section 11.1. Information on R&D performance by MNEs, apart from funding sources, is important for understanding the production of new knowledge. For example, measures of current costs for R&D performance are directly related to R&D employment. In turn, cross-tabulations of business R&D performance/funding statistics for MNEs and non-MNEs (based on the categories summarised in Figure 11.2) provide a more complete picture of global arrangements for the production of new knowledge compared with the exclusive focus on cross-border R&D funding flows. The focus on current R&D costs of MNEs is to facilitate comparisons with MNEs' non-R&D operations statistics such as output, sales/turnover, value added, employment, number of enterprises, and trade in goods and services. Of course, it could be possible to separately identify the capital R&D costs of MNEs.

Figure 11.2. **Aggregation of current costs<sup>1</sup> and personnel for R&D performed by MNEs and non-MNEs within a compiling country, and source of funds**



1. The focus on current R&D costs is to facilitate comparison with MNEs' non-R&D operations statistics. It could be possible to separately identify the capital R&D costs of MNEs.

11.25 At the same time, the collection of statistics on activities abroad presents practical challenges to respondents and national statistical agencies, because the data collection authority of a compiling country typically does not extend beyond its national borders; data on affiliates abroad usually must be collected through surveys targeting or including MNE parents. To the extent that surveys of FDI or MNEs include the activities of affiliates abroad, R&D may be included in these surveys, consistent with the definitions and guidance of this chapter and elsewhere in this manual.

11.26 BERD surveys may also include the R&D activities of controlled affiliates abroad along with other information that is typically outside the scope of FDI/MNE surveys (e.g. type of R&D) with questions directed to MNE parent companies that reside in the compiling economy.

11.27 To the extent that a country collects R&D expenditures and related statistics (such as human resources) for MNE members defined in this chapter, priority should be given to MNE members within the compiling country, namely:

- fully consolidated parent companies of MNEs that own CAAs
- foreign-controlled affiliates (FCA) that are members of foreign MNEs.

11.28 To the extent possible, statistics may also be tabulated for the following categories, which are part of the de facto Rest of the world sector:

- controlled affiliates abroad (CAA) owned by resident MNE parents
- consolidated MNE controlled by residents of the compiling country, that is, resident MNE parents plus their CAAs.

### **MNE R&D statistics, by country and other characteristics**

11.29 Foreign MNEs may own affiliates in a given country through ownership chains that extend across multiple countries. R&D and other activity statistics (e.g. employment) related to inward investment may be classified by the country of immediate control or by the country of ultimate control. The **immediate investing country** is the country of residence of the immediate parent company. The **ultimate investing country** is where the investor of ultimate control resides.

11.30 For activity statistics related to outward investment, CAAs can be classified by the country in which the operations actually take place (**immediate host country**).

11.31 This manual recommends that MNE R&D statistics be collected and tabulated by the country of ultimate control (inward investment) and the country of location of controlled affiliates abroad (outward investment), to the extent possible, especially if other MNE statistics (employment, sales, trade, etc.) are published by the compiling country on this basis. Indeed, consistency between enhanced R&D and non-R&D globalisation statistics increases the analytical value and policy relevance of these statistics, in light of evolving complex organisational arrangements and transactions.

11.32 The industry classification (and related distributions) for inward and outward MNE statistics should follow the guidance in Chapter 7. The industry classification of CAAs should be based, as a first priority, on their own main economic activity in their location abroad and not that of their parent company in the home (compiling) country. To the extent that compiling countries have access to data on parent companies, a second priority on CAAs is to tabulate data by the main economic activity industry of the parent company, particularly for key variables such as current costs for R&D performance, employment and R&D employment.

11.33 MNE R&D statistics are examples of statistics on **activities of multinational enterprises (AMNE)**, including MNE parents and affiliates that may be collected in dedicated R&D surveys or as part of other surveys on international activity such as FDI surveys. MNE R&D may also be published in

national statistics as part of **foreign affiliate statistics (FATS)**, which differ from AMNE statistics by not covering MNE parents. The R&D activities of FCAs in the compiling economy are part of inward FATS; the R&D activities of CAAs are part of outward FATS.

## 11.5. Trade in R&D services

11.34 This section discusses the collection of data on trade in R&D services, the third of the three types of statistical measures of business R&D globalisation identified in Section 11.1. In the SNA and international trade statistics, “R&D services” cover services associated with basic and applied research and experimental development, including activities in the physical and social sciences and the humanities. “R&D services” can be provided by any company, and thus these services are not limited to companies classified in ISIC Rev. 4 division 72 or an equivalent national classification. In standard product classifications, following the capitalisation of R&D, a distinction is made between R&D originals and other R&D services. While the latter have a direct correspondence with R&D performance, the former correspond to assets that have been generated from past R&D performance. The sale and acquisition of those “finished” assets count as part of trade in R&D services in trade statistics, while it is outside the scope of the funding flows captured in this manual.

11.35 Within trade statistics, the general category of R&D services may also include testing and other non-R&D technical activities that result in patents, thus reflecting a wider scope than the R&D definition in this manual. However, the cited manuals account for this difference by explicitly recommending the separate collection of services related to “work undertaken on a systematic basis to increase the stock of knowledge” from “other” services within “R&D services”. Details on R&D services in economic accounts and services trade statistics, as well as the concordance between Balance of payments classification codes and the Classification of Product Codes for R&D and selected related technical services in the future may be found in online annex guidance to this manual available at <http://oe.cd/frascati>. Furthermore, in light of the updated globalisation manuals discussed here, Technology Balance of Payments guidance may be updated in the future.

### **R&D services trade surveys**

11.36 Surveys on international trade in services collect data on cross-border transactions in R&D services from companies located in the compiling economy (regardless of ownership or industrial classification), among other intellectual property transactions and business services. International transactions refer to transactions between residents and non-residents. See the Glossary for a definition of “transactions”. These surveys also collect data on sales/purchases and licences involving proprietary rights arising from R&D (e.g. sale of patents and royalties and licence fees), which are part of “R&D services”. In turn, trade

in services is a component of the current account in the Balance of Payments, a summary measure of economic transactions between resident and non-residents in a given time period.

### **Valuation of R&D services trade versus recording of R&D funding**

11.37 Market price is used as the basis for the valuation of international transactions in services trade surveys. Transactions are recorded on an accrual basis, when services are provided or received, irrespective of when cash is received or paid. At the same time, R&D funded by others outside the company as defined in this manual – and as reported by the funder of the R&D, but not the performer of the R&D – is presumed to include mark-ups and other items beyond R&D costs. However, all R&D expenditures are collected on a cash basis and, more generally, valuation issues are outside the scope of the *Frascati Manual*.

11.38 The previous discussion suggests that R&D funding measures are not a suitable substitute for services trade statistics for national accounts and balance of payment purposes. At the same time, R&D surveys with detailed funding and grants information can complement information from services trade surveys.

### **Cross-border R&D transfers in the balance of payments**

11.39 In the balance of payments, current transfers such as R&D cash grants are recorded in the secondary income account of the current account. Capital transfers consist of either the transfer of ownership of a good or asset, other than cash, or the provision of a service, without receiving anything in return of economic value. As a produced asset (following the recognition of R&D as investment or capital formation in the 2008 SNA), in-kind transfers of R&D are recorded as R&D services trade. Intra-MNE transfers of in-kind R&D are difficult to quantify though they are within the scope of both services trade surveys and BERD surveys. Note that this balance of payments treatment of in-kind R&D transfers differs from “in-kind” R&D transfers that might be captured on R&D surveys. As noted in Chapter 4, Section 4, Transfer funds for R&D, since in-kind transfers do not entail monetary flows, they are not included in intramural R&D expenditure totals or in totals on extramural R&D.

### **Cross-border R&D transfers, across sectors**

11.40 R&D cash grants and other transfers can occur across institutional sectors (from government or business units to higher education or non-profit sectors). But cross-sector international transactions are typically not covered in services trade surveys. Thus BERD and other R&D surveys are an important source of R&D transfers, both within the compiling economy and internationally. For example, cash transfers for R&D involving the Rest of the world are part of total R&D funding in R&D surveys (see Chapter 4).

### *Cross-border R&D transfers, among unaffiliated companies*

11.41 R&D transfers (cash or in-kind) among unaffiliated companies are likely to be infrequent between developed economies, but may occur as part of **technical assistance** across countries, along with R&D transfers involving governments and non-profit institutions. Statistics on grants from R&D surveys along with other sources such as administrative data can be useful to differentiate R&D and non-R&D components of international technical assistance involving private and public sector units.

### *Intra-group services and transfer prices*

11.42 When R&D is transferred within MNEs across borders, it is difficult to obtain market-equivalent measures to assess internal transfer prices that may be distorted due to accounting and organisational complexities, or to tax minimisation strategies (OECD, 2014). Within MNEs, the provision of goods and services that are unrecorded or below market prices does not represent a “transfer” as defined above, unless there is nothing in return to the sender within the survey reference period. Instead, misreported exchanges constitute unreported dividends or investment that should be imputed. Alternatively, cross-border transfer of R&D and other intra-firm services may be part, though not separately identified, of other accounting entries such as retained earnings, dividend payments or cost redistributions/allocations. For detailed guidance on intra-group R&D services, see UNECE/OECD (2015) (para 3.2, 3.3, 4.3, and 4.4). Although there is consensus on the conceptual need for statistical adjustments for “transfer prices” issues (misreported or unreported exchanges), there is little agreement on practical guidance for such adjustments. UNECE/OECD (2015) (para 3.42, 4.23, 4.45) suggests to “stay close to statistical observation”.

11.43 For **both intra-MNE R&D services trade and intra-MNE R&D funding of exchanges**, some reported data may be based on accounting charges or cost allocations formulas with little resemblance to the actual flows of R&D, whereas free or unreported transfers may also result in response error (see possible scenarios in Table 11.1). Another difficulty is that international R&D transactions within MNEs often are difficult to separate from related activities and the transfers of blueprints, prototypes and other intellectual property (see the related discussion in IMF 2014, para 12.126, 12.131, 12.134). Complex global production arrangements involving, for example, factoryless goods manufacturing and special purpose entities, further complicate the recording of intangibles production and trade within and across companies (OECD, 2014, Chapters 3-5 and 11). Respondent recordkeeping studies, survey and statistical methodology research, and MNE accounting research, along with cross-survey collaboration practices, discussed below, are necessary to further develop measures of cross-border MNE flows of R&D, R&D grants and related intangibles flows.

Table 11.1. **Scenarios for possibly reported versus actual MNE R&D flows in BERD and services trade surveys**

| Reported current year cross-border R&D funding/Reported R&D services trade   | Actual exchange of cross-border R&D/R&D services   |   |
|--|--|---|
|  | Yes  | No  |
| Yes<br><br>Of which:<br>Full market value<br>Distorted market value (over or under valuation; “transfer pricing” issues) | 1: Ideal scenario #1, except for response error: current year or cumulative R&D funding and reported R&D services are related to actual R&D flows<br><br>(R&D surveys and services trade surveys)<br><br>Little response error<br>Substantial response error | 2: Allocation formula used in accordance with MNE accounting standards, but with no actual flow of R&D (R&D surveys and services trade surveys challenge: “false positive”) |
| No   | 3: Unrecorded cash grant or unreported in-kind transfer (R&D surveys and services trade surveys challenge: “false negative”)   | 4: Ideal scenario #2: no funding or services payment or purchase reported in the absence of actual flow of R&D (R&D surveys and services trade surveys)                     |

## 11.6. Measuring the globalisation of R&D outside the business sector

11.44 While it is widely recognised that institutions other than business enterprises play an important role as performers and funders in the globalisation of R&D, there is relatively less guidance on how to measure the international R&D flows of such institutions. To a large extent, several of the R&D globalisation measurement concepts and practices outlined for business enterprises can also be applied to units in the Government, Higher education and Private non-profit sectors (or collectively termed here, the **non-business sectors**). These concepts include flows of funds for R&D as well as ownership and control-based linkages. However, it is necessary to take into account some specific features that characterise the international R&D linkages of institutions in the non-business sectors (hereafter collectively termed “non-business units”).

### **Fundamental concepts for measuring non-business global R&D activities**

#### **Rest of the world sources of funds for intramural R&D**

11.45 Non-business units can engage in R&D funding and performance activities with the Rest of the world (non-resident units). The Rest of the world consists of all non-resident institutional units that enter into transactions with resident units or have other economic links with resident units. It also includes

all international organisations and supranational organisations, defined further below, including facilities and operations within the country's borders. Several borderline cases are presented in Chapter 3.

11.46 As noted in Chapter 4, the analysis of the sources of funds for R&D performed by domestic units should seek to identify funding from units located in the Rest of the World for the following categories:

- Business enterprise sector
- Government sector
- Higher education sector
- Private non-profit sector
- International organisations, including those with a physical presence in the compiling country.

11.47 Although these sources are all potentially relevant to each individual performing sector, the use of these categories in surveys should be tailored to the sector of affiliation of the reporting unit. In particular, surveys may potentially inquire about the type of funding received and the extent to which it corresponds to transfer payments (i.e. not requiring a compensatory R&D) or an exchange of funds for R&D or future claims on the outcome of the R&D, using the terminology introduced in Chapter 4.

### ***Institution affiliations, by type of foreign control linkages***

11.48 Most types of non-business units can be linked across countries by various forms of ownership and control ties. As noted in the previous sections on business enterprises, this is an important element of R&D globalisation, since R&D conducted by affiliated units implies both a financial effort on the part of the entire "group" as well as a potential knowledge benefit. For example, as universities or independent research organisations expand globally, it is important to take into account the extent to which the R&D performance in these institutions shares the features of economic globalisation described earlier in this chapter. For example, an organisation comprising a number of research institutes may open institutes abroad, drawing on sources of funds that are specific to the locations in which it sets up, such as local research grants and contracts. This manual currently offers no specific recommendation on identifying and reporting such relationships, except to note that affiliation linkages can shed light on the nature and purpose of the funds received by non-business R&D performers.

### ***R&D personnel and globalisation in the non-business sectors***

11.49 The globalisation of R&D not only relates to flows of funds and cross-border ownership linkages but is also reflected in the mobility of R&D personnel. As is the case with the business sector, the ability of non-business



sector R&D surveys to gather information on the human resource aspects of R&D globalisation is somewhat limited.

11.50 In some cases, it is possible that the human resource records of non-business institutions contain information about the nationality, country of birth or country of previous employment of their R&D personnel, especially researchers (see Chapter 5, Section 5.4). The collection of these data through institutional surveys is not necessarily recommended, although it may be illustrative of some types of R&D international flows.

11.51 When information on the controlled status of institutions is available, breakdowns of standard human resource R&D indicators can be provided, distinguishing those active in foreign-controlled and independent non-business institutions.

### **Government sector**

11.52 Government units can receive R&D funds from abroad, and they can fund extramural R&D activities abroad. These *funding activities* abroad (with non-resident units) should be collected according to the following categories of the Rest of the world, as defined in Chapter 8:

- Business enterprises sector
- Government sector
- Higher education sector
- Private non-profit sector
- International organisations.

11.53 It is also recommended to break down the global performance and funding of R&D by the Government sector into the two categories of funds: exchange funds (specifically termed public procurements for Government sector funding) and transfer funds. While government intramural R&D performance outside of its national territory is not very frequent, government R&D funding to the Rest of the world may be significant. For example:

- As a funder, the government can use public procurements abroad (exchange funds) to encourage the development of a technology or an R&D sector.
- The government is also the main funder of international R&D organisations. With “national contributions” (transfers), the government may fund intergovernmental R&D institutions and intergovernmental R&D programmes/projects. However, only contributions to international R&D programmes or organisations solely or mainly concerned with R&D should be included. General standing contributions to the general budget (such as those to the UN, the OECD, the EU, etc.) should be excluded unless a defined component is specifically earmarked for R&D activities (see Chapters 8 and 12).

### **Higher education sector**

11.54 Higher education units can receive R&D funds from the Rest of the world, and they can fund R&D activities in the Rest of the world. These funding activities with non-resident units should be collected according to the following categories of the Rest of the world:

- Business enterprises sector
- Government sector
- Higher education sector
  - ❖ Branch campuses abroad
  - ❖ Other universities
- Private non-profit sector
- International organisations.

11.55 In particular, many institutions in the Higher education sector have established branches or campuses outside their borders. To the extent that foreign-owned branch campuses inside the compiling country and branch campuses abroad owned by local educational institutions perform R&D, HERD surveys may include supplementary information about these campuses.

- For the purpose of this manual, a **foreign-owned branch campus (FBC)** is defined as a tertiary educational institution, inside the compiling country, that is owned, at least in part, by an entity located (or resident) outside the compiling country (termed a “foreign education provider”); that operates in the name of the foreign education provider; that engages in at least some face-to-face teaching; and that provides access to an entire academic programme leading to a credential awarded by the foreign education provider.
- For the purpose of this manual, a **branch campus abroad (BCA)** is defined as a tertiary educational institution that is owned, at least in part, by a local higher education institution (i.e. resident inside the compiling country) but is located in the Rest of the world (resident outside the compiling country); that operates in the name of the local higher education institution; that engages in at least some face-to-face teaching; and that provides access to an entire academic programme leading to a credential awarded by the local higher education institution.

11.56 R&D performed by foreign-owned branch campuses is part of the domestic HERD performance totals of the compiling country. However, R&D performed in BCAs cannot be included in the domestic HERD performance totals of the compiling country, and instead could be separately identified and tabulated as R&D performed in the Rest of the world by tertiary educational institutions outside the compiling country educational institutions (see Chapter 9, Section 9.4) for further guidance for collecting FBC and BCA totals).

### **Private non-profit sector**

11.57 As with units in other sectors, R&D performing institutions in the Private non-profit sector may have multiple global activities with both affiliated vs non-affiliated units. An institution may receive funds to perform R&D in the form of grants or contracts from other, unaffiliated non-profit institutions located outside of the national territory, or (depending on its affiliation structure) may receive funds from another affiliate or the parent organisation in order to support its activities in the country where it is located. Thus, private non-profit institutions can receive R&D funds from the Rest of the world, and they can fund R&D activities in the Rest of the world. Such relationships can be extremely complex in terms both of identification and statistical measurement. Relevant categories for the Rest of the world are:

- Business enterprises sector
- Government sector
- Higher education sector
- Private non-profit sector
  - ❖ Affiliated institutions (International non-governmental organisations, INGO)
  - ❖ Other non-affiliated institutions
- International organisations, including supranational organisations.

11.58 Some PNP institutions may have a global presence, as is the case of many non-governmental organisations. These are not international organisations in the sense of the SNA and this manual (see Chapter 3 and the section on International organisations below).

### **Special case of international organisations**

11.59 According to the SNA, **international organisations** have as members either national states or other international organisations whose members are national states. International organisations include **supranational organisations**, as defined in Chapter 3. They are established by formal political agreements between their members that have the status of international treaties; their existence is recognised by law in their member countries, and they are not subject to the laws or regulations of the country, or countries, in which they are located. One potential implication of this particular status is that, for example, they cannot be compelled by national authorities to provide statistical information on their R&D performance or funding activities. From the perspective of the compiling country, they are part of the Rest of the world sector.

11.60 Because of the importance of international organisations to global R&D performance in several domains, and in order to attain a more complete representation of R&D activities worldwide, the relevant international and supranational statistical organisations should collaborate to ensure full coverage of these R&D performing units that lie beyond the scope of national

statistical offices. In the future, these totals could be presented in comparative international statistics as part of a separate country-level category. This could also help improve the coherence between R&D statistics and other indicators, such as scientific publications, which are typically attributed on the basis of the country in which the authors' affiliations are based.

11.61 When national statistical offices are able to collect data from the international organisations operating in their national territory, the reporting of national figures should conform to the guidance in this manual to treat these units as part of the Rest of the World sector. In order to establish whether a given institutional unit has the status of an international organisation, attention should be paid to its foundational charter and to the relevant agreements that govern its functioning, including exemptions from the jurisdiction of local law on a number of aspects as a result of the engagement of sovereign states in the organisation's membership.

11.62 One area of potential confusion stems from the potential similarity between **international organisations**, which are defined in this and other statistical manuals to refer to **intergovernmental organisations**, and other international bodies comprising **non-governmental organisations (NGOs)**, which do not meet the criteria to be treated as non-resident units.

11.63 NGOs are voluntary self-governing bodies or organisations established to pursue the essentially non-profit-making objectives of their founders or members (Council of Europe, 2007). They do not include political parties. NGOs encompass bodies or organisations established both by individual persons (natural or legal) and by groups of such persons. They can be either membership-based or non-membership-based. NGOs can be either informal bodies or organisations or bodies that have a legal personality. NGOs can be national or international in their composition and sphere of operation. NGOs should not distribute any profits that might arise from their activities to their members or founders but can use them for the pursuit of their objectives.

11.64 For example, a global NGO that is an international association of universities involved in research in a particular field operating and using research facilities may undertake very similar activities in similar locations to those carried out by an existing international organisation that has governments as its members. From the perspective of the compiling country hosting the R&D performing facilities, the local centre owned by the international association (i.e. the global NGO) should be counted as part of the domestic economy and its intramural R&D performance included in GERD, while the intergovernmental organisation should be treated as part of the Rest of the world.

11.65 Some countries may be part of an institutional agreement that involves financial flows from the member countries to the associated international organisation and the reverse, for example, to R&D performing units. The international organisation may itself also engage in R&D. For the individual countries, the international organisations are non-resident institutional units

that are part of the Rest of the world and may be classified in a specific subsector of the Rest of the world.

11.66 There may be other research infrastructures and organisations with rather similar operational activities to those of international organisations, even within the same country. For example, while a not-for-profit scientific research and measurement facility may have been set up by an organisation whose members are sovereign member states, there may be another similar facility carrying out equivalent functions but under the control of an international consortium of universities or other private and non-profit organisations. The former should be considered as an international organisation in the intergovernmental sense, while the latter should be treated as part of the Private non-profit sector (controlled by abroad). This latter non-governmental institution would contribute to the GERD of the domestic economy, while the former would not. Similar criteria would apply to the human resources engaged in R&D by these organisations.

### **R&D performer issues – domestic or Rest of the world**

11.67 International affiliation linkages need not be constrained to operate within the same sector. For example, a domestic private research centre with a non-profit or even business status may be owned by a foreign university, or vice versa. In regular survey practice, it may be overly burdensome to attempt to introduce all possible permutations of non-resident institutional sources of funds with affiliation linkages.

11.68 Chapter 4 clarifies that the concept of intramural R&D and its allocation to a domestic sector or to Rest of the world is not based solely on where R&D performance takes place, but also concerns under whose institutional authority the research is carried out. For example, if a local university researcher spends part of his/her time at the facility owned by an international organisation while working for her university, and is accountable as an employee to this university, the costs corresponding to this researcher's salary should be counted as the intramural performance of the domestic university. If the international organisation behind the facility funds some of the work, or the individual can claim a double affiliation, the attribution can be more complicated, and there is a possible risk of double counting that should be carefully managed.

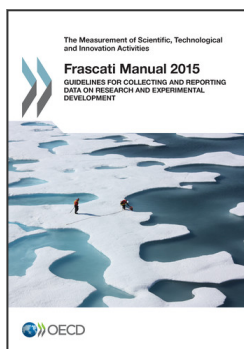
11.69 Also as noted in Chapter 4, intramural R&D expenditure is intended to measure the R&D performed within the statistical units resident in the national territory of the compiling country. Some of the expenditures may, however, have occurred abroad. For example, intramural R&D expenditures might include:

- costs for maintaining and utilising a permanent government research presence in Antarctica
- costs for a higher education researcher to undertake field work in a location outside of the compiling country or within an international organisation located within its own country.

11.70 Priority should be given more 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 national territory of the compiling country. It is difficult to provide precise guidelines for such classification decisions, but at a minimum intramural R&D that has occurred in the Rest of the world should include only R&D that is performed by a statistical unit to fulfil its own objectives and only if the statistical unit has invested its own financial resources and R&D personnel to 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.

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**From:**

## **Frascati Manual 2015**

### **Guidelines for Collecting and Reporting Data on Research and Experimental Development**

**Access the complete publication at:**

<https://doi.org/10.1787/9789264239012-en>

#### **Please cite this chapter as:**

OECD (2015), "Measurement of R&D globalisation", in *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/9789264239012-13-en>

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