

ANNEX 1

National specifications

OECD member countries

- In 2001 in **Australia**, R&D in the business enterprise sector saw a significant increase due to a change in government policy in regard to the R&D tax concession scheme (introduction of the 175% premium (incremental) tax concession for additional investment in R&D; introduction of an R&D tax offset for small companies in tax loss that undertake R&D, enabling them to “cash out” their R&D tax losses; and a new treatment of R&D plant-asset depreciation that allows a 125% deduction for effective life depreciation of assets used in R&D activities (on a pro rata basis).

From 2011, Australia has included submission from agencies that have previously not submitted R&D expenditure data. The agencies have been asked to provide retrospective time series and this results in a break in series in 2002 in GBAORD data. From 1999, Australia has prepared its Federal Budget details according to the principles of accrual accounting, leading to a break in the series for GBAORD data.

Up to 1998, TBP data come from the business enterprise R&D survey, and only refer to technical know-how. From 1999, TBP data are based on ABS's quarterly *Survey of International Trade in Services*, and include all TBP components.

Since 2006, a definition of foreign ownership has not been provided in the national survey and R&D data on foreign affiliates have been accepted (by the Australian Bureau of Statistics) as reported.

- Since 2009 in **Austria**, a large unit previously omitted has been included as an R&D performer in the PNP sector.

From 2007 onwards, the former “post-secondary colleges for teacher training” (“*Pädagogische Akademien*”) have become “Universities of Education” and are, consequently, surveyed as units of the higher education sector (up to 2006, these units were covered in the government sector).

In the BE sector, the “research premium” is included in “funds from government” beginning 2006. This measure was introduced for the first time for the calendar year 2002, and for the 2002 and 2004 data, government funding for R&D via the “research premium” was subsumed under “funds from enterprises”.

In 2004, Statistics Austria's regular annual updating procedure of the R&D expenditure data resulted in revisions showing a significant increase compared to previous estimates, mainly due to the inclusion of results from the 2002 survey of the business enterprise sector.

As from 1995, TBP data cover royalties and license fees, technology-related services and R&D performed abroad. Until 1991 inclusive, these data cover only royalties and license fees. TBP data are published according to the new Balance of Payments and International Investment Position Manual (BPM6) as from 2006.

- In **Belgium**, some institutions were reallocated from the PNP to the Government sector in 2012. Beginning with the 1998 data, two large non-profit organisations, formerly included in the higher education sector, were reclassified in the government sector.

As from 1993 (1992 for the business enterprise sector), data are based on full surveys and no longer on a combination of budget figures and survey findings.

The national total expenditures (Tables 1 to 4) are underestimated in 1987 and 1988, as is the contribution of government (Table 14) as R&D financed by federative authorities (about 2-4% of GERD and 7-15% of government-financed GERD) is excluded. As a breakdown of this sum by sector of performance is not available, the impact on the other R&D expenditure tables cannot be estimated, though it probably affects R&D in the government and higher education sectors.

As from 1995, TBP data are collected according to the *OECD, IMF and Eurostat Manuals*. Up to 2001, data refer to the Belgium-Luxembourg Economic Union (BLEU). From 2002 onwards, data refer to Belgium only. TBP data are published according to the new BPM6 as from 2008.

- In **Canada**, as from 2012, the coefficients used for estimating R&D expenditure in the Higher Education sector have been revised, as well as the distribution of HERD between funds from direct government, GUF and higher education. As from 1988, included in the R&D expenditure of the higher education sector are the estimated values for R&D in hospitals not covered by university reports and not previously included.

As from 1989, non-federal sources are no longer excluded from General University Funds in GBAORD.

- For **Chile**, in 2013, some institutions previously classified in the PNP sector were included in the government sector. BERD funded by industry and by abroad has also significantly increased as a result of better reporting in the R&D surveys starting with reference year 2013. From reference year 2009, in the business sector, innovation and R&D surveys are separated and the survey sampling has been modified. Astronomical observatories are surveyed and included in the PNP sector from 2009.
- For the **Czech Republic**, beginning 2005, there is a change in methodology for the collect of R&D personnel data in FTE. Data are provided in FTE by the reporting units, and based on new, more precise guidelines.

Between 2004 and 2008, some public research institutions were included in the business enterprise sector because of their classification as non-financial enterprises (ISEKTOR 11) in the European System of Accounts (ESA). These institutions have been re-classified into the government sector and R&D expenditure and personnel data have been recalculated for those years.

Up to 2004, TBP data come from the balance of payments of the Czech National bank. From 2005, TBP data are prepared by the Czech Statistical office and come from the quarterly trade in services survey, except for the item “sale/purchase of patents and inventions” which continued to be collected by the central bank up to reference year 2008. TBP data are published according to the new BPM6 as from 2013.

- In **Denmark**, from reference year 2007, the surveys are conducted by Statistics Denmark. Modifications in the questionnaires have increased the response rate; this is particularly noticeable in the business enterprise sector where survey response is now mandatory. Additionally, due to changes in the administrative structure, a number of institutes, previously classified in the government sector, were merged with universities.

Until 2002, the HE sector R&D expenditure was underestimated as R&D carried out in hospital departments at the university-hospitals was included in the government sector.

As of 2002, the business enterprise survey specifically requests data on researchers, technicians and other. Earlier data for R&D personnel by occupation are based on qualification.

As from 2001, GBAORD data include government-financed R&D on renewable energy. In addition, a new principle concerning budgeting of commitments was introduced:

from 2001, commitments of grants are carried to the debit side at the time of entering the commitment, where previously commitment of grants was carried to the debit side at maturity. As from 1999, provincial and local government funding is included in the GBAORD data (in particular funding in provincial hospitals), as well as funding from the Danish National Research Foundation and the Danish Investment Fund. In 1983, 1988 and 1993, the method of assessing GBAORD data by socio-economic objectives changed, leading to breaks in series.

- In **Estonia**, TBP data are published according to the new BPM6 as from 2013.
- In **Finland**, a new methodology was implemented in 2011 for calculating the R&D coefficients. As a consequence, R&D personnel (measured in FTE) in the higher education sector decreased. As from 2004, R&D personnel data are available according to occupation. Previous breakdown was by formal qualification.

In 1998, due to a greater number of responses to the BE survey on the group level, the questionnaire category funds from other foreign enterprises of the group have been merged with business enterprise funds (own funds) thus reducing the share of funds coming from abroad.

As from 1997, the higher education sector covers central university hospitals.

As from 1997 and the implementation of ISCED-97, also included in researchers are holders of engineering degrees and graduates of vocational polytechnics, degrees which are now classified in first stage tertiary education (ISCED 5A).

In 1991, the method of measuring R&D expenditures in the government and the higher education sectors changed. Since 1994, PNP institutions are included in the government sector in non-survey years.

Data on GBAORD have been revised back to 1991 because of changes in R&D coefficients for certain research institutes. In 1991, there was an upward adjustment in the total due to the inclusion of pension costs. As from 1995, funds from external sources of the state research institutes are excluded from government appropriations. As from 1997, the data covers appropriations for central university hospitals.

Until 1998 inclusive, TBP data refer to royalties and licence fees. As from 1999, data also include architectural, engineering and other technical services, computer services and R&D performed abroad. TBP data are published according to the new BPM6 as from 2013.

- In **France**, the National Centre for Scientific Research (CNRS) is included in the higher education sector, whereas in other countries such as Italy for example, this type of organisation is classified in the government sector. This affects comparisons of the breakdown of R&D efforts by sector of performance.

The methodology of the public administrations survey was changed in 2010: the method for measuring the resources devoted to R&D in ministries and some public organisations has been modified, leading to a better identification of their financing activities. The impact is notably a 900 million GOVERD drop and a 3 200 FTE personnel drop.

In 2007, a new methodology was introduced to correct for some double-counting in source of funds for universities, and the higher education R&D expenditure data revised for 2004. Also in 2007, the sampling method in the BE sector was modified and the 2004 data revised according to the new methodology.

Beginning with the 2006 survey, in order to better take into account SMEs, there is no longer a cut-off point in the business enterprise sector of one full-time-equivalent on R&D for an enterprise to be included in the survey population.

In 2001, coverage of the BE sector was expanded, and the data communicated by the Ministry of Defence now cover research that was not considered R&D in earlier years.

In 2000, several methodological changes which improved the quality of the public sector data have resulted in a break in series for that year: social charges and civil pensions are better evaluated in universities' research expenses; modification of responses from some institutes to better harmonise with the corresponding multi-annual programme; and implementation of a redesigned questionnaire. National sources estimate that the previous method would have produced a 1.6% increase in GERD, where the current method results in 4%.

Due to changes in the methods used to evaluate domestic expenditure on defence, the results of the 1998 surveys revealed significant modifications requiring new estimates for 1997. This break in series relates also to the GBAORD data.

In 1997, the method used to measure R&D personnel in administrations has changed.

Between 1991 and 1992, France Télécom and GIAT Industries were transferred from the government to the business enterprise sector following a change in their legal status.

- The data in this publication for **Germany** cover unified Germany from 1991 and Western Germany only until 1990.

The method for calculating public-financed R&D in the business enterprise sector was reviewed, resulting in the revision of business enterprise R&D and the national total back to 1991.

In 1992, the methodology of the survey on resources devoted to R&D in the government sector was changed.

From 1991, the data for the private non-profit sector have been included in the government sector.

For 1997, the methodology of assessing GBAORD by socio-economic objective changed. The 1997 total budget figure of the Federal Ministry of Education, Science, Research and Technology was reduced, but the global reduction was not available by socio-economic objective. Therefore, total GBAORD reflects the adjusted budget figure, and the sum of the breakdown does not add to the total. This is also the case beginning with the 2001 GBAORD data.

Until 1985 inclusive, the TBP data for Germany cover transactions concerning patents, licence, trademarks, models and designs. As from 1986, this data also covers technical services, computer services and industrial R&D. TBP data are published according to the new BPM6 as from 2013.

- In **Greece**, in 2011, methodological improvements and a better coverage resulted in breaks in series: in the business enterprise sector, a new frame population was defined to cover exhaustively all R&D-performing firms; in the government sector, the coverage was extended to also cover public hospitals as well as all institutions administered by the Ministry of Culture; and in the higher education sector, all Technological Educational Institutes (TEI) and post-secondary establishments were included. These methodological changes were also applied to estimate the total GERD between 2008 and 2010.

The methods of assessing R&D in the higher education sector changed in 1983, 1989 and 1995.

As from 2008, GBAORD data are exclusively based on R&D funders. Part of the increase in 2008 is also explained by a better identification of GBAORD for cultural and archaeological activities.

- In **Hungary**, the breakdown of R&D expenditure data by sector of performance and by source of funds is not complete. Beginning 2006, government-financed R&D, some of which was not allocated to the appropriate sector, is now allocated, in particular to the business enterprise sector. Prior to 2004, only defence R&D performed in the civil sector is covered. Until 1993, business enterprise expenditure includes purchase of licenses and know-how. As from 1994, the Central Technology Fund has been reclassified from the business enterprise sector to the government sector.

2013 GBAORD data include multi-annual R&D projects which are not allocated to the year in which they were budgeted.

Up to 2003, the source of TBP data was the balance of payment statistics compiled by the Hungarian Central Bank, and data covered royalties and licence fees and sale/purchase of patents and inventions only. Since 2004, TBP data have been collected by the Hungarian Central Statistical Office from enterprise surveys on trade in services. TBP data also include computer services, architectural, engineering and other technical services and R&D carried out abroad. TBP data are published according to the new BPM6 as from 2008.

- In **Iceland**, from reference year 2013, the R&D data collection methodology has been changed resulting in breaks in series. Main differences concern the redesign of the questionnaire, the use of business registers in the sample selection mechanism, the legal obligation for firms to respond, the definition of key R&D concepts in the questionnaire and changes in the allocation of institutions into the business or the government sectors. New sampling methods have caused a break in series in 2010 (or in 2011 for sectors with no 2010 data).

From 2006, GBOARD data is compiled making better use of R&D information from the state budget and is based on a better coverage of relevant R&D funding in major recipients organisations. As from 1993, new methods for collecting and processing budget data for GBAORD, result in a break in series.

TBP data are published according to the new BPM6 as from 2013.

- In **Ireland**, as of 2000, personnel data in the government sector were surveyed in FTE. Prior to 2000, data were collected for human resources devoted to S&T in FTE, and the R&D expenditure to total S&T expenditure ratio was applied.

The government data were revised back to 1992 inclusive, as some government expenditures are no longer classified as R&D.

Prior to 2004, EU funds were included in GBAORD data.

- In **Israel**, from 2000 onwards, hospitals were transferred to the business sector from the government and PNP sectors. Both the business enterprise and higher education surveys were improved introducing a break in series in 2009 for the BERD financed by abroad and by the business enterprise sector as well as a break in 2007 for the HERD financed by abroad and by the higher education sector. Since 2001, the government sector is covered by a survey. Before 2001, data on R&D expenditure in the government sector were estimated through financial reports and interviews of accountants.

Data for the higher education sector are partly based on data from financial reports of the universities. Before 2008, humanities and law are only partially covered in the higher education sector.

Hospitals and medical centres are included in the PNP sector and in the government sector, as are university hospitals.

The 2009 BERD survey has given more options to businesses to break down the data (from 1993) by sources of funds. Consequently, there are breaks in series in 1993 for BERD (as for GERD) financed by the business enterprises and by abroad.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities or third party. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

- For **Italy**, in 2005 and 1997, new methods for estimating R&D in universities were introduced, resulting in breaks in series in the higher education sector.

Up until 1990, the national total expenditures on R&D are overestimated by more than 10% as they include extramural R&D expenditures. As from 1991, data on extramural R&D expenditures are available separately and are excluded.

2010 GBAORD data are calculated with a new set of coefficients especially affecting the data on non-oriented research programmes.

Up to reference year 2007, the source of TBP data was the balance of payment statistics compiled by the Ufficio Italiano dei Cambi, based on the ITRS system (settlement data collection system). On 1st January 2008, UIC ceased to exist and its functions have been taken over by the Bank of Italy. The data are derived from a new data collection system, mainly based on direct reporting from enterprises. Until 1991 inclusive, R&D performed abroad is excluded.

- For **Japan** in 2013 and 2008, the FTE coefficients for researchers in the higher education sector were revised, producing an increase (in 2013) and a decrease (in 2008) in both R&D expenditure and personnel for this sector and the national total.

Beginning with the 2002/03 survey (OECD data 2002), the coefficients supplied by the Ministry of Education, Culture, Sports, Science and Technology were applied to doctoral level students as well as teachers when calculating FTE for the HE sector, resulting in a break in series for that year.

Before 1996, in the Higher Education sector, expenditure and personnel data in FTE are OECD estimates derived from official headcount-based data.

GBAORD data represent the budget for S&T and cover central government only. From 2011 onwards, GBAORD for education and society data include a more accurate measure of the budget of the National Institute for Cultural Heritage. Military procurement contracts are excluded from defence GBAORD, and before 2010, GUF excludes social sciences and humanities.

- In **Korea**, social sciences and humanities are excluded from the R&D data prior to 2007. From 2013, GBAORD data on the education objective are available separately, while previously included in the non-oriented research. Since 2008, estimates have been done in GBAORD breakdown to fit NABS 2007.

For the TBP data, data for technology receipts and payments do not come from the same source and are therefore not comparable. Technology receipts data come from the R&D survey and are probably underestimated as all firms are not surveyed. Technology payments data come from the balance of payments statistics compiled by the Bank of Korea.

- In **Luxembourg**, a better identification of R&D in software-related activities resulted in a break in series in 2012 for BERD (and for GERD). From 2009, some budgetary items for the Ministry of Research and other ministries are no longer included in the government's own R&D funds. The impact on GOVERD is less than a 7 million drop.

In 2004, the significant increase in R&D performed in the higher education sector is due to the re-defined role of higher education in the national system of innovation and research, in particular the newly created University of Luxembourg.

Government budget appropriations for space programs and GUF are included from 2006. The Luxembourg balance of payments was based on an International Transactions Reporting System (ITRS) until 2011 included. From 2012 onwards, this has been replaced by direct reporting from companies. Banks are still reporting their own BOP transactions.

- Beginning with the 2004 data, **Mexico's** business enterprise survey register was increased to include large firms previously not identified as R&D providers. The first R&D surveys based on the *Frascati Manual* covered the period 1992-93. Earlier data for R&D performed in the government sector are based on broader national estimates, and thus do not exactly correspond to the recommendations of the *Frascati Manual*.
- In the **Netherlands**, in 2012, the method for sampling enterprises included in ISIC industries 84 to 99 (community, social and personal services) as well as the breakdown of personnel data by occupation were modified in Dutch surveys leading to breaks in series in the business and the government sectors. In 2011, the method for producing business enterprise data has changed: all observed enterprises are included whereas before 2011, only enterprises with substantial R&D activities (i.e. with a minimum number of R&D personnel) were incorporated. Subsequent changes affected the higher education sector: before 1999, a large number of PhD candidates were formally employed by research institutes financing their research. As from 1999, universities became the formal employer of PhD candidates and their research activities moved from the government sector to the higher education sector. Besides this, the R&D activities of the Universities of Applied Sciences (HBO) were for the first time taken into account. Finally, the R&D activities of the Academic hospitals were increasingly underestimated due to the merging of the Academic hospitals and (parts) of the Faculties of Medicine of the universities into so-called University Medical Centers (UMC's). This started in 1998 and meant for instance that staff of the Faculty of Medicine of the university became employees of the UMC. So, data on R&D in the field of medical sciences were also revised. As from 2000, newly-recruited researchers on the payroll of the Netherlands Organisation for Scientific Research (NOW), previously included in the government sector, were included with personnel in the higher education sector. In 1982 and 1990, the methodology of the survey on R&D expenditure changed.

In 2003, Statistics Netherlands revised the panel of the R&D survey for the government and PNP sectors, resulting in breaks in series for both sectors. Also beginning 2003, R&D personnel in the PNP sector are grouped with government sector R&D personnel.

In 1994 and 1996, there were major expansions of the area covered by the business enterprise sector survey; R&D expenditure and personnel data in the latter sector and in the whole economy are thus not comparable with those for the previous years.

In 1990 and 1999, new methods of calculating GUF are used for GBAORD series.

TBP data are published according to the new BPM6 as from 2014.

- **New Zealand** revised the methods of collection and estimation of R&D data respectively in 1984 (for the higher education sector), 1992 (for GUF), and 2001 (BERD and national total and HE personnel).

GBAORD figures have been revised back to 2007, resulting in a break in series. From 2006 onwards, GBAORD data are collected from all government agencies, together with analysis of selected budgetary information. Prior to that year, data were derived from the

budget estimate of the pool for science funding, together with figures on government department's operational research.

Up to 1997, TBP data came from the R&D survey conducted by the Ministry of Research, Science and Technology. From 1999 onwards, the data are based on the quarterly *International Trade in Services and Royalties Survey* carried out by Statistics New Zealand. All TBP components are covered. TBP data are published according to the new BPM6 as from 2012.

- In **Norway** in 2007, break in series with previous years because of a change in compilation methods for health institutions. This affects both higher education sector (university hospitals) and government sector (other hospitals).

In 1995, the survey sample was revised to improve coverage of small firms (10 to 50 employees) and non-manufacturing industries.

As of 1991, personnel in central administration units of higher education are not included, however the cost of such personnel is included in other current R&D expenditure (in line with the *Frascati Manual*).

In 1987, own funds from public enterprises have been reclassified from funds from government to the funds from the business enterprise sector. As from 1989, R&D performed by PNP institutes has been included in the government sector.

The growth in resources devoted to R&D in 1984 is due to the expansion of the area covered by the business enterprise sector survey.

The method for compiling GBAORD data changed in 1996. The series have been revised retrospectively to exclude contract research, state enterprises and payments to the European Commission.

Before 1988, TBP data cover only patent licensing and are consequently underestimated.

- In **Poland**, from reference year 2013, improvements in R&D surveys enable the entire redistribution of expenditure by type of R&D, leading to a break in basic research series.

Up to 1999, TBP data cover trade in techniques; transactions involving trademarks, patterns and designs; services with a technical contents (including prospecting until 1995 and spatial planning, town planning and architectonic work); R&D performed abroad. From 2000, all categories are covered (acquisition/disposal of non-produced, non-financial assets, royalties and licence fees, computer services, architectural, engineering and other technical services and R&D services). TBP data are published according to the new BPM6 as from 2011.

- In **Portugal**, a significant number of entities previously classified in the PNP sector have been allocated to the higher education sector in 2013. Besides, R&D personnel occupation categories have been reviewed: researchers, technicians and other support staff have been defined according to the main functions performed by each individual as part of R&D activities and according to criteria based on the ISCO classification, rather than being defined only by the level of academic qualification. In 2008, the R&D personnel increased because of methodological improvements in the different institutional sectors (government, higher education, as well as private non profit institutions): the results of the individual survey forms were crossed with information from other internal databases resulting notably in the inclusion of all permanent academic staff and all researchers funded by the Ministry of Science, Technology and Higher Education in 2008.

Due to methodological improvements in the 2008 R&D survey as well as complementary information collected from internal databases, there is now a more complete and accurate measure of R&D resources, both expenditure and personnel, in the higher

education sector. In particular, the large increase in higher education funded R&D is due to the inclusion of more accurate data related to private higher education institutions.

Beginning with the 2007 survey, the following measures resulted in a significant increase in Business enterprise R&D: the reintroduction of the fiscal incentive, SIFIDE; an increase in the number of the firms performing R&D activities; and an updating of the Business Enterprise Register.

New methodological procedures have been adopted for the 1997 survey so that only R&D activities are covered in the survey. The classification of BERD by NACE (Rev. 1) was introduced and the data have been revised back to 1995. Some of the PNP units have been resectored in the business enterprise and higher education sectors.

In 1997, due to a new accounting method for structural funds from the European Commission, funds from abroad and direct government financing are not comparable with those of earlier years.

GBAORD data have been revised back to 2008 according to a new methodological exercise. TBP data are published according to the new BPM6 as from 1996.

- For the **Slovak Republic**, data before 1994 refer to the *Research and Development Base (RDB)* and cover the whole activity of institutions and not only R&D. Defence R&D was totally excluded until 1997 and only partially included thereafter.

Since 2002, a new budget classification compatible with COFOG enables the identification of government budget appropriations for defence R&D. The defence category includes R&D appropriations for defence, safety and security of the country. For earlier years, defence R&D was included in the GBAORD total.

- For **Slovenia**, in 2011, the increase in R&D personnel and expenditure is notably explained by both the improvement of non-response analysis and new administrative sources to better identify R&D performers. Beginning reference year 2008, survey coverage was expanded to include some innovative companies that were not previously recognised as R&D performers.

- For **Spain**, beginning 2008, the R&D questionnaire includes a specific category for on-site consultants undertaking R&D projects in the enterprise; as well as a specific category within the breakdown of current costs.

Since 2004, loans for R&D that are returnable are not included in GBAORD, in order to ensure international comparability.

From 2002, R&D expenditure and personnel data for the business enterprise sector include the occasional and the systematic R&D.

R&D personnel data prior to 1989 are underestimated because the R&D personnel data for the higher education sector only include researchers. In consequence, total R&D personnel in Spain may be underestimated for these years by between 10 and 15%.

In 1992, there was an upward reestimation of the General University Funds causing a break in series in the financing of HERD and GERD. In 1995, the sources of funds for R&D in the higher education sector were reviewed; own funds are now separated from the General University Funds where they were previously included.

In 1997, the defence objective in GBAORD almost doubled in magnitude due to an exceptional contribution by the Ministry for Industry and Energy. The incorporation in 1997 of the Spanish contribution to CERN has involved substantial changes in the “energy” category.

Up to 1992, TBP data come from the annual survey into technological transfer in companies conducted by the Ministry of Science and Technology (former Ministry of Industry and Energy). From 1996 onwards, TBP data come from the balance of payments statistics compiled by the Spanish Central Bank. All TBP items are covered. TBP data are published according to the new BPM6 as from 2008.

- In **Sweden**, part of personnel data were reallocated from the category “technicians” to the category “researchers” in 2013. In 2011 and 2009, the PNP sector decreased due to a new sampling method. In 2011, for personnel data, the institutional coverage of the Government sector was improved.

Beginning 2007, researchers in the business enterprise, government and PNP sectors are now surveyed by occupation; prior to that year, university graduates were counted in their place.

Until 2005, R&D data for Sweden were underestimated: R&D in the government sector covered central government units only and companies between 10-49 employees were excluded from the coverage. Moreover, prior to 1993 the surveys in the business enterprise, government and private non-profit sectors excluded R&D in the social sciences and humanities. Also beginning 2005, FTE on R&D in the higher education sector reflects a change in survey method. Concerning the government sector, beginning 2005, the data exclude R&D personnel from the County councils, resulting in the personnel data being underestimated.

As from 1997, funding from the Public Research Foundations, previously classified in the PNP sector, is considered as funding from the government sector.

In 1995, some institutions from the PNP sector have been reclassified to the business enterprise or the government sectors, and in the higher education sector, capital expenditures are excluded.

As from 1998, GBAORD series refer to the calendar year (January-December) instead of the period July-June which has been used until 1994. Budget appropriations for 1995 and 1996 are estimates based on the period July 1995-December 1996. Also from 1998, funding from the Public Research Foundations is excluded from the GBAORD data.

Up to 1993, TBP data came from the R&D survey and referred to the transactions linked to patents, licences, royalties and know-how. From 1998, the data are based on the quarterly trade in services survey. All TBP components are covered. TBP data are published according to the new BPM6 as from 2013.

- In **Switzerland**, the business enterprise sector comprises private enterprises only. Public enterprises are included in the government sector.

As from the reference year 2000, the government sector no longer includes the telecommunications companies that have been privatised (Swisscom).

The Swiss contribution to the European Space Agency is allocated to the space objective in GBAORD as from 2006, while it was before included in the non-oriented research programmes. As from 1998, the Federal Office of Agriculture and its research institutes no longer break down their R&D by socio-economic objective but group all under “Agriculture”. For GBAORD, this results in a break in series for both Agriculture and Health objectives, where half of the funds previously declared under Health are now declared under Agriculture. Also in 1998, the telecommunications field of the Federal Post office has become the private enterprise Swisscom which is no longer included under the Infrastructure objective in GBAORD. Before 1994, GBAORD did not include the public sector financed R&D mandates.

The TBP statistics are drawn from the Swiss balance of payments. Up to 2001, they include sales and purchases of intangible assets, technological services (construction services, commercial and technical consulting), license and patent fees, including management fees, computer and information services. From 2002 onwards, TBP data include the following BPM6 items: Charges for the use of intellectual property; Computer services; Architectural, engineering and planning, scientific and other technical services; and Research and development services.

- Total R&D personnel data for **Turkey** (Tables 9 and 10) are underestimated because personnel data for the higher education sector only include researchers.
- Beginning with the 2005 data, **United Kingdom** counts of researchers in full-time equivalent on R&D reflect a more accurate measure of post-graduate students. Estimates are based on the sum of student time allocated to different research activities (some students may be involved in several research projects). Students who spend 50% or more of their time on research activities are counted as one FTE; those for whom it is less than 50% are not counted.

In 2001, the government research agency, the Defence Evaluation and Research Agency (DERA) was disestablished and two new organisations were created. Around one quarter of DERA remained within the Ministry of Defence as a government agency, whilst the remaining three quarters became a private limited company, resulting in a break in series in both the government and business enterprise sectors as well as GBAORD.

Following work to enhance the estimates of R&D by PNP undertaken in 1996, estimates for R&D performed by PNP sector were substantially revised downwards. The data for previous years were revised accordingly.

Until 1994, in the business enterprise sector, R&D funding by business includes funds that may have been collected from other national sources such as higher education or PNPs.

A new method of estimating government-financed R&D in the higher education sector was applied as from 1993.

Reclassification of institutes explains most of the growth of the R&D personnel in the government sector between 1991 and 1992 and the decline in the following year.

As from 1991, the data for the government sector include an estimate for R&D expenditures in the public health services.

Between 1985 and 1986, the “United Kingdom Atomic Energy Authority” was transferred from the government sector to the business enterprise sector. Expenditure revisions have been made back to 1985.

Due to lack of official data for the higher education sector, the OECD Secretariat has made estimates for total researchers beginning 1999 and total R&D personnel beginning 1994.

As from 1995, the health objective in GBAORD has been broadened to include the total net costs to National Health Service trusts of their involvement in R&D.

Oil company operations have been included in the United Kingdom TBP data as from 1984. From 1996 onwards, the TBP data cover sale of patents and inventions, patent licensing, trademark patterns and designs, technology-related services and R&D. TBP data are published according to the new BPM6 as from 2003.

- For the **United States**, in the business sector, the funds from abroad previously included in the business-financed BERD, are available separately since 2009. In the higher education sector all fields of SSH are included from 2003 onwards.

Following a survey of Federally-Funded Research and Development Centers (FFRDCs) in 2005, it was concluded that FFRDC R&D belongs in the government sector – rather than the sector of the FFRDC administrator, as had been reported in the past. R&D expenditures by FFRDCs were reclassified from the other three R&D performing sectors to the government sector; previously published data were revised accordingly. Between 2003 and 2004, the method used to classify data by industry has been revised. This particularly affects the ISIC category “wholesale trade” and consequently the BERD for total services.

US R&D data are generally comparable, but there are some areas of underestimation:

- i) up to 2008, government sector R&D performance covers only federal government activities; that by State and local government establishments is excluded;
- ii) except for the government sector, the R&D data exclude capital expenditures; for the business enterprise sector, depreciation is reported in place of gross capital expenditures.

Higher education (and national total) data were revised back to 1998 due to an improved methodology that corrects for double-counting of R&D funds passed between institutions.

Breakdown by type of R&D (basic research, applied research, etc.) was also revised back to 1998 in the business enterprise and higher education sectors due to improved estimation procedures.

No data is available for total R&D personnel; only data for R&D scientists and engineers are collected. The methodology for estimating researchers was changed as from 1985. In the government, higher education and PNP sectors, the data since then refer to employed doctoral scientists and engineers who report their primary work activity as research, development or the management of R&D, plus, for the higher education sector, the number of full-time equivalent graduate students with research assistantships averaging an estimated 50% of their time engaged in R&D activities. As from 1985, researchers in the government sector exclude military personnel. As from 1987, higher education R&D personnel also include those who report their primary work activity as design.

Due to lack of official data for the higher education sector, the total researchers figure is an OECD estimate.

2009 GBAORD data also includes the one time incremental R&D funding legislated in the American Recovery and Reinvestment Act of 2009. Beginning with the 2000 GBAORD data, budgets for capital expenditure – “R&D plant” in national terminology – are included. GBAORD data for earlier years relate to budgets for current costs only.

Up to 2000, the United States TBP data cover only royalties and licence fees. From 2001, data also include “research, development and testing services”. Beginning 2006, new statistics on total trade for several types of services are available for the first time. As from 2006, TBP data include royalties and license fees related to industrial processes, business format franchising fees, trademarks and other intangibles; research, development and testing services; computer and data processing services; architectural, engineering and other technical services; industrial engineering services.

Non-member economies

- In **Argentina**, *Frascati Manual* definitions are followed. Since 1997, data for human resources are strictly R&D. Before that, human resources data were expressed in terms of Science and Technology Activities (STA), involving R&D and diffusion activities of S&T (library services, training services, conferences, etc.). These have not been transferred to the *OECD Database*. Since 2002, the source of funds data for private non-profit organisations, universities and S&T public organisations are requested for R&D. Before 2002, these source of funds data

were requested in terms of STA. These data were converted into R&D by means of a coefficient for each sector of performance. The main source of funds for science and technology activities in Argentina is the National Budget.

- In **China**, the national breakdown by source of funds does not fully match with the classification defined in the *Frascati Manual*. The R&D financed by the government, the business enterprises and by abroad can be retrieved, but part of the expenditure has no specific source of financing, i.e. self-raised funding (in particular for independent research institutions), the funds from the higher education sector and left-over government grants from previous years.

The government and higher education sectors cover all fields of NSE and SSH, while the business enterprise sector only covers the fields of NSE. There are only few organisations in the private non-profit sector. Hence no R&D survey has been carried out in this sector and the data are not available.

From 2009, researcher data are collected according to the *Frascati Manual* definition of researcher. Beforehand, this was only the case for independent research institutions, while for the other sectors data were collected according to the UNESCO concept of “scientist and engineer”.

In 2009, the survey coverage in the business and the government sectors has been expanded.

Before 2000, all of the personnel data and 95% of the expenditure data in the business enterprise sector are for large- and medium-sized enterprises only. Since 2000 however, the survey covers almost all industries and all enterprises above a certain threshold. In 2000 and 2004, a census of all enterprises was held, while in the intermediate years data for small enterprises are estimated.

Due to the reform of the S&T system, some government institutions have become enterprises, and their R&D data have been added to the enterprise sector since 2000.

- In **Romania**, in 2011, R&D questionnaires have been redesigned for all sectors (and merged with the *Community Innovation Survey* in the case of the business enterprise sector). This has had an impact on the number of researchers in both the higher education and business enterprise sectors. A substantial proportion of R&D expenditure and R&D personnel reported in the data for the business enterprise sector are performed/employed in public enterprises (57.4 and 62% respectively for the year 2003).

The higher education sector includes faculty hospitals. For some of these hospitals, as well as for other types of medical centres, there are problems of delimitation between R&D activities and health activities and in these cases no data is available on R&D expenditures and personnel. The higher education sector does not include experimental stations: given the specific nature of their activity, these are directly co-ordinated by the Ministry of Agriculture, and therefore included in the business enterprise sector.

In 2013, a change in methodology for the allocation of GBAORD data by socio-economic objectives has resulted in a break in series.

TBP data are published according to the new BPM6 as from 2013.

- In the **Russian Federation**, the business enterprise sector includes all organisations and enterprises whose main activity is connected with the production of goods and services for sale, including those owned by the state, and private non-profit institutions serving the above-mentioned organisations. In practice however, R&D performed in this sector is

carried out mostly by industrial research institutes other than enterprises. This particularity reflects the traditional organisation of Russian R&D.

Headcount data include full-time personnel only, and hence are underestimated, while data in full-time equivalents (FTE) are calculated on the basis of both full-time and part-time personnel. This explains why the FTE data are greater than the headcount data.

New budgetary procedures introduced in 2005 have resulted in items previously classified as GBAORD being attributed to other headings and have affected the coverage and breakdown by socio-economic objective.

- In **Singapore**, the Public Research Centres are located within the universities and draw upon university expertise. They are closely linked with the universities and several have “spun off” from university research groups. However, they are administratively separate from the universities and funded by the Agency for Science, Technology and Research (A*STAR) and industry. The centres have been included in the “Public Research Institutes and Centres” category in the R&D survey since 1995. Until 1995, they were subsumed in the higher education sector. This leads to a discontinuity in the statistics for the government/public and higher education sectors between 1994 and 1995.

Data for TBP receipts do not include services with a technical content, unless covered under “licensing of new technologies”.

- For the 2001/02 R&D survey in **South Africa**, no comprehensive business register was available, nor was there any official register of the specific subset of those entities that actually conduct R&D. However, lists of firms surveyed in previous R&D surveys, those covered in previous technology audits, public listings of the top 200 companies in the economy, as well as lists of firms that participate in public innovation and R&D support programmes were available to the survey agency. These lists provided the basis for a purposive sample of all firms known to have R&D activities. There may however be an underestimation of R&D expenditure by 10 to 15%.
- In **Chinese Taipei**, since 2003 the business sector includes R&D data of private enterprises in the sectors of electricity, gas and water supply; construction; and services, which were not surveyed before.

Postgraduate students engaged in R&D were not included in the higher education sector until 2002.

Researchers must have a university degree or above.

TBP data do not include R&D performed abroad, services with a technical content, or transactions involving trademarks, design, patterns (sale, licensing, franchising).



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