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**JOINT EUROSTAT – OECD TASK FORCE ON
LAND AND OTHER NON-FINANCIAL ASSETS**

**FINAL REPORT ON
– INTELLECTUAL PROPERTY PRODUCTS –**

JANUARY 2020

Preface and acknowledgements

The *Report on Intellectual Property Products* was prepared by the Task Force on Land and other non-financial assets. Both the statistical office of the European Union (Eurostat) and the Organisation for Economic Co-operation and Development (OECD) consider the compilation of non-financial assets as a high priority and therefore in June 2012 they decided to join efforts and create a joint Eurostat-OECD Task Force. The Task Force started their work by looking at land which led to the publication of the ‘Eurostat-OECD compilation guide on land estimation’ in May 2015. This was followed by a study on inventories which was concluded in June 2017 with the publication of the ‘Eurostat-OECD compilation guide on inventories’. Subsequently, the Task Force was mandated to continue their work with a study on the compilation of estimates of intellectual property products. As a lot of existing guidance is already available, it was decided to not aim for a compilation guide, but a report that provides practical guidance and recommendations to countries to compile estimates for intellectual property products.

Representatives from various European Union (EU) and non-EU OECD countries, as well as from the European Central Bank (ECB), have contributed to this report. The Task Force was chaired by Paul Konijn/John Verrinder (Eurostat) and Jennifer Ribarsky/Jorrit Zwijnenburg (OECD). Other members of the Task Force were, in alphabetical order: Walther Adler (Germany), Virginie Andrieux/Alice Thang/Sylvain Humbertclaude (France), Hugo de Bondt/Joseph Haynes (the Netherlands), Isabelle Brumagne/Lotte van Mechelen (Belgium), Brenda Bugge (Canada), Taehyoung Cho/Byoungoo Choi/Jinho Park (Korea), Timea Cseh (Hungary), Josef Falkinger (Austria), Angela Forte (Italy), Martin Freiberg (Luxembourg), Christian Gysting (Denmark), Bob Kornfeld (United States), Jure Lasnibat (Slovenia), Gang Liu (Norway), Oisín Mangan/Ruth O’Shaughnessy (Ireland), Antonia Matas Mir/Pierre Sola/Stanimira Kosekova (ECB), Joe Murphy (United Kingdom), Petr Musil/Martina Němečková/Vladimir Kermiet/Vladimir Caba (Czech Republic), Fernando Pineda (Mexico), Jolita Reidman (Lithuania), Alicja Truszyńska/Magdalena Mojsiewicz/Mariola Jaskow/Piotr Mordan (Poland) and Jonas Zeed (Sweden). Henk Nijmeijer/Andreas Dollt (Eurostat) and Nadim Ahmad/Daniel Ker (OECD) also contributed to the drafting of the report. The work on the report was coordinated by Jorrit Zwijnenburg (OECD).

Regarding the topic of intellectual property products, the Task Force met four times:

- First meeting: 19-20 June 2017 in Paris.
- Second meeting: 12-13 February 2018 in London.
- Third meeting: 10-11 September 2018 in Luxembourg.
- Fourth meeting: 27-28 March 2019 in Paris.

The Task Force report benefited from contributions of many countries that replied to the questionnaire on intellectual property products. The report also benefited from comments received from the Eurostat’s National Accounts Working Group, the OECD’s Working Party on National Accounts, and the Eurostat’s Group of Directors of Macroeconomic Statistics.

Eurostat and the OECD would like to thank all those who contributed to the Eurostat-OECD report on intellectual property products.

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Executive summary

The Eurostat-OECD Task Force on Land and other non-financial assets was launched in 2012 to provide guidance on the compilation of various types of non-financial assets. After finalising compilation guides on land estimation and on inventories, the mandate of the Task Force was extended in the second half of 2017 to focus on guidance for the measurement of intellectual property products (IPPs).

Intellectual property products are produced non-financial assets that are the result of research, development, investigation or innovation which lead to knowledge that can be marketed or be used in production. The importance of IPPs in economic activity has increased significantly over recent years, accompanying structural and qualitative changes in the operation of the economy, and thereby increasing the importance of obtaining comprehensive, consistent and comparable data on IPPs across countries.

The Task Force focused on three types of IPPs: research and development, computer software and databases, and other IPPs. As a lot of guidance is already available from manuals and other reports, the Task Force decided not to aim for a compilation guide but to draft a report that provides practical guidance and recommendations to countries to compile estimates for IPPs, building upon the already existing guidance.

In order to obtain a better understanding of the range of methods countries currently employ, and to assess the extent to which existing measures follow international recommendations, the Task Force conducted a survey of methods used by countries for deriving capital measures for the distinguished types of IPPs. The Task Force met four times to discuss the survey results and to explore in more detail some of the common compilation problems, identifying best practices and making recommendations for future improvements.

This report provides an overview of the main results of the work of the Task Force, describing available data sources, methodologies and calculation methods for research and development, computer software and databases, and other IPPs. The report includes recommendations to further improve the stock measures of IPPs. An overview of all recommendations is provided at the start of the paper.

Overview of the recommendations

Research and development

1. Countries are encouraged to use Frascati Manual surveys in collecting data on R&D. It is recommended to align the surveys to the latest version of the Frascati Manual, i.e. the 2015 version.
2. Countries should explore possible additional data sources that may be used to estimate output of R&D to cross-check the Frascati Manual survey results and to possibly correct for exhaustiveness.
3. Given that company reporting of information on capital stocks or consumption of fixed capital (CFC) is not typically available or rarely aligns with national accounts concepts, for countries with sufficiently long time-series of GFCF used in the production of R&D, it is preferable to adopt the PIM approach to derive estimates of CFC to feed into the sum-of-costs approach for deriving output of R&D. For industries whose main activity is not the production of R&D, any investment in R&D should not, by convention, be included in deriving estimates of CFC incorporated in the sum-of-costs approach.
4. The alternative is to derive an estimate of CFC by using national accounts data for specific industries as a proxy, i.e. applying the ratio of CFC to the amount of current expenditures (i.e. intermediate consumption plus compensation of employees) in these specific industries to the current expenditures incurred in producing R&D in other industries. Data from industry ‘Scientific research and development’ (NACE 72) could serve as the basis of a robust proxy. However, if data for this industry is too volatile or does not seem plausible, data for other industries where R&D forms a significant part of output may also be considered. In deriving the proxy, any consumption of fixed capital related to existing R&D assets should be excluded for calculating the value of own-account production of R&D in industries outside of NACE 72. Applying an arbitrary rate is not recommended.
5. Countries should include an estimate for the return to capital in estimating own-account production of R&D output of market producers.
6. The preferred approach for estimating the return to capital is to apply an explicit rate of return to estimates of the capital stocks of assets used in producing R&D, derived from the PIM. An acceptable alternative is to apply a mark-up based on NA data, such as the ratio of net operating surplus to (preferably) capital stock or to the amount of current expenditures (i.e. intermediate consumption plus compensation of employees), for relevant specific industries, ideally the ‘Scientific research and development’ industry (NACE 72)¹. Applying an arbitrary rate is not recommended.
7. Countries should avoid double counting of own-account production of software and databases in estimating own-account production of R&D. For that purpose, countries should investigate if a noticeable amount of own-account production of software and databases is included in the sum-of-costs method when estimating own-account production of R&D, and are encouraged to include them in separate estimates for own-account production of software and databases.

¹ If the data of this industry does not seem to provide a plausible proxy, data for other sectors where R&D forms a significant part of output may also be considered.

8. Countries are encouraged to confront supply and demand of R&D on the basis of multiple data sources in deriving estimates of GFCF.
9. In confronting multiple data sources, compilers should take into account any differences in scope, coverage, level of detail, and definitions between the data sources and correct for the impact of these differences, possibly by making confrontations at the macro, meso and/or at the micro level.
10. Countries should break down their GFCF estimates at the level of the main institutional sectors. Furthermore, countries should try to compile results at the 2-digit ISIC/NACE industry classification level.
11. If good quality information is available on price change in purchased R&D products, this can be applied in deriving volume estimates for the use and (with the appropriate adjustments for taxes, subsidies and margins) the output of purchased R&D.
12. For own-account R&D input prices will have to be applied. This approach requires a breakdown of the various components (i.e. compensation of employees, intermediate consumption, consumption of fixed capital, net operating surplus, and taxes less subsidies on production), if possible including compensation of employees by occupation.
13. Separate estimates of prices by sector and by industry are preferred wherever R&D activity is likely to differ for businesses, government, and non-profit institutions and across industries.
14. Compilers should explicitly assess and validate the trends of their R&D GFCF deflator, ideally at the most granular level of detail.
15. Countries should regularly re-examine the service lives of the different types of R&D assets. In the absence of direct information, using a service life of 10 years is acceptable until further reliable information becomes available.
16. In measuring net capital stock of R&D, the geometric depreciation approach is preferred unless there are conceptual or practical objections.
17. Back-casting of GFCF in R&D should at least cover the period needed to arrive at proper stock estimates for the time period covered in the publication.

Computer software and databases

18. Costs of creation (extension/improvement) of databases must be included in assets category AN.1173 Computer software and databases. Distinguishing sub-categories AN.11731 Computer software and AN.11732 Databases may not be possible and should not be regarded as a high priority.
19. Strictly according to the 2008 SNA and ESA 2010, all databases should be capitalised. However, for pragmatic purposes, a focus on the databases that are key for a business (and not on all kinds of smaller databases for auxiliary activities) is acceptable.
20. For own-account production of databases, the valuation is estimated by using the sum-of-costs approach. The costs of the database management system and the acquisition of the data are excluded. The following costs should be included: costs of preparing data in the appropriate format; staff time spent on developing the database; and costs of items used as intermediate consumption. Furthermore, it should include an estimate for consumption of fixed capital used in the own-account production of databases and a mark-up for net operating surplus for market producers.

21. To ensure that expenditures on developing databases (that satisfy the asset criteria) are included in the estimates for own-account production of AN.1173 Computer software and databases, demand-side surveys should explicitly mention expenditures on databases.
22. Depending on the availability of underlying information, countries should apply a demand-side or sum-of-costs (macro) approach to derive estimates of output of computer software and databases. Ideally, results from both approaches are confronted in the estimation process.
23. In applying the sum-of-costs (macro) approach to estimate own-account production of software and databases, countries should focus on the following occupations (ISCO-codes): 251 (Software and Applications Developers and Analysts) and 2521 (Database Designers and Administrators). Where countries have differing occupational classifications, the choice of occupations should be aligned to the ISCO-08 codes above as far as possible, and other codes included only where country-specific evidence exists.
24. Where possible, countries should conduct research on the appropriate time factors to apply for each occupation. The time factors should vary according to the role of the occupation in own-account software and database production. In higher-skilled countries, IT managers may play an important role, and should in that case be given an appropriate time factor. Where evidence is unavailable, a time factor of 50% should be applied to the most relevant occupations. Furthermore, countries are encouraged to take account of the industry and the enterprise size when deciding on time factors to apply in the macro approach. Workers in specific industries may spend more time on own-account software and database production, and workers in larger enterprises may be able to spend more time on own-account software and database production than those in smaller firms. This should be taken into account when determining the time factors, on average not exceeding the 50% across all enterprises.
25. In deriving estimates for other expenses and a mark-up for net operating surplus as part of the sum-of-costs method in order to estimate the output of own-account software production, countries should include an estimate for consumption of fixed capital, in which all relevant asset categories should be included. However, consumption of fixed capital of own-account software and databases assets should be excluded.
26. Countries should distinguish between own-account and purchased software in making estimates of GFCF.
27. Countries should try to break down their GFCF estimates at the level of the main institutional sectors. Furthermore, countries should try to compile results at the 2-digit ISIC/NACE industry classification level.
28. If good quality information is available for purchased software, output prices should be used for the measurement of price changes.
29. For own-account software input prices will have to be applied. This approach requires a breakdown of the various components (i.e. compensation of employees, intermediate consumption, consumption of fixed capital, net operating surplus, and taxes less subsidies on production), if possible including compensation of employees by occupation.
30. Separate estimates of prices by sector and by industry are preferred wherever production of own-account software is likely to differ for businesses, government, and non-profit institutions and across industries.
31. Compilers should explicitly assess and validate the trends of their software and databases GFCF deflator, ideally at the most granular level of detail.
32. Countries should regularly re-examine the service lives of the different types of software assets.

33. In measuring net capital stock of software and databases, the geometric depreciation approach is preferred unless there are conceptual or practical objections.
34. Back-casting of GFCF in software should at least cover the period needed to arrive at proper stock estimates for the time period covered in the publication.

Other intellectual property products

35. Countries should investigate if there are IPPs that constitute fixed assets but are not yet captured in one of the other IPP categories, nor in one of the other fixed assets categories.

Economic ownership of IPPs

36. Countries should bring their R&D surveys in line with the 2015 Frascati Manual guidance to breakdown government funding into exchange funds and transfer funds, and to distinguish funding flows between affiliated units from those between non-affiliated units.

1. Introduction

1. Because of the importance of comprehensive balance sheet information for economies and for their main institutional sectors, Eurostat and the OECD decided to launch a joint task force in 2012 to provide guidance on the compilation of various types of non-financial assets. This *Task Force on Land and other non-financial assets* (referred to as “Task Force” hereinafter) started by looking at the compilation of estimates for land, which led to the publication of the ‘Eurostat-OECD compilation guide on land estimation’ (Eurostat & OECD, 2015) in May 2015. In the next phase, the Task Force focused on measurement of inventories which led to the publication of the ‘Eurostat-OECD compilation guide on inventories’ (Eurostat & OECD, 2017) in June 2017. In the second half of 2017, the mandate of the Task Force was extended to focus on guidance for the measurement of intellectual property products (IPPs)². As a lot of existing guidance is already available on R&D and software, it was decided to not aim for a compilation guide, but a report that provides practical guidance and recommendations to countries to compile estimates for IPPs.

2. Intellectual property products are defined as produced non-financial assets that are the result of research, development, investigation or innovation which lead to knowledge that the developers can market or use to their own benefit in production, because use of the knowledge is restricted by means of legal or other protection.³ Publicly available R&D (such as university research) is also regarded as an asset, on the grounds that it constitutes a public good which is beneficial to society for a longer period of time. The importance of IPPs in economic activity has increased significantly over recent years, accompanying structural and qualitative changes in the operation of the economy, and thereby increasing the importance of obtaining comprehensive, consistent and comparable data on IPPs across countries. The national accounts distinguish five types of IPPs: (i) research and development; (ii) mineral exploration and evaluation; (iii) computer software and databases; (iv) entertainment, literary or artistic originals; and (v) other intellectual property products⁴. The Task Force focused on three of these, i.e. research and development, computer software and databases, and other IPPs.

3. The basic rules for the interpretation and compilation of intangible assets are included in the 2008 System of National Accounts (United Nations et al, 2009) (referred to as “2008 SNA” hereinafter) and the European System of National and Regional Accounts 2010 (European Commission, 2013) (referred to as “ESA 2010” hereinafter)⁵. Furthermore, extensive guidance on the preparation of estimates of these assets is available in the OECD Handbook on Deriving Capital Measures for Intellectual Property Products (OECD, 2010) and the Eurostat Manual on Measuring Research and Development in ESA 2010 (Eurostat, 2014). Additionally, explanation of general methods for estimating net capital stocks, and of the perpetual inventory method (PIM) which is used by most countries in the compilation of estimates for net capital stocks of IPPs, can be found in the second edition of the OECD Manual on Measuring Capital (OECD, 2009). Specific guidance on the measurement of software is available from reports by the Eurostat Task Force on Software Measurement

² Annex A contains the mandate of this Task Force.

³ See for more information para.10.98-10.117 of the 2008 SNA.

⁴ See 2008 SNA para 10.103 – 10.117.

⁵ As the manuals are broadly in line, the text only refers to the 2008 SNA where relevant, except in case where the ESA 2010 provides more detailed guidance or where it deviates from the 2008 SNA.

(2002) and by the OECD Task Force on Software Measurement in the National Accounts (2003).

4. In order to obtain a better understanding of the range of methods countries employ, and to assess the extent to which existing measures follow the international recommendations as specified in the manuals and various task force reports, mentioned above, the Task Force conducted a survey of methods used by countries for deriving capital measures of research and development, and software and databases in the national accounts. The Task Force discussed the survey results, exploring in more detail some of the common problems in compiling the results, trying to arrive at best practices and recommendations for future improvements. This report provides an overview of the main results of the work of the Task Force, describing available sources, methodologies and calculation methods for research and development, computer software and databases, and other IPPs, and also making recommendations.

5. The report is structured as follows. Chapters 2 and 3 discuss the compilation of estimates of net capital stocks of respectively research and development, and of computer software and databases. In addition to focusing on the calculation of net capital stocks, these chapters also describe in more detail the estimation of the various inputs needed in the calculation of these estimates. These include output, gross fixed capital formation and price measures. Chapter 4 discusses the category of 'Other intellectual property products', providing insight on what could be covered in this category. Because of the importance and complexity of the issue of economic ownership in relation to IPPs, particularly in the case of IPPs within a multinational corporation, Chapter 5 provides a detailed discussion of this issue. Chapter 6 discusses the follow-up of this report, identifying areas for further work.

2. Research and development

2.1. Introduction

6. This chapter describes the available sources, methodologies and calculation methods for the measurement of net capital stock of the results of research and development (R&D), and makes recommendations to further improve and harmonise measurement across countries. The recommendations already included in the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010) serve as a starting point and are referred to whenever relevant.

7. Before describing the compilation method for capital stock measures of R&D, it is important to first properly define R&D. The 2008 SNA explains that R&D consists of the value of expenditures on creative work undertaken on a systematic basis in order to increase the stock of knowledge and use of this stock of knowledge to devise new applications (see para. 10.103 of the 2008 SNA). The stock of knowledge is recognized as an asset in the 2008 SNA. The SNA applies the same definition of R&D as used in the Frascati Manual which describes the measurement of R&D and provides important input in deriving measures of R&D (see Box 2.2).

8. In general, balance sheet data has to be valued at market prices, but in case this information is lacking, the value of capital stock data is often derived in a different way. In that regard, most countries apply the PIM, in which capital stock data is estimated by aggregating gross fixed capital formation (GFCF) volumes over time, adjusting for declines in efficiency and value until assets reach the end of their service lives and are retired. In some cases, information on GFCF can be directly obtained from surveys or administrative data sources, but often information on the production of R&D is used in the estimation process, particularly in case of own-account produced R&D. For that reason, this chapter starts by explaining the measurement of output of R&D in Section 2.2. In order to derive information on the use of this R&D, including GFCF, it is important to identify who becomes the economic owner of the R&D. In some cases this is relatively straightforward, but in several cases this may lead to discussion. For that reason, the issue of economic ownership of R&D is discussed in Section 2.3. Subsequently, Section 2.4 focuses on the measurement of GFCF of R&D. As in the PIM approach net capital stocks are derived on the basis of the aggregation of GFCF volumes over time, price measurement is also an important issue. This is discussed in Section 2.5. Finally, the estimation of net stocks will depend on assumptions on the expected service life of a group of assets and the retirement function applied. These issues are discussed in Section 2.6.

2.2. Measurement of output

2.2.1. Introduction

9. A correct measurement of R&D output is an important condition for the compilation of good quality data on net stock of R&D. For that reason, it is important to assess what data sources countries use to obtain information on the production of R&D and what methodology they apply to arrive at the output estimates.

10. In order to measure output, it is important to understand that R&D can take place under any of the following conditions: for sale on the market, for own use by a market producer, or within government units and non-profit institutions serving households

(NPISH). In theory, the value of R&D should be determined in terms of the economic benefits it is expected to provide in the future. However, unless the market value of the R&D is observed directly, the SNA offers an approach to valuing own-account R&D output based upon the total production costs relating to R&D⁶. Referred to as the “sum-of-costs” approach, it pools estimates of the various costs of production – including consumption of fixed capital⁷. The 2008 SNA defines the sum-of-costs approach for valuing non-market output as the sum of the following items: intermediate consumption, compensation of employees, consumption of fixed capital and other taxes on production less other subsidies on production⁸. For market producers, it is necessary to also include an estimated mark-up to account for its net operating surplus⁹. For R&D activities, subsidies can be a relevant item. In this regard, it is important to distinguish between subsidies on products, other subsidies on production and general investment grants (see Box 2.1 for an example for Norway).

Box 2.1. Example of SkatteFUNN tax scheme in Norway

Subsidies to R&D activities can appear in different forms in practice. An example is the so-called SkatteFUNN tax scheme in Norway. Aiming at increasing business expenditures on R&D activities in Norway, a tax deduction scheme (SkatteFUNN)¹⁰ has been introduced, for small and medium-sized firms in 2002 and for all firms in 2003. According to this scheme, all firms that are registered and subject to taxation in Norway can apply for tax deduction for an R&D project. The tax deduction is up to a maximum of 20 percent of the total R&D expenses related to a project for small and medium-sized firms and a maximum of 18 percent for large firms. Furthermore, the total R&D expenses qualified for tax deduction for each project is limited to NOK 25 million per income year for in-house R&D expenditures and NOK 50 million for purchased R&D. If the tax deduction exceeds the tax payable by a firm, the difference is paid to the firm as a grant. Approval of eligible projects is normally granted for up to three years at a time, but in special cases, it may be provided for four years. Information collected from this tax deduction scheme serves as an important supplementary data source for compiling R&D statistics at Statistics Norway.

⁶ See also recommendation 3 of the OECD Handbook (2010): “As a general rule, all expenditures on intellectual property products, either purchased or produced on own account, should be recorded as gross fixed capital formation if they are expected to provide economic benefits for the owner. Only in cases where units specialise in producing a type of intellectual property product for sale should acquisitions of that type of product be expensed, or if it is clear that they are completely embodied in another product.” Moreover, recommendation 8 explains that “when summing costs to estimate gross fixed capital formation of intellectual property products, all costs should be included irrespective of whether the activity is eventually successful or not.”

⁷ Please note that the purchase of fixed assets should not be included in the sum of costs. See also recommendation 10 of the OECD Handbook (2010): “When asking units to estimate the costs of producing assets on own account they should be asked to itemize their costs, separately identifying purchases of fixed assets. The latter should not be included in the sum of costs.”

⁸ See para. 6.130 of the 2008 SNA.

⁹ For non-market producers net operating surplus is zero by convention.

¹⁰ See <https://www.skattefunn.no/> for more information.

2.2.2. Main data sources

11. The Frascati Manual (OECD, 2015) provides guidance on the collection of data on the performance of R&D (the provider), the sources of funds for the performance of the R&D (the funder), and expenditures on R&D performed in other statistical units. The first version of this manual dates back to 1963 and the latest update was published in 2015, including among other things some recommendations for additional breakdowns of specific flows that may assist in assigning economic ownership of R&D output (see Box 2.2). All countries that responded to the survey conducted by this Task Force use data from Frascati Manual surveys as the main data source for estimating R&D. The Frascati Manual based R&D surveys focus on performers of R&D and collect data on intramural expenditures, that is expenditures on all R&D performed by the statistical unit regardless of the source of funds. Therefore, it is relatively straightforward to determine where the performance (output) of R&D is taking place. However, some countries also use additional data sources to obtain information on specific sectors. Administrative data is, for example, used for the production of R&D in the government sector, whereas information from Balance of Payments is sometimes used to obtain information on exports (and imports) of R&D¹¹ ¹², feeding into the estimation of domestic production (and domestic supply). In some specific cases, financial reports may also be used as input for estimating the production of R&D. As this often only provides limited information on R&D, this usually requires a lot of assumptions in estimating the relevant amounts and determining the ownership of the R&D.

12. Because R&D performers are not the only actors in the economy engaging in transactions on R&D, Frascati Manual surveys may only provide partial information on the production and use of R&D in an economy. In that regard, most countries apply an adjustment to the data obtained via the Frascati Manual surveys to correct for exhaustiveness. This is usually based on standard statistical techniques. However, in some cases, additional information is available that may assist in making a more informed correction at micro or meso level, such as information available from tax returns or information from structural business statistics. Some countries also look at the confrontation of supply and use of R&D to detect possible under-coverage.

Recommendations:

1. Countries are encouraged to use Frascati Manual surveys in collecting data on R&D. It is recommended to align the surveys to the latest version of the Frascati Manual, i.e. the 2015 version.
2. Countries should explore possible additional data sources that may be used to estimate output of R&D to cross-check the Frascati Manual survey results and to possibly correct for exhaustiveness.

¹¹ In this case, one has to bear in mind that the valuation of the balance of payments data will usually be recorded at purchasers' prices, which may be different from the results obtained from Frascati Manual based surveys, which will largely be based on input costs.

¹² The treatment of R&D activities can also have an impact on measures of Foreign Direct Investment. Annex E - based on input by the Czech Republic and Ireland - provides an example.

Box 2.2. The OECD Frascati Manual

The Frascati Manual provides guidance for the collection of data on the performance and funding of R&D activity. First published in 1963, it has its direct roots in work undertaken in the formative years of the SNA, which was first published in 1953. The two have grown together over successive editions - with the Frascati Manual drawing certain approaches, definitions, and terminology from the SNA, while the Frascati Manual gave the foundational definition of R&D adopted in the SNA. Furthermore, Frascati Manual data provided a vital basis for the eventual decision to treat R&D as investment in the 2008 SNA. Key similarities include a core focus on measuring financial flows and balances, and disaggregation of the economy into institutional sectors.

Nevertheless, there are important differences between the two. Most notably, the SNA is an input-output framework covering all economic activities while the Frascati Manual sets out to measure inputs used for R&D activity during the reporting year in both financial and human resource terms. Measurement is primarily through surveys of units undertaking R&D activity (R&D performing units) although alternative data sources are also used - in particular administrative data on Government Budgetary Appropriations for R&D (GBARD).

The key aggregate produced is Gross national Expenditure on R&D (GERD), which is the total spent by all R&D-performing institutional units in the economy on doing R&D themselves (intramural R&D expenditure). It is this amount which forms the basis for deriving R&D output in the National Accounts. Amounts paid from one R&D-performing unit to another for the performance of R&D (extramural R&D expenditure) are also collected, with the key aim being to ensure these are not double-counted within GERD.

A range of breakdowns of GERD are also compiled, including total R&D expenditure by different sectors and a breakdown by the source of the funds spent on R&D which indicates, for example, how much R&D performed by businesses is underpinned by funding from the business itself, other businesses, government, etc. For National Accounts purposes, these “R&D expenditure by sources of funds” data can give a useful indication of which institutional sector may be regarded as the owner of the R&D assets resulting from R&D activity.

The 2015 edition of the Frascati Manual maintained the definition of R&D as relied upon in the SNA - although it should be noted that when implementing the 2008 SNA most countries now treat R&D expenditure undertaken in the course of developing software as producing software assets (rather than R&D assets), resulting in a downward adjustment of R&D figures when compiling National Accounts R&D statistics (not changing overall investment, all other things being equal). The 2015 edition further ensures interoperability with other statistical frameworks through alignment of the fundamental criteria for classifying institutional units to sectors (i.e. control, market/non-market nature) and recommending links are made with central business registers where possible.

The 2015 edition also encouraged the collection of “revenues from sales of R&D services” and recommended the breakdown of “R&D expenditure by source and type of funds”. This can offer National Accountants improved insight into which sector owns the resulting R&D assets by distinguishing funds received in exchange for R&D services from unrequited transfers received for R&D activity (such as government subsidies), the former implying that the resulting R&D is market output purchased by the funding unit/industry/sector, while the latter indicates ownership by the performing unit/industry/sector. Countries are strongly encouraged to implement this breakdown, especially for combinations of R&D performing and funding sectors where the type of funding is likely to be relatively heterogeneous.

The OECD Frascati Manual is available at <https://oe.cd/frascati>. A complementary paper by Ker and Galindo-Rueda (2017), “Frascati Manual R&D and the System of National Accounts” (<https://oe.cd/FMSNA>), provides a detailed comparison of the frameworks. Furthermore, it sets out how new data and breakdowns recommended in the 2015 edition can be useful in compiling National Accounts R&D statistics.

2.2.3. *Measuring the cost of capital*

13. In the sum-of-costs approach, the SNA includes the cost of using capital in the production of R&D. This relates to the consumption of fixed capital and, in case of market producers, a return to capital. The consumption of fixed capital captures the costs associated with the decline in the value of capital as it is used in the production over multiple accounting periods until it ‘wears out’ or becomes obsolete¹³. In business accounting this is often referred to as depreciation and it is relevant for all R&D producers that use capital goods in their production process. The return to capital reflects the opportunity costs of using capital in the production of R&D, i.e. diverting from other possible uses that yield an economic return. As non-market producers do not aim to maximize their profits, the SNA adopts the convention that their cost of capital should not include a return to capital, but for market producers this is a relevant component.

14. As the Frascati Manual focuses on measuring transactions as they occur, it does not contain information on depreciation. This is usually not included as a separate item in the Frascati Manual surveys, to avoid the risk of double counting. Furthermore, information on the opportunity costs of using capital in the production of R&D is not covered in the surveys as it does not constitute an actual transaction. This means that countries have to rely on other methods to account for the cost of capital, i.e. estimating for the consumption of fixed capital and deriving a mark-up for net operating surplus.

Consumption of fixed capital

15. Just a few countries use information on consumption of fixed capital as directly reported by entities, such as from tax data or survey data. Instead, a majority of countries derive consumption of fixed capital on the basis of the PIM, taking the capital stock that is used in the production of R&D as a starting point and deriving depreciation on the basis of a specific depreciation approach (see Section 2.6). Estimates of investment used in the production of R&D are captured in the Frascati Manual measure of GERD. Although these expenditures should not be included when summing costs to measure output, the value of the capital services (including consumption of fixed capital) provided by the stock of fixed assets used in the production of R&D should be included.

16. In a large number of countries, estimates of consumption of fixed capital in producing R&D are based on proxies drawn from R&D intensive industries, typically the ‘Scientific research and development’ industry (NACE 72) and/or other industries where R&D forms a significant part of output. In these cases, the ratio of consumption of fixed capital to the amount of current expenditures (sometimes including compensation of employees) is applied to the current expenditures in producing R&D in other industries to arrive at a value for consumption of fixed capital in these latter industries. In using this proxy approach, it is important to note that existing R&D assets may often be used in the production of R&D by commercial R&D producers (e.g. in NACE 72). However, by convention, for other R&D producers (i.e. not in NACE 72¹⁴), it is assumed that own-account production of R&D will mainly be used (and consumed) in regular production rather than for the purpose of producing

¹³ See also Recommendation 2 of the OECD Handbook (2010): “Intellectual property products are not subject to wear and tear, but they can be subject to amendment and augmentation.”

¹⁴ It is important to underline that for commercial R&D producers this is only relevant with regard to own-account R&D, as purchased R&D is treated as intermediate consumption in the production of new R&D for commercial R&D producers (see Eurostat Manual on measuring Research and Development in ESA 2010, Box 3.1 and para. 3.19-3.21). For all other entities, purchased R&D is treated as GFCF.

new R&D. For that reason, in deriving the proxy ratio as described above, consumption of fixed capital related to existing R&D assets should be excluded when estimating the proxy ratio for industries outside of NACE 72.

17. The suggested exclusion of consumption of fixed capital of existing R&D assets in the valuation of own-account production of R&D does not imply that overall consumption of fixed capital should be reduced, but rather that it should not be regarded as a cost element in the production of new own-account R&D (except, as explained above, for commercial R&D producers). However, consumption of fixed capital of existing R&D assets is still a cost related to the other production activities of the relevant units/companies. This means for non-market producers that the consumption of fixed capital of existing R&D assets feeds into the overall sum-of-costs valuation of their total output. This issue may be particularly relevant with regard to government finance statistics, also related to the fact that for pragmatic reasons all expenditures by government intended to result in an IPP that can be used for production for more than a year should be recorded as gross fixed capital formation (see OECD Handbook on deriving capital measures of IPPs and the Eurostat Manual on measuring R&D in ESA 2010). This also applies to ‘freely available R&D’ produced by general government. This convention is justified with the fact that these IPPs constitute a public good which is beneficial to society for a longer period of time, similar to public roads and bridges.¹⁵

18. In very few cases countries arrive at an estimate for consumption of fixed capital on the basis of an assumed ratio, but this is not to be preferred.

Recommendations:

3. Given that company reporting of information on capital stocks or consumption of fixed capital (CFC) is not typically available or rarely aligns with national accounts concepts, for countries with sufficiently long time-series of GFCF used in the production of R&D, it is preferable to adopt the PIM approach to derive estimates of CFC to feed into the sum-of-costs approach for deriving output of R&D. For industries whose main activity is not the production of R&D, any investment in R&D should not, by convention, be included in deriving estimates of CFC incorporated in the sum-of-costs approach.
4. The alternative is to derive an estimate of CFC by using national accounts data for specific industries as a proxy, i.e. applying the ratio of CFC to the amount of current expenditures (i.e. intermediate consumption plus compensation of employees) in these specific industries to the current expenditures incurred in producing R&D in other industries. Data from industry ‘Scientific research and development’ (NACE 72) could serve as the basis of a robust proxy. However, if data for this industry is too volatile or does not seem plausible, data for other industries where R&D forms a significant part of output may also be considered. In deriving the proxy, any consumption of fixed capital related to existing R&D assets should be excluded for calculating the value of own-account production of R&D in industries outside of NACE 72. Applying an arbitrary rate is not recommended.

¹⁵ The way in which the recommendation under this point should be elaborated in COFOG statistics should be taken forward by government finance statistics (GFS) experts.

Return to capital

19. Almost all countries make estimates for the return to capital when estimating R&D output for market producers. A lot of countries rely on capital stocks as derived from the PIM, assuming a specific ex ante rate of return, which is the preferred approach.
20. Most countries use a proxy, usually based on the ratio of net operating surplus to either gross output or the sum of intermediate consumption and compensation of employees, observed in the ‘Scientific research and development’ industry (NACE 72). However, some countries look at different industries (e.g. ‘manufacturing’ (Section C), ‘professional, scientific, and technical services sector’ (NACE 74) or specific industries (or a set of companies¹⁶) with a high R&D intensity). In selecting the specific industries, it is important to assess the plausibility of the results. When the results look too volatile or implausible¹⁷, countries should consider selecting other or additional industries or applying an alternative approach.
21. A couple of countries use alternative methods to derive the mark-up, for example applying the long-year average of government bond yields to the capital stock of assets used in the production of R&D or looking at multi-year average profits as percentage of the sales of market-R&D as observed in the Frascati Manual survey data.
22. Looking at the levels of the mark-up across countries, this broadly ranges between 4 and 15 percent (with an exceptional rate of more than 20 percent).

Recommendations:

5. Countries should include an estimate for the return to capital in estimating own-account production of R&D output of market producers.
6. The preferred approach for estimating the return to capital is to apply an explicit rate of return to estimates of the capital stocks of assets used in producing R&D, derived from the PIM. An acceptable alternative is to apply a mark-up based on NA data, such as the ratio of net operating surplus to (preferably) capital stock or to the amount of current expenditures (i.e. intermediate consumption plus compensation of employees), for relevant specific industries, ideally the ‘Scientific research and development’ industry (NACE 72)¹⁸. Applying an arbitrary rate is not recommended.

2.2.4. Adjustment for double counting of own-account software and databases

23. The SNA specifically distinguishes own-account production of software and databases from the production of R&D. However, whereas this distinction is relatively straightforward from a theoretical point of view, this may be more problematic from a practical point of view. Only a few countries specifically ask information on the production

¹⁶ Some countries also apply specific mark-ups for companies that are part of a multinational corporation, for example on the basis of the relevant ratio for the parent company or of the parent company’s industry.

¹⁷ In this regard, it is important to highlight that a negative ratio is not necessarily implausible. Negative mark-ups may for example occur in case of investment grants provided for the development of R&D. Furthermore, in some years some companies may run a temporary loss.

¹⁸ If the data of this industry does not seem to provide a plausible proxy, data for other sectors where R&D forms a significant part of output may also be considered.

of in-house software, whereas most countries have to rely on assumptions to derive relevant estimates. It has to be borne in mind that own-account production of software and databases may be covered in the sum-of-costs method in estimating own-account production of R&D, so in that case, the latter will have to be corrected to avoid double counting.

24. The approaches applied by countries to adjust for double counting show large differences. Some countries make an adjustment by excluding (part of the) expenditures as reported in the Frascati Manual survey for entities in a specific industry, such as ‘manufacture of computer, electronic and optical products’ (NACE 26), ‘computer programming, consultancy and related activities’ (NACE 62), ‘Information service activities’ (NACE 63) and/or ‘scientific research and development’ (NACE 72), and assign these to computer software and databases. Others focus on expenditures in a specific research field as reported in the surveys, such as R&D in computer programming. A range of countries make an adjustment on the basis of labour data. This may be done by correcting Frascati Manual data with information on the number of employees working on own-account software (or with a specific occupational code) from other data sources, such as structural earnings statistics or census data (see for more information Chapter 3).

25. It is important that countries investigate to what extent double counting may indeed be an issue when compiling results for own-account production of R&D and of software and databases. They should then assess which method as described above will perform best in making the relevant adjustment to correct for the double counting. In these cases, it is important to ensure that the adjustment is limited to the part that relates to own-account production. It may for example be the case that the information on software also includes information on the part that is intended for sale (for example when amending the Frascati survey with additional information on software development with the intention of using that information to adjust for double counting). In that case, only the part that relates to software development for own use should be taken into account for the adjustment, as the other part will not be included in own-account production of R&D.

26. Box 2.3 includes a specific example from Denmark on how to validate source data for estimating own-account production of R&D and software, and how to avoid double counting.

Box 2.3. Danish pilot study on validating source data for measuring own-account software and R&D

Statistics Denmark has worked on a pilot study – partially financed by Eurostat via an EU-grant – in order to improve the quality and use of source data for compiling own-account software and R&D output. The aim of the project was to improve the methods for grossing-up source data, distribute data across industries and cross-check information across different data sources.

The first part of the project was to improve the grossing-up procedures for non-covered units. For own-account software, grossing up was done by using fixed ratios, but these were considered to be outdated after being used for 15 to 20 years. Furthermore, for R&D, figures were grossed-up by legal unit on the basis of information on employment and turnover. The new methods for grossing-up own-account software and R&D expenditure are based on information from the adapted Structural Business Statistics (SBS) (i.e. employment and indirect production costs by KAU). Particularly for own-account software, the introduction of this new approach had a significant impact on the results. The pilot study showed that the

estimate for own-account software decreased by 10.1 percent as a result of the new approach, whereas the figure for R&D expenditure increased by 2.7 percent.

The second part of the project was a transformation from legal units to kind of activity units (KAU) in allocating R&D output and production of own-account software across industries. The main benefit of this part of the project was that it ensures consistency with information as included in supply-and-use-tables which are also based on KAU in Denmark. The transformation was done by bridging information between legal units and KAUs on the basis of SBS data. This part of the project left overall levels of R&D output and production of own-account software unaffected, but led to a change in their distribution across industries.

The third part of the project was to cross-check source data for the production of R&D and own-account software with other data sources, specifically focusing on wages and salaries. Estimates for own-account production of software are based on Statistics Denmark's salary statistics, focusing on selected occupations (i.e. software developers and application programmers). This information was confronted with data from the survey on ICT expenditure in enterprises. For larger units, it was decided to replace the occupation based estimates with wage figures from the ICT statistics. This cross-check resulted in a net increase of 20.4 percent in the estimate for own-account software in 2015. Furthermore, the combined values of wages from Frascati Manual data (used for compiling R&D output) and those as used for the estimation of own-account software were confronted with SBS data at unit level. If the combined level of wages exceeded the one as recorded in SBS, the former were adjusted proportionally. This led to a net downward adjustment of R&D expenditure (i.e. wages and intermediate costs) with 0.4 percent and of own-account software with 1.4 percent in 2015.

In combination with introducing updated source data, the above projects led to an increase in results for own-account software with 5.1 percent (0.4 percent of GDP) and for R&D expenditures with 3.5 percent (0.6 percent of GDP) for the year 2015.

Recommendations:

7. Countries should avoid double counting of own-account production of software and databases in estimating own-account production of R&D. For that purpose, countries should investigate if a noticeable amount of own-account production of software and databases is included in the sum-of-costs method when estimating own-account production of R&D, and are encouraged to include them in separate estimates for own-account production of software and databases.

2.3. Ownership of R&D output

27. R&D output is most often the starting point for deriving estimates of gross fixed capital formation (GFCF) in R&D. Depending on the nature of the output (i.e. market output for sale, own-account R&D and non-market R&D) and information on the funding, it can be assigned to the relevant industry or sector and included in the GFCF and capital stock statistics. This allocation is often very straightforward (e.g. in case of own-account production or an explicit purchase of R&D). However, in some cases, the owner of the R&D output is not evident. This is mainly the case when the R&D producer is part of a multinational enterprise (MNE) or when it is receiving funding from the government. The funding may often relate to the initial owner of the R&D, however R&D products can change ownership at a later stage. Changing ownership within an MNE complicates the issue further,

especially when special purpose entities (SPEs) are involved. All these elements regarding ownership of IPPs are discussed in more detail in Chapter 5.

2.4. Gross Fixed Capital Formation

2.4.1. Introduction

28. As explained in the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010), there are two ways to derive estimates of Gross Fixed Capital Formation (GFCF) in R&D. The first approach is surveying entities to ask for details on their expenditures, also known as the 'demand-side' approach. The second approach is by estimating the supply of R&D and allocating it to different uses. In this approach, estimates of investment are usually derived as the residual of supply (output plus imports) and estimated expenditures on intermediate and final consumption, exports, and changes in inventories. This is known as the 'supply-side' or 'commodity flow' approach. The main advantage of the demand-side approach is that it is a direct measure, but it has the disadvantage that it often leads to underestimation because respondents do not typically identify all of their expenditures on IPPs in a way that is consistent with the SNA definition of an IPP asset. The main advantage of the supply-side approach is that the major components of supply and use for capital products (output, imports and exports) are comparatively well measured at a detailed product level, although there is considerable room for improvement in respect of IPPs. The main disadvantage is that the supply-side approach does not provide estimates by type of user. For these reasons, it is recommended that the two sets of estimates be confronted and reconciled using supply-and-use tables in such a way as to take account of their relative strengths and weaknesses¹⁹.

29. When looking at the supply-side approach, it has to be understood that the SNA treats almost all payments for R&D services as an acquisition of R&D assets (i.e. GFCF). However, an exception is made when the purchasing unit is in the “Scientific research and development” industry (NACE 72). As these units specialise in the performance of R&D, the purchased R&D may be used as input in their production of R&D²⁰. In the absence of detailed information on the nature of that input (i.e. as a capital input used across multiple periods or as an intermediate input in a specific R&D project), national accountants make the simplifying assumption that all such R&D is incorporated, without transformation, in the R&D performed by the purchaser (OECD, 2010). This means that a significant amount of

¹⁹ See also recommendation 6 of the OECD Handbook (2010): “Whenever possible, estimates of purchased fixed assets should be derived using both the demand and supply-side approaches, and then confronted and reconciled with each other.” Furthermore, recommendation 7 states that “Whenever possible, estimates of own-account gross fixed capital formation should be derived using both micro and macro approaches, and then confronted and reconciled with each other.”

²⁰ See also recommendation 3 of the OECD Handbook (2010): “Only in cases where units specialise in producing a type of intellectual property product for sale should acquisitions of that type of product be expensed, or if it is clear that they are completely embodied in another product.” This is confirmed by recommendation 20 which states that “unless specific information to the contrary exists, all expenditures on purchases of R&D or on R&D production by market producers in the Scientific Research and Development industry (Division 72 ISIC rev. 4) should be recorded as intermediate consumption, or otherwise expensed on the presumption that such units produce R&D for sale, and any purchases are incorporated in products for sale. Only when specific information is available to the contrary should acquisitions of R&D be recorded as gross fixed capital formation, such as R&D performed by start-ups that do not yet have sales or cases when a unit takes out a patent and sells licences to use.”

R&D may be recorded as intermediate consumption and should be included as current cost of the relevant entity in deriving its R&D output on the basis of the sum-of-costs approach.

2.4.2. Methodology and country practices

30. Almost all countries calculate GFCF of R&D as the residual of supply and demand of R&D products (as shown in Table 5.2 of Eurostat Manual on R&D and page 58 of the OECD IPP Handbook). Only one country uses a demand-side approach by directly surveying GFCF of R&D.

31. As almost all countries use the supply-side approach, it is interesting to assess what amounts countries record for the different types of use in their supply-and-use tables with regard to R&D. Countries show quite different results in this regard. Some countries allocate all of the domestic use to GFCF, whereas other countries also record considerable amounts of intermediate consumption and final consumption (by the government), and in some cases even inventories²¹. It will often depend on the availability of underlying information how these amounts are assigned to the different types of use. However, as different allocations may significantly affect GFCF estimates, it is important that compilers try to come up with best estimates for all use categories, even if underlying data sources may be lacking, and to assess the reliability of the (residual) outcomes. In this case, it may be helpful to apply this methodology at a sufficient level of detail of R&D. Furthermore, most countries will have separate information on own-account production which may also add to the quality of the estimates. In deriving the information for the various use categories, several countries also take into account the acquisitions and disposals of R&D assets, as derived from the Frascati Manual surveys and from Balance of Payments or foreign trade statistics with regard to cross-border transactions²². However, more than half of the countries do not take into account acquisitions and disposals of R&D assets due to lack of data. Moreover, analysis of foreign trade statistics concerning IPPs showed that the asymmetries in this area are quite large, which is an indication of quality concerns.

32. An issue that occurs in deriving results on the basis of the residual approach is that data sources do not always contain information that is fully comparable. For that reason, recommendation 11 of the OECD Handbook (2010) also explains that “business records of asset acquisitions should only be used to derive estimates of gross fixed capital formation of intellectual property products with extreme caution”. Issues may arise when data sources differ in scope, in coverage, in level of detail, and when they use different definitions. These issues should be borne in mind when confronting data from different data sources and ideally adjustments are made beforehand to correct for any differences. Confrontation of data at macro, meso and micro level may prove useful for this purpose. In that regard, several countries have created Large Case Units in which data from different data sources is confronted at the micro level for the largest units in the economy in order to spot and correct any inconsistencies. This may be very beneficial in deriving good quality results on GFCF on R&D when applying the residual approach.

²¹ In this case it seems to be an anomaly caused by the use of a specific balancing technique, in the absence of information on the use split.

²² It also has to be borne in mind that R&D GFCF may become negative in specific industries, in case of large disposals of R&D assets.

Recommendations:

8. Countries are encouraged to confront supply and demand of R&D on the basis of multiple data sources in deriving estimates of GFCF.
9. In confronting multiple data sources, compilers should take into account any differences in scope, coverage, level of detail, and definitions between the data sources and correct for the impact of these differences, possibly by making confrontations at the macro, meso and/or at the micro level.

2.4.3. Available breakdowns

33. Recommendation 5 of the OECD Handbook (2010) states that “the degree of product detail should be determined by the needs of users, data availability and the heterogeneity of the products, taking account of the rate of price change and variation in the service lives”. Furthermore, the Frascati Manual advocates compiling estimates not only at the level of the whole economy but also for institutional sectors and industries. This provides valuable insights into the relative size and importance of different parts of the economy in terms of R&D. The compilation of R&D output statistics at the institutional sector level is facilitated by the close relationship between Frascati and SNA sectors and recommendations in the 2015 Frascati Manual to use common registers and dual tagging. The use of business registers is also relevant for the compilation of R&D output at the industry level (within or across institutional sectors). Alternatively, some countries collect the information needed to assign R&D performers to an industry through their R&D surveys.

Breakdown by actor

34. All countries responding to the survey estimate R&D GFCF broken down by institutional sectors. More than half of the countries calculate R&D for all main institutional sectors, but for other countries information on one or more sectors is missing. When looking at the sector coverage, all countries compile information on the non-financial corporations sector and the general government sector. Furthermore, almost all countries have information available for the financial corporations sector. Information on the household sector and the non-profit institutions serving households has the lowest coverage, although both sectors are still covered by around two thirds of countries. In addition to the main sectors, some countries also compile information at a more detailed level, breaking down the two corporations’ sectors into public and private corporations.

35. Almost all countries also compile GFCF data on R&D by industry. Half of them use NACE 2-digit level classification for the industry breakdown, whereas quarter of countries uses a more detailed classification and the remaining quarter a more aggregated breakdown.

36. A lot of countries use business register data to derive the sector and industry classification, whereas funding data from the Frascati Manual survey also constitutes an important data source. In some cases the classifications can be derived from administrative data or from information provided in surveys. As the ownership of R&D often depends on the funding, several countries use multiple data sources.

Breakdown by nature

37. Only a small number of countries produce GFCF data on R&D at a more detailed level of asset type. A couple of countries break it down into type of R&D, i.e. R&D in natural sciences and engineering (CPA 721) and R&D social sciences and humanities (CPA 722) or into basic and applied research and experimental development. One country breaks down GFCF into purchased and own-account produced R&D. Furthermore, one country has estimations for the types of R&D by the COFOG classification in the general government sector.

Recommendations:

10. Countries should break down their GFCF estimates at the level of the main institutional sectors. Furthermore, countries should try to compile results at the 2-digit ISIC/NACE industry classification level.

2.5. Measurement of price changes

2.5.1. Introduction

38. As R&D activity is heterogeneous, and because most of R&D is produced on own account rather than sold for a price, R&D prices are especially difficult to measure. The OECD Handbook (recommendation 21, page 61) states that “in principle, output, or pseudo-output, price indexes should be derived for R&D. But at the present time no consensus has been reached on how such price indices should be derived. Until that time input-cost price indices should be used“. This is confirmed by the Eurostat Handbook on prices and volume measures in national accounts (Eurostat, 2016) that explains that an A method does not exist as “neither collection of actual output prices from e.g. the research institutes nor ‘model prices’ makes sense since you cannot meaningfully price the same R&D output in two periods in succession”. For that reason, the Handbook recommends using input methods as B methods. For marketed output, the Handbook recommends so-called charge-out rates (i.e. price charged per hour) or hourly fees deflated by a general measure of inflation, in combination with an index of average wages, to arrive at measures in volume terms. For own-account production, the Handbook explains that price change can be based on the weighted average of the price movements of the inputs used in the production of R&D. For non-market output it refers to the standard methods for producing volume growth estimates of collective services. The Frascati Manual also recommends the use of input price indices, constructed from detailed breakdowns of input costs.

39. Because of the importance of price measurement for the measurement of net capital stock of R&D and the difficulties in measuring price changes, this section looks at the methodologies applied by countries to measure price changes.

2.5.2. Methodology and country practices

40. Over the period 1995-2017, price indices for R&D GFCF show large differences across countries and across industries. These may be explained by differences in the approach to measure prices (i.e. input-cost approach versus output-price approach), costs that are taken on board in applying the input-cost approach, at what level of detail (in terms of industries)

price measures are derived, and whether productivity or quality adjustments are made²³. Furthermore, the Task Force discussed that diverging trends may also be caused by different balancing procedures for current and constant price series²⁴.

41. Most responding countries, with only a few exceptions, use the same price measure for own-account and purchased R&D. Almost all countries use an input-cost approach for these two categories. The costs that are taken into account in this approach vary across countries. Several countries look at a full range of costs, including compensation of employees, intermediate consumption, consumption of fixed capital, and, in some cases, taxes on production, capital purchases, and net operating surplus. However, several countries only look at some of these components. It is obvious that the overall price deflator may be very dependent on the costs included in the approach and on their relative importance. In this regard, in some countries the deflators may be largely driven by the labour cost index, whereas in others countries the impact of non-labour cost may be more important. Results showed that the non-labour cost components usually have a smoothing effect on the price trends, usually leading to more convergence across countries²⁵ and industries. In applying the input-cost approach, it is important that countries try to apply it at the most detailed level, e.g. looking at underlying occupations for compensation of employees and at underlying products for intermediate consumption, to arrive at the most accurate results.

42. In applying the input-cost approach, only very few countries make an adjustment for productivity changes. Those that do so base it on changes in multifactor productivity of the private sector, by applying a fixed rate each year, or on a case-by-case basis at the micro level. In most cases it is applied to all R&D, although in a single case it is only applied to a specific institutional sector (i.e. the general government). In case countries are able to come up with reliable estimates of productivity change, these may be used to improve their input-cost price estimates.

43. A few countries use an output price approach or a consumer price index for estimating R&D price change. This seems like an acceptable approach but only if good quality information is available on price changes in one or some R&D categories, for example with respect to ongoing licences to use existing R&D, which may also serve as a useful proxy for price change in other R&D types; recalling that the objective is to measure price change – and so the assumption is that price changes in broader R&D expenditures can be reasonably proxied by price changes in specific R&D categories where price changes²⁶ are observable. Following this logic, in some countries the output price approach is also specifically applied to own-account R&D. However, such an approach is not recommended, especially in cases where the observed output-based prices (used for consumption of R&D) reflect imported R&D. An output or pseudo-output price index, in theory, reflects both input costs and

²³ On a theoretical level, the use of different price index formulae (e.g. Paasche, Laspeyres or Fischer) may also partly explain differences in deflators across countries. However the relevance of this potential determinant has not been further investigated by the Task Force.

²⁴ This may particularly be an issue in re-balancing time series information after a benchmark revision.

²⁵ Of course also bearing in mind that general price trends may differ across countries. This should be accounted for when comparing deflators across countries. For this purpose, the results can be scaled against the general GDP deflator.

²⁶ However, considerable care is needed to ensure that the price changes observed in transactions for comparable R&D products are truly representative. For example, the use of price changes observed in royalty payments should be treated with some caution if the payments reflect payments for R&D that may be more than a few years old, as in that case the price change is likely to also capture aspects of obsolescence.

productivity gains (which are also difficult to measure) although an output price index may also capture any unrelated factors that affect output prices. This output price approach is sometimes based on price indices of related products or by using the CPI (either a general CPI or a CPI for services).

44. Although several countries apply the same price indices across sectors and industries, almost half of the countries apply different indices depending on the sector or industry. Separate indices are, for example, derived for ‘academic R&D’, ‘(central) government R&D’ and ‘business R&D’. In some cases, different indices are compiled at the industry level depending on differences in underlying data sources.

45. Compilers are encouraged to explicitly analyse the price trends for GFCF series on R&D in the compilation process. This can be done by frequently analysing the implicit deflators derived as GFCF in R&D in current prices divided by GFCF in constant prices. Ideally, this is done at the most granular level of detail, as underlying series may show different trends and their impact on the totals may change over time due to changing weights. If possible, compilers should analyse their results in comparison with other countries and cross-check the results across industries. In case of remarkable trends or differences, compilers should check the plausibility of the results by exploring the main underlying reasons.

Recommendations:

11. If good quality information is available on price change in purchased R&D products, this can be applied in deriving volume estimates for the use and (with the appropriate adjustments for taxes, subsidies and margins) the output of purchased R&D.
12. For own-account R&D input prices will have to be applied. This approach requires a breakdown of the various components (i.e. compensation of employees, intermediate consumption, consumption of fixed capital, net operating surplus, and taxes less subsidies on production), if possible including compensation of employees by occupation.
13. Separate estimates of prices by sector and by industry are preferred wherever R&D activity is likely to differ for businesses, government, and non-profit institutions and across industries.
14. Compilers should explicitly assess and validate the trends of their R&D GFCF deflator, ideally at the most granular level of detail.

2.6. Estimation of net stocks of R&D

2.6.1. Introduction

46. All countries derive their estimates of net capital stock of R&D on the basis of the PIM. This method involves aggregating deflated GFCF in R&D over time, allowing for declines in value until assets reach the end of their service lives and are retired. Two important components for deriving estimates on the basis of the PIM, i.e. GFCF in R&D and price indices of R&D, have already been discussed in the previous sections. However, information is also needed on the retirement (or mortality) profiles of the R&D assets to model how their relative value develops over time. For that reason, this section focuses on the determination of the service lives of groups of assets and the depreciation profiles for categories of R&D

assets. Furthermore, it is discussed at what level of detail countries compile estimates of R&D capital stock.

47. Information on the length of time over which R&D assets are used (their “lives”) allows survival and depreciation profiles to be computed to keep R&D assets in the capital stock for an appropriate duration. Although R&D assets are not subject to the wear-and-tear which afflicts physical capital, the useful life of R&D is limited because R&D is generally superseded at some point by further research which renders it obsolete (either instantaneously or gradually so that the old R&D asset loses its value over time). Common approaches to estimating R&D service lives are survey questions asking about how long R&D assets are useful for/provide benefits to their owners and deriving estimates from administrative data on payments of annual patent renewal fees (on the assumption that patents protect the results of R&D, are only renewed if the R&D they protect remains of value, and that findings will be representative of R&D in general). This information provides useful input to derive average service lives for groups (or cohorts) of assets. Furthermore, in the absence of direct information, the Manual on measuring Research and Development in ESA 2010 (Eurostat, 2014) includes a recommendation that “a service life of 10 years is acceptable until further reliable information becomes available”.

48. In addition to determining the service life, it is also important to decide how the value of assets depreciates over time. In general, there are two approaches that are used for this purpose. The first one is the linear approach in which the value of the asset depreciates linearly at a constant value every year. The second is to use more complex functions, such as the geometric or hyperbolic approach. In the geometric approach the value of the asset depreciates at a constant rate every year. The depreciation rate δ is usually computed by a declining balance rate (DBR) divided by an average service life. As a particular vintage of investment approaches its average service life, its value approaches zero, but, with geometric depreciation, only reaches zero when combined with a retirement function. The hyperbolic approach is a form of delayed depreciation in which depreciation is concave to the origin (i.e. bowed outwards). This means that depreciation is lower in the early years of the asset’s life and increases as the asset ages.

49. With regard to the retirement function, it has to be borne in mind that assets will usually not retire from the capital stock simultaneously. For that reason, depreciation often includes an assumption on the retirement pattern of the group of assets, usually based on their average and maximum service life. In some cases, countries apply a delayed linear retirement pattern which assumes that retirement starts after a certain period of time, after which equal parts are discarded until the entire vintage has disappeared. However, it is more common to use a bell-shaped function in which retirement starts gradually after a period of time, builds up to a peak around the average service life and then tapers off in a similar gradual fashion some years after the average. Various mathematical functions are available to produce bell-shaped retirement patterns and most provide considerable flexibility as regards skewness and peakedness. They include gamma, quadratic, Weibull, Winfrey and lognormal functions. The last three are most widely used in PIM models. By applying the specific type of depreciation in combination with the retirement profile to the various cohorts of assets, the value of each cohort can be derived. When this is applied to time series of GFCF, this yields a measure of the net capital stock of R&D assets (OECD, 2009). Recommendation 15 of the OECD Handbook (2010) explains that because the geometric model has a number of advantages, it should therefore be used unless there are strong conceptual or practical objections.

2.6.2. Methodology and country practices

50. Most countries apply geometric depreciation in measuring net capital stock of R&D. Most of these countries use the double declining balance rate (DBR=2) in determining the depreciation rate while some use smaller rates, ranging between 1.0 and 1.88. Combined with assumptions on average service lives, this leads to depreciation rates ranging from 0.063 to 0.400. Although the application of geometric depreciation does not necessitate the use of an explicit retirement distribution (as pure geometric depreciation means that the asset is never retired), several countries do apply retirement profiles such as delayed linear, truncated normal, log-normal, and Weibull. The countries that apply the hyperbolic approach all combine this with a bell-shape retirement pattern. The efficiency reduction parameter varies across the countries, ranging from 0.75 to 1, whereas they all apply a discount rate of 4.0 percent. Most of the countries applying linear depreciation combine this with a bell-shaped retirement pattern such as normal, log-normal or truncated-normal or (in one case) with a delayed linear retirement pattern. Only few countries apply linear depreciation without any retirement pattern.

51. Looking at the average service lives of R&D assets, this ranges between 8 to 12 years across countries, with most countries applying an average service life of 10 years. Some countries apply the same service life across all types of R&D assets and across sectors and industries, whereas several countries make distinctions in this regard. Some countries differentiate in service lives for different types of R&D, assigning relatively long service lives to 'basic research' (12-13 years), slightly shorter service lives to 'applied research' (10-11 years) and the shortest service lives to 'experimental research' (8-9 years). Other countries distinguish R&D service lives by industry, e.g. assigning relatively long service lives to R&D by manufacture of chemicals and chemical products (NACE 20), of basic pharmaceutical products and pharmaceutical preparations (NACE 21), and/or of machinery and equipment n.e.c. (NACE 28). Again other countries focus on the type of product, e.g. assigning longer service lives to R&D for 'chemicals', 'textile', 'basic metal', 'fabricated metal products' and 'electricity, gas and steam supply' and short service lives to 'electronic and electrical equipment'. Finally, some countries distinguish according to institutional sector, usually assigning longer service lives to R&D in the corporations' sectors and shorter service lives to R&D in the general government sector and the non-profit institutions serving households' sector. Several countries also combine some of these elements to derive service lives at an even more detailed level.

52. Regarding the data sources to derive the service lives, some countries have access to direct information, for example from survey data or from patent data. However, a lot of countries have to rely on international guidelines, advice from experts, estimates used by other countries or guidance that is used for taxation purposes. It is also recognized that it is difficult to obtain good quality data on service lives from surveys.

53. The service life is also important for determining the minimum length of time series information on GFCF in R&D that is needed to calculate the relevant net capital stock of R&D. In the PIM, GFCF volumes need to be cumulated over a number of years equal to the maximum service life in order to arrive at the appropriate estimate of capital stock for the current period. Countries are encouraged to compile longer time series of GFCF, that would allow to calculate longer time series of net capital stock of R&D, but at the minimum countries should cover the period needed to arrive at a proper stock estimates for the current period.

Recommendations:

15. Countries should regularly re-examine the service lives of the different types of R&D assets. In the absence of direct information, using a service life of 10 years is acceptable until further reliable information becomes available.
16. In measuring net capital stock of R&D, the geometric depreciation approach is preferred unless there are conceptual or practical objections.
17. Back-casting of GFCF in R&D should at least cover the period needed to arrive at proper stock estimates for the time period covered in the publication.

3. Computer software and databases

3.1. Introduction

54. This chapter describes the available sources, methodologies and calculation methods for the measurement of net capital stock of software and databases. The 2008 SNA explains that **computer software** consists of computer programs, program descriptions and supporting materials for both systems and applications software (see para. 10.110 of the 2008 SNA). **Databases** consist of files of data organized in such a way as to permit resource-effective access and use of the data (see para. 10.112 of the 2008 SNA). Even though they are defined separately they are often grouped together into one category because they are difficult to separate in practice, in particular the software component in a database. Computer software and databases are regarded as assets if they are to be used in production by their owner for more than one year. Both the software and databases may be intended for own use or for sale. Gross fixed capital formation in computer software includes both the initial development and subsequent extension of the software original, as well as the acquisition of copies which classify as assets.²⁷ Also the purchase of software licences may be treated as gross fixed capital formation if it is expected to be used in production for more than one year and the licence assumes all the risks and rewards of ownership. Similarly, the purchase of a database as an entity or the purchase of a licence to access the information in a database may qualify as the acquisition of an asset if above mentioned criteria are met.

55. This chapter discusses the various steps in deriving estimates of the net capital stock of computer software and databases. However, before going into detail on the various components, Section 3.2 first discusses the issue of obtaining separate information on databases. Section 3.3 then discusses the estimation of output of computer software and databases. Subsequently, Section 3.4 discusses the issue of economic ownership. Section 3.5 focuses on the measurement of GFCF of computer software and databases, whereas Section 3.6 discusses the measurement of price changes. Section 3.7 explains the methodologies that are applied by countries in estimating the net stock value of computer software and databases, also focusing on how they determine the service life and what retirement function they use.

3.2. Focus on Databases

3.2.1. Introduction

56. As was mentioned above, databases consist of files of data organized in such a way as to permit resource-effective access and use of the data. When looking at the delineation of databases to be included in the estimates, the asset boundary in the 1993 SNA was limited to 'large' databases, but this restriction was omitted in the 2008 SNA.

57. According to para. 10.112 of the 2008 SNA, "databases may be developed exclusively for own use or for sale as an entity or for sale by means of a license to access the information contained". Databases for sale should be valued at market price, including the value of the information content, and if available separately, excluding the value of a software component, which should be recorded as the sale of software (see para. 10.114). The value of own account databases should be derived on the basis of a sum-of-costs approach, focusing on "the cost of preparing data in the appropriate format" which "will include staff time

²⁷ See 2008 SNA 10.110.

estimated on the basis of the amount of time spent in developing the database, an estimate of the capital services of the assets used in developing the database and costs of items used as intermediate consumption". The following cost elements can be distilled from this paragraph: i) the cost of preparing data in the appropriate format; ii) staff time spent on developing the database; iii) capital services of the assets used in developing the database; and iv) costs of items used as intermediate consumption.

58. What is explicitly excluded from the value of own account databases are the costs related to purchasing or producing the database management systems (DBMS) and costs associated with "acquiring or producing the data". A major reason why the SNA chose to record DBMS under software rather than databases per se, reflects two key factors: (a) the fundamental nature of the DBMS, especially 'off-the-shelf DBMS', is that it is software and (b) in practice the approaches used to estimate own-account software would almost certainly include any costs in developing a DBMS (see below). Costs related to "acquiring or producing the data" are excluded from the value of own account databases, in order to exclude any value associated with the actual knowledge embodied in the data from the valuation of investment in databases²⁸.

59. Estimating the value of own-account software (including database management systems) is typically done on the basis of a sum-of-costs approach using information from labour force surveys on staff of particular occupations, such as software engineers, combined with information on hours and employment costs as a starting point. Especially when data processing is the core business of the company involved, it will be hard to delineate the costs made on the DBMS from other forms of software. The OECD Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010) proposed using time spent by occupation groups like 'database assistants/clerks', but in reality, this may now be an outdated way of viewing the activity of developing databases – much of database creation may now be instead performed by staff with occupations such as 'software engineers', 'system architects', or more recently 'data scientists'. Similarly it may be the case that such job roles have been replaced by the capital services provided by software developed for the purpose of updating, structuring, and interrogating databases. There may also be challenges in estimating the other costs involved in developing own-account production of databases, as described above, such as the capital services of the assets that are specifically used for developing the databases and the intermediate products that are specifically used for this purpose. Also with regard to purchased software and databases, it may be difficult to arrive at the correct distinction between software and databases. For example, when sales of entire databases occur, it may be difficult to separate out the part that relates to the underlying database management system (DBMS), which should in theory be recorded as software (see also para. 10.114 of the 2008 SNA).

60. This leads to two important practical issues to address. Firstly, is it really possible to delineate the costs for developing the database apart from developing the database management system? In practice this work could be intertwined. It is important here to discern between off-the-shelf (or even free) database management systems, and the own-account development of algorithms to automate the work of interrogating/classifying/structuring data. Although the 2008 SNA recognises a subcategory AN.11732 Databases, the priority of the Task Force is to improve the quality and the comparability of estimates regarding IPP asset category AN.1173 Computer software and databases, not of the two subcategories separately. In this regard, the ESA 2010 transmission programme does not require separate data on databases, mainly reflecting the difficulty in

²⁸ See for more information Ahmad and Van de Ven (2018).

differentiating between databases and software in practice. It is therefore more important that the abovementioned elements are included in category AN.1173 Computer software and databases (without double counting!) than the allocation in the proper subcategory.

61. Secondly, the cost of preparing data in the appropriate format could be very close to the cost of 'acquiring or producing the data', while these latter costs should be excluded according to the SNA. Actually, the same goes for staff time spent on developing the database. In practice it is an ongoing process and (re-)developing the database could concern a mix of work on software and data.

Box 3.1. Databases as assets

The recommendation in the 2008 SNA not to include the cost of obtaining information when summing costs to value database gross fixed capital formation was, according to the Handbook on Deriving Measures of Intellectual Property Products (OECD, 2010), made primarily to avoid indirectly capitalising knowledge. That is not to say that the knowledge itself had no value, but instead it was to recognize that the knowledge (in an SNA sense) was not viewed as arising from an act of production, i.e. it was considered as non-produced.

Of course, when databases are sold in their entirety, a large part of the value may indeed reflect the embodied knowledge, which is why 2008 SNA para. 10.114 also says: "Databases for sale should be valued at their market price, which includes the value of the information content." In this respect, the data stored in databases are treated in the 2008 SNA in a comparable way as goodwill and marketing assets (see para. 3.51 which states that "goodwill and marketing assets are only recognized as assets in the SNA when they are evidenced by a sale"). Similarly to these assets, this would suggest that the new value which appears on the balance sheet when a database previously retained for own use is sold should be recorded as economic appearance of assets.

For the purpose of this report, a discussion about the possible inclusion of data within the asset boundary would go (way) too far. It would mean a fundamental change of the SNA and should be (if at all) part of the SNA research agenda. So, in this context the exclusion of the content of databases produced for own use is regarded as a given. However, for further elaboration on the character of databases and for possible future discussions a number of remarks are listed below:

- In a recent article in the Economist (May 6th-12th 2017) data is regarded as the world's most valuable resource (and no longer oil).
- For companies like Google, Microsoft, Apple, Facebook and Amazon, data is more and more key business.
- Also industrial firms as General Electric and Siemens now market themselves as data firms.
- Initially data was used by companies primarily to target advertising better. In recent years they have discovered that data can be turned into any number of artificial-intelligence (AI) or 'cognitive' services.
- Big companies buy small companies. Sometimes for the data, but more often for the knowledge to collect and process the data (or to avoid the new company becomes too great a threat; so-called 'shoot-out acquisitions').
- Especially regarding personal data, ownership can be unclear.
- The quality of data has changed. They are no longer mainly stocks of digital information – databases of names and other well-defined personal data, such as age, sex and income. It is more about real-time flows of often unstructured data.
- Google's chief economist: "What matters more is the quality of the algorithms that crunch the data and the talent a firm has hired to develop them. Google's success 'is about recipes, not ingredients'."

For more information on this issue, please also see Ahmad and Van de Ven (2018).

62. Furthermore, the International Accounting Standard (38) on Intangible Assets does not mention the term 'databases'. Quoting Ahmad (2004): "Nevertheless it seems to be widely accepted in the business accounting world that valuable databases can and should be identified as separate intangible assets." However, would companies when approached to

provide data for a statistical survey really be able to give sound data on the intellectual property asset category Databases (excluding the software as well as the content)? In that sense, it is important to explicitly mention expenditures on databases in demand-side surveys to ensure that the relevant expenditures are included in the estimates for own-account production of AN.1173 Computer software and databases²⁹, but indirect methods for estimating the costs of own-account database production seem more promising to derive estimates for the specific subcategory.

63. Finally, in deriving stock estimates of databases, it has to be borne in mind that not all output or purchases of databases will automatically qualify as assets. This will only be the case for those databases with a useful life of more than one year. In the absence of specific information, the Handbook on Deriving Capital Measures of Intellectual Property Products gives the following advice: "Not all databases creation qualifies as GFCF. In the absence of any information on the proportion that does, it is recommended that it be assumed to be 50%."

3.2.2. Country practices

64. Only a few countries estimate databases distinctly from software. One country looks at data on acquisitions less disposals of purchased software. Two other countries make the distinction on the basis of information on occupations. A fourth country relies on assumptions, as no direct information is available. In applying the approach using information on occupations, it is important to have sufficient coverage at a relatively granular level of detail. For a lot of countries, this lack of coverage at this detailed level is the main reason for not making the distinction between software and databases. Furthermore, in the next update of the ISCO-classification, it is important to include more detailed breakdowns to clearly distinguish between occupations related to development of software and of databases.

Recommendations:

18. Costs of creation (extension/improvement) of databases must be included in assets category AN.1173 Computer software and databases. Distinguishing sub-categories AN.11731 Computer software and AN.11732 Databases may not be possible and should not be regarded as a high priority.
19. Strictly according to the 2008 SNA and ESA 2010, all databases should be capitalised. However, for pragmatic purposes, a focus on the databases that are key for a business (and not on all kinds of smaller databases for auxiliary activities) is acceptable.
20. For own-account production of databases, the valuation is estimated by using the sum-of-costs approach. The costs of the database management system and the acquisition of the data are excluded. The following costs should be included: costs of preparing data in the appropriate format; staff time spent on developing the database; and costs of items used as intermediate consumption. Furthermore, it should include an estimate for consumption of fixed capital used in the own-account production of databases and a mark-up for net operating surplus for market producers.

²⁹ It is also essential to specify the relevant categories to avoid respondents including costs that should not be covered under this category according to the 2008 SNA (e.g. related to the purchase of data).

21. To ensure that expenditures on developing databases (that satisfy the asset criteria) are included in the estimates for own-account production of AN.1173 Computer software and databases, demand-side surveys should explicitly mention expenditures on databases.

3.3. Measurement of output

3.3.1. Introduction

65. When deriving the output value of computer software and databases, it is important to bear in mind that, in case of sales, the software and databases should be valued at purchasers' prices, while in-house developed software and databases will have to be valued at their estimated basic price or at their costs of production. With regard to databases this usually includes the cost of preparing data in the appropriate format, time spent in developing the database, an estimate of the capital services of the assets used in developing the database and costs of items used as intermediate consumption. However, it does not include the cost of the database management system (unless used under an operating lease) or the cost of acquiring or producing the data. For software, there is no internationally comparable data source like the Frascati Manual provides for R&D. However, the 2015 Frascati Manual recommends collecting separate data on software R&D. Ideally, this should also be broken down by the various types of expenditure to allow straightforward incorporation in National Accounts methods. Response burden (including whether administrative sources might provide this information) and the prevalence of software activity in the economy (or individual industries) must be considered when designing data collections but, where possible, such collections can provide a vital empirical basis for the national accounts adjustments and a means by which to contextualise this important difference between R&D estimates from the two frameworks. Such an approach can help to provide a more comprehensive view of the specific roles of R&D and software in national economies.

66. In compiling estimates for own-account software and databases, there are generally two approaches. The first one is to use data directly obtained from demand-side surveys. The second approach is based on a sum-of-costs approach that takes as inputs labour costs for relevant occupations involved in the production of the relevant products and other expenses, including consumption of fixed capital, and a mark-up for net operating surplus. This is also known as the 'macro-approach'. Because own-account software is more typically produced across a range of industrial sectors (and not just the software producing industry), the macro-approach is usually regarded as more suitable for software and databases than relying on survey data.

3.3.2. Main data sources

67. A wide range of data sources is used across countries in the estimation of output of computer software and databases. All countries use multiple data sources, three on average. Structural Business Statistics (SBS), Labour Force Survey (LFS) and administrative or tax records are the most frequently used data sources, although a lot of countries also use information from specialized surveys, such as capital expenditure surveys or Information and Communication Technology (ICT) surveys. In some cases the latter constitute the main data sources, whereas in other cases they are used as secondary data source, used to cross-check the results. Other sources that are used include population and business census, structure of earnings surveys, international trade surveys, national accounts data and annual reports.

3.3.3. Methodology and country practices

68. Since it is difficult to produce separate estimates of databases, many countries produce estimates for the combined category “software and databases”. Software and databases can be produced on own-account or purchased, and the vast majority of countries produce estimates for both categories. Furthermore, almost half of the countries further distinguish purchased software into ‘pre-packaged’ and ‘customized’ software. In most cases, the distinction between these two categories is based on the activity of the producer of the computer services, i.e. software produced by companies included in ‘software publishing’ (NACE 58.2) is recorded under ‘pre-packaged’ software, whereas software produced by companies classified in ‘computer programming’ (NACE 62) is recorded as ‘customized’ software. One country also recognizes a separate category for ‘software licence’.

69. Most countries apply a macro approach in deriving estimates of own-account production. For this purpose, they start by estimating labour costs for various relevant occupations and then add up estimates for other expenses and apply a mark-up for net operating surplus. Only a small number of countries use information directly from statistical surveys (partly adjusted for profit margin), business accounts, or budget data for public entities or tax data.

70. The countries that use a macro approach include a wide range of occupations when deriving the labour costs. In general, countries focus on ISCO-08 categories ‘software and applications developers and analysts’ (ISCO 251) and ‘database and network professionals’ (ISCO 252) in line with the guidance from the OECD Handbook on deriving capital measures of IPPs. However, more detailed analysis of the descriptions and of the typical work tasks of the underlying subcategories indicates that not all of these occupations are likely to be involved in own-account software and database production. For that reason, some countries restrict their methods to certain sub-categories. Specifically in the case of ‘database and network professionals’ (ISCO 252), the subcategories ‘system administrators’ (ISCO 2522), ‘computer network professionals (ISCO 2523) and ‘database and network professionals n.e.c.’ (ISCO 2529) are less likely to be involved in own-account software and database production. For that reason, it would be better to exclude them from the calculations of estimates according to the macro approach. In contrast, subcategory ‘database designers and administrators’ (ISCO 2521) aligns closely with activities to transform data to facilitate resource-effective access to data, consistent with the definition of own-account databases. If countries have more detailed information on the types of workers that are included in each ISCO-08 category, this could also be used to include workers likely to be involved in own-account software and database production, regardless of their ISCO-08 category. In this regard, as was mentioned in section 3.2.2, it is important to have sufficient coverage at a relatively granular level of detail. Furthermore, in the next update of the ISCO-classification, it is important to include more detailed breakdowns to clearly be able to target the relevant occupations.

71. Information on the number of employees by occupation is combined with data on average wages and the average time spent on software development. Estimates of the average time spent by in-house staff on software development are either based on specific surveys (such as ICT surveys or structural business statistics surveys) or on expert knowledge and assumptions. Several countries apply the recommendation from the OECD Handbook on Deriving Capital Measures of Intellectual Property Products (OECD 2010) of 50 percent in case information or expert knowledge is missing. However, countries are encouraged to arrive at more accurate factors, by regularly assessing how much time persons in various occupations spend on own-account software and data production, possibly incorporating a wider range of occupations and possibly distinguishing between different industries and/or

types of corporations (see for more information Box 3.2 with country experiences by the UK and Slovenia). In the end percentages range from 10 to 100% (partially differentiated by occupation, industry and/or sector).

Box 3.2. Examples of analyses on occupations and time use factors in deriving estimates of own-account production of software and databases

The Office for National Statistics (ONS) in the UK estimates own-account software using the macro-approach, and conducted a consultation on the occupations and time factors to use with representatives of the software industry in 2005. Consultees recommended the use of a broad range of occupations based on the UK's Standard Occupational Classification (SOC) 2000, with varying time factors to reflect the varying contribution of each occupation to the development of own-account software. Based on this evidence, the OECD Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010) recommended the broader set of occupations than just those in ISCO-88 category 213 (computing professionals).

The UK conducted further research on occupations and time factors in 2018, by consulting with Multi-National Enterprises (MNEs) and analysing available labour market microdata. Table 1 shows the findings of the 2005 consultation converted to the UK SOC 2010 using a proportional mapping, and matched with ISCO-08. The UK SOC 2010 does not have codes equivalent to group 252 (Database and Network Professionals) in ISCO-08; these workers are assumed to be captured in other related occupations codes, predominantly those in Table 1. The UK SOC 2010 also separately identifies working-level managers (referred to as 'supervisors' in ISCO-08), which are included within the 251 codes in ISCO-08 but not separately identified. Table 1 also shows the average contribution between 2011 and 2017 that each occupation makes to the total for own-account software and databases, based on ONS time factors (column 5) and based on the OECD 50% guidance (column 7). When using the ONS time factors, over 80% of the total comes from the occupations consistent with ISCO-08 category 251. However, the ONS time factors reflect a more conservative approach than the OECD 50% guidance overall.

Table 1: UK occupational codes used in estimating labour costs of own-account software production

ISCO-08	UK SOC 2010	UK SOC 2010 Description	ONS time factors (%)	Contribution to UK total using ONS time factors (%)	OECD 50% guidance (%)	Contribution to UK total using OECD 50% guidance (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1330	1136	IT and telecoms directors	10	2	0	
251	2133	IT specialist managers	35	27	50	35
251	2134	IT project and programme managers	35	3	50	4
2511	2135	IT business analysts, architects and systems designers	35	14	50	19
2512	2136	Programmers and software development professionals	50	26	50	24
2513	2137	Web design and development professionals	35	4	50	5
2514, 2519	2139	IT and telecoms professionals n.e.c.	25	7	50	13
3511	3131	IT operations technicians	15	5	0	
3512	3132	IT user support technicians	15	6	0	
4132	4217	Typists and related keyboard occupations	5	0	0	
7422	5245	IT engineers	5	0	0	
Unmatched						
2521	N/A	Unmatched	N/A		50	
2522	N/A	Unmatched	N/A		50	
2523	N/A	Unmatched	N/A		50	
2529	N/A	Unmatched	N/A		50	
Additional codes for own-account databases						
2120	2425	Actuaries, economists and statisticians	10	1	0	

3314	3539	Business and related associate professionals n.e.c.	10	5	0	
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Evidence from MNEs in the UK supports the existing selection of occupations, covering IT managers and software development professionals in particular. In some cases, MNEs indicated that the higher skilled staff in the development chain (such as managers) worked for UK units, while lower skilled workers in the chain were employed by affiliated foreign units in less developed countries where labour costs are lower. This indicates that managerial occupations may be especially important in high-skilled economies. Some MNEs reported that staff had target capitalisation rates for the time of around 80% for software professionals, and around 50% for managers. Some indicated that information from time sheets may give further information.

Consulted MNEs identified internal activity to transform data to facilitate resource-effective access to the data, consistent with the definition of own-account databases in the 2008 SNA. Workers involved in such activity in consulted MNEs typically have job titles such as ‘data analyst’, ‘data scientist’, ‘data architect’ and ‘business intelligence analyst’. In the UK SOC 2010, many of these workers are coded to the ‘actuaries, economists and statisticians’ occupation code. MNEs indicated that development of databases may be closely linked to product cycles, especially in areas associated with production; databases developed for internal finance or HR activities may be less dependent on this. As with software, MNEs indicated that the development chain could be across units in multiple countries, and the resultant asset could be used by units in multiple countries.

Evidence from Slovenia indicates that software professionals in larger enterprises typically spend a greater proportion of their time on own-account software production. In 2009, The Statistical Office of the Republic of Slovenia ran a survey of units identified to have at least one employee in any relevant occupation group, including computing professionals, IT managers and computer assistants. Respondents were asked to provide the average share of time of these employees on 1) software and databases for own use, 2) software and databases for sale, 3) other work. Table 2 shows the results of the survey. Units in industries other than the ‘computer and related activities’ industry (NACE 72; Rev.1.1) reported an average time share of 41%. The average reported time share varied by sector, being much higher for S.12 and lower for S.14 and S.15. The average time share also increased significantly as the size of the unit increased, from 10-20% for small units, to 25% for medium sized units, and about 50% for large units.

Table 2: Results of the Slovenian survey on time factors in estimating labour costs of own-account software production

Industry	Sector	Employment bandwidth	Time share (%)
Computer and related activities (NACE 72; Rev.1.1)			11
Other industries			41
Other industries	S.11		32
Other industries	S.12		71
Other industries	S.13		35
Other industries	S.14		3
Other industries	S.15		3
Other industries		10 or less	9
Other industries		11 to 30	17
Other industries		31 to 150	25
Other industries		151 to 250	45
Other industries		251 to 500	51
Other industries		More than 500	48

The European e-commerce survey also indicates that in-house software development is more prevalent amongst larger units. Respondents to the e-commerce survey are asked to report whether the development of ‘business management software/systems’ and ‘web solutions’ is mostly done by own employees, external providers, or not applicable. While these categories do not cover all own-account software and database activity (especially, software associated with core production of the unit), it provides a useful piece of evidence. In data for 2015 to 2017, the proportion of units reporting that these

tasks were mostly done by own employees increases as the size of the unit increases for almost all countries in almost all years.

72. The methods for estimating the other expenses and the mark-up for net operating surplus in compiling estimates for own-account production of software and databases show substantial differences across countries. About half of the countries do not include an estimate for consumption of fixed capital at all. For countries that do include these costs, the type of assets that are included differs among countries. A couple of countries include 'equipment', 'structures', 'software' and 'R&D' in the calculation of their estimate of consumption of fixed capital, whereas most other countries only include a selection of these categories.

73. For own-account R&D it was decided (see Section 2.2.3) that consumption of fixed capital of R&D (purchased and own-account) should be excluded from the sum-of-costs method for estimating output as this is not expected to feed into new R&D and to avoid the issue of ever increasing output and capital stock. The Task Force decided that for software and databases only consumption of fixed capital with regard to own-account software and databases should be excluded, as it may be expected that purchased software and databases feed into the production of new software and databases.

Recommendations:

22. Depending on the availability of underlying information, countries should apply a demand-side or sum-of-costs (macro) approach to derive estimates of output of computer software and databases. Ideally, results from both approaches are confronted in the estimation process.
23. In applying the sum-of-costs (macro) approach to estimate own-account production of software and databases, countries should focus on the following occupations (ISCO-codes): 251 (Software and Applications Developers and Analysts) and 2521 (Database Designers and Administrators). Where countries have differing occupational classifications, the choice of occupations should be aligned to the ISCO-08 codes above as far as possible, and other codes included only where country-specific evidence exists.
24. Where possible, countries should conduct research on the appropriate time factors to apply for each occupation. The time factors should vary according to the role of the occupation in own-account software and database production. In higher-skilled countries, IT managers may play an important role, and should in that case be given an appropriate time factor. Where evidence is unavailable, a time factor of 50% should be applied to the most relevant occupations. Furthermore, countries are encouraged to take account of the industry and the enterprise size when deciding on time factors to apply in the macro approach. Workers in specific industries may spend more time on own-account software and database production, and workers in larger enterprises may be able to spend more time on own-account software and database production than those in smaller firms. This should be taken into account when determining the time factors, on average not exceeding the 50% across all enterprises.
25. In deriving estimates for other expenses and a mark-up for net operating surplus as part of the sum-of-costs method in order to estimate the output of own-account software production, countries should include an estimate for consumption of fixed capital, in which all relevant asset categories should be included. However,

consumption of fixed capital of own-account software and databases assets should be excluded.

3.4. Ownership of computer software and databases

74. As was the case with R&D, the output of computer software and databases is usually the starting point for deriving gross fixed capital formation (GFCF). Depending on the nature of the output (i.e. market output for sale or own-account production), the amounts can be assigned to the relevant industry or sector and included in the GFCF and capital stock statistics. In many cases, this may be rather straightforward (such as in case of own-account production or explicit sales of software and databases) but as was the case with R&D, in some cases it may be more difficult to properly assign economic ownership. The decision tree as included in the UNECE 2015 Guide to Measuring Global Production (UNECE, 2015) (Figure 4.1, pp 50-51) may provide guidance on determining economic ownership in case of MNE relations. Chapter 5 discusses the issue of economic ownership of IPPs in more detail.

3.5. Gross Fixed Capital Formation

3.5.1. Introduction

75. As explained in Section 2.4.1, there are two ways to derive estimates of GFCF. The first approach is surveying entities to ask for details of their expenditures, also known as the demand-side approach. The second way for estimating GFCF is by following the supply-side approach, where the domestic production (e.g. from structural business statistics or special ICT surveys) is increased with imports (from trade statistics) and reduced by exports (from trade statistics) and households' expenditure (e.g. from household's expenditure surveys) to give rise to an estimate of GFCF. Quite often, the estimation by the supply-side approach is undertaken at detailed product level, in which countries can also distinguish between pre-packaged and customised software.

3.5.2. Methodology and country practices

76. When looking at country results, there are significant differences in how they record the use of software. For 'software publishing products' some countries allocate large parts as GFCF, whereas some countries record almost the full amount as intermediate consumption and record no GFCF at all. With regard to 'computer programming services' (including own-account software) some countries record the full amount of domestic supply as GFCF, whereas others only record a part of it as GFCF. In this regard, it is interesting to see how countries come to these results.

77. In estimating GFCF, almost half of the countries use a demand-side approach, whereas the other half use a supply-side approach. Several countries use an approach in which they reconcile estimates from both approaches, which is to be preferred. As regards the demand-side approach, the data sources used for estimating GFCF (in purchased software) include structural business statistics (SBS), investment surveys and administrative sources, where in some cases countries rely on a single data source, whereas in other cases they use multiple data sources to further improve the data. However, solely relying on the demand-side approach seems to lead to an underestimation as companies do not always record the full amount of software purchases. Furthermore, these surveys do not always cover investment in software on an annual basis and do not always cover the whole business economy.

78. As for the approach by reconciliation of both demand and supply, the reconciliation is usually carried out within the framework of the Supply and Use Tables (SUTs). By taking both sides of demand and supply into account, and more importantly, by reconciling the estimates from both approaches within an integrated and consistent framework of the SUTs, this approach seems to be more appealing than making estimates of GFCF in purchased software, taking either demand- or supply-side approach only. The latter may be less data and resource demanding, but does not provide an opportunity to cross-check the quality of the estimates. However, although it seems more appealing, only a few countries currently seem to apply this approach.

Box 3.3. Licencing agreements

The legal form of an acquisition of a copy of software is in most cases a licencing agreement for endless use, and if it fulfils the capitalisation criteria it has to be accounted as software GFCF according to para. 10.110 of the 2008 SNA. However over recent years it has become more common that licence payments may be for a limited period of time, some for more than one year and some for less, which has an impact on capitalization. Only a few countries take into account licencing arrangements in estimating GFCF in software. Most countries do not, mainly because of lack of detailed information on these arrangements. In most cases information is lacking on the length and distribution of payments (over time) of licences. However, most countries do not think this is an important issue as it is believed that the type of licencing arrangements that satisfy asset requirements would usually only be small.

3.5.3. Available breakdowns

79. Almost all countries have estimates of software GFCF broken down by institutional sectors and by industries. Only one country does not currently compile any breakdown at all.

80. Most countries have information at the level of the main sectors, although for some countries information is missing on the household sector and/or on the non-profit institutions serving households' sector. In addition to the main sectors, some countries also compile information at a more detailed level, breaking down the two corporations' sectors into public and private corporations.

81. Almost all countries also compile GFCF data on software by industry. Half of them use NACE 2-digit level classification for the industry breakdown, whereas half of the other countries use a more detailed classification and the other half a more aggregated breakdown.

82. The data sources used for these breakdowns depend on the approach applied and on the specific country. Several countries have direct information from surveys (e.g. business statistics) or administrative data (e.g. for the general government), whereas others combine it with information from the business register. Others use a more complex method or a combination of sources, for example combing direct information for part of the data with applying a labour or output ratio for another part. Own-account software estimates are mostly based on labour cost data or information from ICT surveys.

83. Only a small number of countries estimate databases distinctly from software. In some cases this distinction is available from the underlying data sources, whereas in other cases countries need to rely on assumptions. Information on occupations is also used for this purpose. In that regard it has to be borne in mind that some of the occupations used in own-account software are arguably more related to database development than software development. Further alignment in this area is required to arrive at harmonisation across

countries. Arriving at this breakdown may indeed be useful in order to be able to account for differences in assumptions for service lives and the calculation of prices.

Recommendations:

26. Countries should distinguish between own-account and purchased software in making estimates of GFCF.
27. Countries should try to break down their GFCF estimates at the level of the main institutional sectors. Furthermore, countries should try to compile results at the 2-digit ISIC/NACE industry classification level.

3.6. Measurement of price changes

3.6.1. Introduction

84. When looking at deflators for computer software and databases, they show large differences across countries and for some countries also across industries. For these reasons, it is important to assess how countries compile these estimates.

3.6.2. Methodology and country practices

85. Some countries apply a single method for measuring price changes for both own-account and purchased software. These countries mostly rely on an output-price approach, based on (service) producer price indices (PPI and SPPI). However, most countries distinguish between the two types of software and within purchased software also between pre-packaged and customised software. Most countries apply an input-cost approach for own-account software, whereas they apply an output-price approach for purchased software. The latter are mostly based on PPI and SPPI, although some countries also use consumer price indices (CPI) or a combination of the indices. For customised software a few countries apply an input-cost approach. For purchased software, the *Eurostat Handbook on price and volume measures in national accounts* identifies the use of a suitable national PPI or SPPI for deflation as the preferred method. However, if suitable national price indices are not available referring back to price indices in other countries might be a good proxy. For example, several countries use the US software price index for deflating purchased software, as the biggest share of this purchased software is produced from US based companies. In this case, the deflator needs to be adjusted for exchange rate effects.

86. In applying an input-cost approach, the full range of costs should be taken into account, including compensation of employees, intermediate consumption, consumption of fixed capital, and, if relevant, taxes on production, capital purchases, and net operating surplus. Furthermore, ideally it is applied at the most detailed level of underlying costs, e.g. looking at underlying occupations for compensation of employees and products for intermediate consumption.

87. Only a small number of countries make an adjustment to correct for productivity growth or quality change. With regard to the latter, countries adjust on the basis of information on hours worked and wages for the relevant industries, on the basis of the functioning of similar services for IT industries over time, and on the basis of maintaining similar quality or hedonic-type price indices. In case countries are able to come up with reliable estimates of productivity change, these may be used to improve their input-cost price estimates. These may also provide best practices for other countries.

88. As was explained above, price indices for GFCF in software and databases currently show large differences, both across countries and across industries. These may be explained by differences in the approach to measure prices (i.e. input-cost approach versus output-price approach), costs that are taken on board in applying the input-cost approach, at what level of industry price measures are derived, and whether productivity or quality adjustments are applied. Furthermore, for some countries that use a foreign price index, the impact of exchange rate changes may also be significant. Compilers are recommended to explicitly assess the price trends for IPP GFCF series, when compiling results on software and databases.

Recommendations:

28. If good quality information is available for purchased software, output prices should be used for the measurement of price changes.
29. For own-account software input prices will have to be applied. This approach requires a breakdown of the various components (i.e. compensation of employees, intermediate consumption, consumption of fixed capital, net operating surplus, and taxes less subsidies on production), if possible including compensation of employees by occupation.
30. Separate estimates of prices by sector and by industry are preferred wherever production of own-account software is likely to differ for businesses, government, and non-profit institutions and across industries.
31. Compilers should explicitly assess and validate the trends of their software and databases GFCF deflator, ideally at the most granular level of detail.

3.7. Estimation of net stocks of computer software and databases

3.7.1. Introduction

89. Like in case of R&D, all countries derive their estimates of net capital stock of software and databases on the basis of the PIM. This method involves aggregating GFCF over time, allowing for declines in value until assets reach the end of their service lives and are retired. Two important components for deriving estimates on the basis of the PIM, i.e. GFCF and price indices, have already been discussed in the previous sections. However, information is also needed on the retirement (or mortality) profile of the assets to model how their relative value develops over time. For that reason, this section focuses on the determination of the service lives of groups of assets and the depreciation profiles for categories of software and databases. Furthermore, it is discussed at what level of detail countries compile estimates of software and databases capital stock.

3.7.2. Methodology and country practices

90. Whereas a majority of countries rely on geometric depreciation in case of R&D, for software and databases an equal number of countries seem to use linear and geometric depreciation.

91. For countries that apply a linear approach, almost all of them apply the same service life to all types of software and databases. Only a few countries estimate service lives based on the type of software and/or on the sector, although to a lesser extent than for R&D. With regard to retirement patterns, several countries apply a bell-shaped distribution such as normal, log-normal, truncated-normal or gamma, whereas few countries apply a delayed

linear retirement pattern. However, quite a lot of countries do not use any retirement pattern at all.

92. Among the countries that apply a geometric depreciation pattern, the majority use the double declining balance rate (DBR=2) in determining the depreciation rate. However, some use smaller rates, ranging between 1.0 and 1.65. Combined with assumptions on average service lives, this leads to depreciation rate ranging from 0.200 to 0.500 across countries applying geometric depreciation.

93. Three countries use a hyperbolic approach to measure the value of stock of software and databases. They all combine this with a bell-shape retirement pattern. The efficiency reduction parameter varies across the countries, ranging from 0.50 to 1, whereas they all apply a discount rate of 4.0 percent, similar to the one used for R&D.

94. Looking at the average service lives used in the measurement of software and databases, most countries apply an average service life of 5 years (in line with the Eurostat and OECD recommendations in case information is lacking) although a few countries apply significantly longer service lives (i.e. 9 or 10 years). Furthermore, compared with R&D, service life differentials by sector or industry seem quite limited for software and databases. Only two countries apply different service lives by industry. Furthermore, when pre-packaged software is identified separately, its service life tends to be shorter than for the two other types of software, i.e. customised and own-account software.

95. Some countries include questions on service lives in their questionnaire, although many countries have to rely on expert advice, other countries' estimates and annual reports.

Recommendations:

32. Countries should regularly re-examine the service lives of the different types of software assets.
33. In measuring net capital stock of software and databases, the geometric depreciation approach is preferred unless there are conceptual or practical objections.
34. Back-casting of GFCF in software should at least cover the period needed to arrive at proper stock estimates for the time period covered in the publication.

4. Other intellectual property products

4.1. Introduction

96. Besides asset categories AN.1171 Research and development and AN.1173 Computer software and databases, the Task Force also focused on AN.1179 Other intellectual property products (hereinafter: Other IPPs). The 1993 SNA already recognized Other IPPs. The AEG recommended in 2006 that this category should be maintained based on Canberra II Group advice "just in case some intangible fixed assets could not be allocated to any of the other intangible fixed asset categories".

97. The guidance included in the 2008 SNA states that Other IPPs "include any such products that constitute fixed assets but [that] are not captured in one of the specific items above". However, that does not provide concrete examples of what types of IPPs may be included under this category. For that reason, it is interesting to see whether, and if so what, countries include under this heading.

98. Section 4.2 treats the current recording of the category Other IPPs. Section 4.3 discusses the possible coverage of this category.

4.2. Current recording of Other IPPs

99. Among EU and OECD countries, only two currently record values in the balance sheet of asset category 'Other IPPs'. One country describes the included assets as studies on project feasibility, project documentation, investment studies, technical expertise, etc., mainly related to building projects. For the other country it is not specified what assets are recorded here. It is a category that is obtained as the residual after deducting expenditures on certain IPP assets (e.g. software) from the total IPP assets category obtained from a survey. For that reason, the country concerned indicates that it is possible that the Other IPP category includes some expenditures that should not be recorded as GFCF (e.g. goodwill). In addition, one country reports values for GFCF in the category Other IPPs but excludes these from the balance sheets. The data come from the investment statistics survey and comprises new information, special knowledge and other ownership rights (e.g. licences, know-how, etc.) used in production but not included in other categories.

4.3. Discussion of possible coverage of Other IPPs

100. When looking at the possible coverage of the category Other IPPs, it is interesting to assess whether the examples as provided in the previous section would indeed qualify for this category. A first question that needs to be answered for this purpose is whether these examples should be regarded as IPP. Para. 10.98 of the 2008 SNA defines IPPs as "the result of research, development, investigation or innovation leading to knowledge that the developers can market or use to their benefit in production because use of the knowledge is restricted by means of legal or other protection". When looking at the examples provided, these indeed qualify under this definition, provided that some form of protection is restricting their use. The question then remains whether these examples would qualify for any of the other categories. The only possible other IPP category in which these assets conceivably could be included is AN.1171 Research and development. Para. 10.103 of the 2008 SNA explains that "research and [experimental] development consists of the value of expenditures on creative work undertaken on a systematic basis in order to increase the stock of

knowledge, including knowledge of man, culture and society, and use of this stock of knowledge to devise new applications. This does not extend to including human capital as assets within the SNA.” So, the SNA speaks about creative work to increase the stock of knowledge. The 2015 Frascati Manual provides additional insight in what may be covered by R&D. In its Table 2.3 it discusses the borderline between R&D, innovation and other business activities³⁰.

Table 2.3 from the 2015 Frascati manual

Table 2.3. Borderline between R&D, innovation and other business activities

Item	Treatment	Remarks
Prototypes	Include in R&D	As long as the primary objective is to make further improvements.
Pilot plant	Include in R&D	As long as the primary purpose is R&D.
Industrial design	Split	Include design required during R&D. Exclude design for production process.
Industrial engineering and tooling up	Split	Include “feedback” R&D and tooling up industrial engineering in innovation processes. Exclude for production processes.
Trial production	Split	Include if production implies full-scale testing and subsequent further design and engineering. Exclude all other associated activities.
Pre-production development	Exclude	
After-sales service and troubleshooting	Exclude	Except “feedback” R&D (to be included).
Patent and licence work	Exclude	All administrative and legal work needed to apply for patents and licences (delivering documentation as an outcome of R&D projects is R&D). However, patent work connected directly with R&D projects is R&D.
Routine tests	Exclude	Even if undertaken by R&D personnel.
Data collection	Exclude	Except when an integral part of R&D.
Routine compliance with public inspection control, enforcement of standards, regulations	Exclude	

101. From the table it can be derived that the design part should not be regarded as R&D but may qualify as an IPP according to the SNA. That means that, theoretically, the design part that is split off could qualify as a separate IPP asset. As it is not included in one of the other IPPs, it would then qualify for the category 'Other IPPs'. The same goes for the design part in case of dwellings and other buildings and structures (AN.111 and 112). Normally, these costs are included in the price of the asset (and not split). However, one could imagine the situation that a design is produced but the project is cancelled. In that case the design may still be recorded as IPP. Another possibility is that a design is used for several projects. In both cases the design (if some form of protection restricts the use of the asset concerned) can be classified as a (separate) IPP asset and assigned to the category 'Other IPPs'.

³⁰ Para. 2.62 and 2.63 of the Frascati Manual provide more information on distinguishing between design and R&D.

102. This means that some items may indeed qualify as Other IPPs, although this does not provide an exhaustive list. In that regard, there is a need for the statistical community to better define and delineate the category of ‘Other IPPs’. It should be clearly defined when items such as industrial and architectural designs would qualify as Other IPPs and it should be further explored which other items might qualify for this category. In this regard, the TF discussed the specific issue of ‘marketing assets’. Although it was acknowledged that the 2008 SNA is clear that these should not be regarded as assets unless an explicit transaction takes place, it was also recognized that the current guidance raises some questions, also in relation to the recording of IPPs (see more information in Box 4.1). This shows the need for further discussion on specific types of ‘assets’, to clearly explain how they should be dealt with within the system of national accounts and to obtain a better delineation of what qualifies as an IPP. This will improve the comparability of results across countries and provides the opportunity to draft more specific guidance on deriving capital measures of these specific types of IPPs.

103. The fact that only a few countries record data for Other IPPs also raises the question whether other countries may be missing some IPPs. In that regard, most countries mentioned that “all assets concerned are already included in other categories”. This may imply that the types of IPPs discussed above may already be included in some of the other categories. In that case it would be recommended to try to separate them out and to include them in the category ‘Other IPPs’. If they are not yet included in another category, countries are encouraged to assess to what extent these types of IPPs are important in their country and to come up with estimates to ensure comprehensiveness of results on IPPs.

Recommendations:

35. Countries should investigate if there are IPPs that constitute fixed assets but are not yet captured in one of the other IPP categories, nor in one of the other fixed assets categories.

Box 4.1. The issue of ‘marketing assets’

The discussion on the coverage of ‘Other IPPs’ opened the discussion on the current treatment of ‘marketing assets’ in the SNA. These consist of items such as brand names, mastheads, trademarks, logos and domain names (see para. 10.198 of the 2008 SNA). These are often used by their owner to obtain royalty payments, but as these assets are regarded as non-produced assets, the payments are not within the production boundary. This leaves the question how these payments should be recorded. The 2008 SNA does not seem to provide a coherent answer on this issue.

Para. 10.9 of the 2008 SNA makes the distinction between produced and non-produced assets. Three asset categories are defined as non-produced assets: natural resources; contracts leases and licences; purchased goodwill and marketing assets. It is further explained in para. 10.196-10.199 that marketing assets are only recorded in capital stocks when there is evidence of a sale and a market price.

As marketing assets are regarded as non-produced assets, the related royalty payments and licence fees are outside the production boundary. Para. 6.213-6.215 of the 2008 SNA explain that intermediate consumption does include rentals paid on the use of fixed assets that are leased from other institutional units under an operating lease, as well as fees, commissions, royalties, etc., payable under licencing arrangements, such as relating to originals and copies of produced assets (books, films, software etc.), but does not mention any payments with regard to non-produced assets. Therefore, in theory, they should be recorded as property income. However, the 2008 SNA only refers to property income accruing when the owners of financial assets and natural resources put them at the disposal of other institutional units,

and makes no reference to royalty and licence fees from other non-produced assets. In practice, it seems that countries might record some payments for the use of these other non-produced assets as payments for services, although there remains some uncertainty as to where (i.e. which product categories and which industries).

The Balance of Payments Manual (IMF, 2009) has a more explicit recognition that this category of other non-produced assets should be included in primary income flows (equivalent to property income in the SNA) explaining that “franchise fees, trademark revenue, payments for use of brand names, and so forth include aspects of property income (i.e., putting a nonfinancial non-produced asset at the disposal of another unit) as well as aspects of services (such as the active processes of technical support, product research, marketing, and quality control)” and that ideally these two elements are recorded separately (see para. 10.140). However, it is acknowledged in the Manual that such a split is difficult in practice. Because of the lack of harmonisation in international guidelines and the uncertainty on country practices, this area should be subject to further research.

There is an additional complication concerning the valuation and recording of other non-produced assets on national balance sheets. Presently, these are only evidenced, in theory, when an explicit sale occurs. This raises the question as to whether there is a need to impute a value (for example for a marketing asset) when related flows are observed. This is also an issue that should be further explored. In that regard, it is important to note that the issue of marketing assets is included on the 2008 SNA research agenda (see para. A4.53 of the 2008 SNA), under the discussion of broadening the fixed asset boundary to include other intellectual property products³¹.

A related question is what sources are available to identify royalty payments and licence fees related to, for example, marketing assets. Obtaining consistent and accurate source data on royalty and licence payments can be difficult. Some firms may declare royalty and licence fees as part of their turnover, whereas others may include them in other current operating income. Furthermore, when firms declare royalties in turnover, a survey (Structural business statistics) may provide the breakdown by product, but this may not be the case when firms declare royalties within “other current operating income”. In that case, royalties are mixed with all kinds of other items, such as share of joint venture profit (or loss) and revenues from buildings (when this is not the core business). In some cases information on royalties and licence fees may be available from tax data, but often this does not require reporting at this level of detail. This means that often assumptions will be needed to obtain estimates of the relevant amounts.

³¹ There is a linkage to be drawn with the recording of data in national accounts (see section 3.2 above), including flows relating to the use of data.

5. Economic ownership of IPPs

5.1. Introduction

104. The intangible nature of intellectual property products means that once they are produced their ownership and use are not easily observed since IPPs are not physically constrained and are non-rivalrous in nature. In other words, where IPPs are produced does not necessarily reflect where they are used or where they are owned. It also provides a lot of freedom for enterprise groups on how to use and allocate the IPP, because the use of the IPP by one part of an enterprise group does not prevent the simultaneous use by another part, and the legal ownership can be placed anywhere within the group.

105. In determining the ownership, the national accounts focus on the concept of economic ownership. The SNA defines economic ownership as follows: *“The economic owner of entities such as goods and services, natural resources, financial assets and liabilities is the institutional unit entitled to claim the benefits associated with the use of the entity in question in the course of an economic activity by virtue of accepting the associated risks”* (2008 SNA para. 3.26). A change in economic ownership typically coincides with a financial transaction between two institutional units and this would usually also coincide with a change in legal ownership, although there are exceptions to this rule³².

106. The principle of economic ownership is not straightforward in the case of MNEs. As is discussed in Moulton and Van de Ven (2018), *“All affiliates of an enterprise group are to some degree controlled by their parent, whereby the case of multinational enterprise groups has the added complication of having non-autonomous affiliates which are considered as institutional units by convention, simply because they are resident in an economic territory that is different from the parent’s. Transactions between units of a multinational enterprise, or the absence of such transactions as recorded in business accounts, may therefore be at odds with the principle of economic ownership.”*

107. Determination of economic ownership of IPPs, and the recording of related transactions is a major issue as it affects the recording of assets and related income flows, and consequently also directly impacts the allocation of output and value added to units and countries and indeed, critically, multifactor productivity estimates.

108. This chapter first elaborates on defining GFCF immediately after producing the IPP. This implicitly includes the question of the economic ownership of that IPP. Section 5.3 discusses country practices and Section 5.4 subsequently discusses the pros and cons of the different options concerning economic ownership within MNEs.

5.2. Current guidance to determine economic ownership

109. Depending on the nature of the output (i.e. market output for sale, own-account R&D and non-market R&D) and information on the funding, the output of IPPs can be assigned to the relevant industry or sector. This allocation is often very straightforward (e.g. in case of own-account production or an explicit purchase of IPP output). However, in some cases, it is not evident to determine the owner, particularly when the producer is part of a multinational

³² An exception to the rule is for financial leasing. The lessor is the legal owner of the relevant asset but the lessee is considered to be the economic owner.

enterprise or when it is receiving funding from the government. It then often depends on the funding which entity is to be regarded as the owner of the IPP output.

110. As cases where the government or non-profit organisations fund the R&D frequently lead to questions about the ownership of the R&D, the 2015 Frascati Manual includes specific recommendations to break down government funding of R&D in government grants (transfer funds) and procurement (exchange funds). This should provide more guidance on how to determine the ownership³³. In the case of grants, the government pays (a part) of the R&D costs, but will not become the owner of the produced R&D which remains generally with the performer. In case of exchange funds it is expected that the government does become the owner of the R&D.

111. As situations in which an R&D producer is part of a multinational enterprise may also lead to complicated situations in assigning ownership, the 2015 Frascati Manual also encourages countries to split funding flows between affiliate companies and those between non-affiliated companies. Furthermore, it recommends the collection of data on revenues from the sales of R&D, in which intra-MNE flows may also play an important role. Countries may also use information from international (foreign) trade statistics (as recorded in the balance of payments statistics), although this often does not provide a breakdown of imports and exports of R&D services and of software into intra-concern and extra-concern³⁴. Furthermore, it has to be borne in mind that definitions may sometimes differ between what is covered in Frascati Manual surveys and Balance of Payments statistics. For example, service categories as used in trade statistics may include services that are not covered by the definition as used in the Frascati Manual, such as R&D testing services³⁵. This may complicate using both data sources to determine who owns what part of the IPP outputs.

112. The UNECE 2015 Guide to Measuring Global Production (“UNECE Guide”) includes a decision tree for determining economic ownership of IPPs in the case of production within an MNE. It assigns the ownership on the basis of whether the unit is a producer of the IPP or not, whether it receives explicit payment to produce the IPP or a payment to acquire the whole of the IPP (corresponding with a change in ownership) or the use of the IPP (no change in ownership). The decision tree assigns IPP ownership to one unit within the MNE structure even if other members of the MNE benefit from the IPP. Changes in ownership essentially follow the type of monetary transaction observed (i.e., whether it is payment for the current production, payment for the whole of the IPP, or licencing the use of the IPP). Further information on this can be found in Box 5.1, and a summary of the Italian experience with applying the decision tree can be found in Annex F.

Box 5.1. Decision tree from UNECE 2015 Guide to Measuring Global Production

Because of the difficulty in determining economic ownership of IPPs within multinational enterprises (MNEs), the UNECE 2015 Guide to Measuring Global Production includes a decision

³³ It should also be determined if there is a ‘true sale’, a subject which has been the subject of discussion amongst government finance statisticians.

³⁴ In this regard, it has to be understood that trade between affiliates can constitute a significant share of trade flows.

³⁵ For R&D services, the Manual on Statistics of International Trade in Services (MSITS) (United Nations et al, 2010) recommends a further breakdown of research and development services into two subgroupings: work undertaken on a systematic basis to increase the stock of knowledge (reflecting the coverage of research and development within a 2008 SNA context) and other. Charges for the use of proprietary rights or charges for licences to reproduce and/or distribute the intellectual property are included in a separate category.

tree for determining economic ownership of an IPP (and IPP related transactions) within MNEs and within global production arrangements.

The starting point of the decision tree is the observation of IPP output or IPP ownership for a specific unit. The tree then follows a sequence of steps to determine the ownership, focusing on the following questions (see pp 50-51 of the UNECE Guide for the full decision tree):

a) The first question focuses on the ownership relation, distinguishing between units that are part of an MNE and units that are participating in a global production arrangement but not as a member of an MNE.

b) For both groups, the second step looks at whether the units produced the IPP or not.

c) The third step then focuses on the main kind of activity of the unit, trying to distinguish the role of the IPP in the production process. For that purpose, the questions try to distinguish whether the unit is a main IPP producer, is a producer of other goods and services for which the IPP is used in the production process, is a factoryless goods producer based on the IPP, or is not a producer of other goods and services but a unit for which the main output is IPP related.

d) The last step then focuses on any income and expenditure flows related to the use or sale of the IPP. For that purpose, the questions focus on any funding received or provided for developing the IPP, any expenditure or receipts in relation to the purchase or sale of the IPP original, any royalties and licences income paid or received related to the use of the IPP, or the lack of any of these flows.

On the basis of the answers to these questions, the decision tree should lead to a coherent decision on the economic ownership of the IPPs, as well as on the recording of capital formation and the recording of IPP related services (imports/exports).

The Guide also acknowledges that a proper application of the decision tree may sometimes be hampered by lack of information to answer some of the questions in the tree. It may, for example, be difficult to separately identify IPP funding, IPP purchases and sales, and payments for IPP use in case of MNE groups. For that reason, the decision tree also includes default solutions in case information is insufficient to run properly through each of the decisive steps. See Annex F for an example of the application of the decision tree by the Italian National Institute of Statistics (ISTAT).

5.3. Country practices for determining ownership of R&D

113. Although the guidance on how to determine the economic ownership following the UNECE schema is in principle clear, country practices seem more nuanced. Only a small number of countries use the decision tree as included in the UNECE Guide, mainly due to the fact that in many countries relevant information to apply the decision tree is currently lacking. Furthermore, not all countries have already updated their questionnaire to include the extended guidance of the 2015 Frascati Manual to obtain more information on funding source. This section provides an overview of the approaches used by countries, depending on the underlying funding.

Funded from domestic business sources

114. Most countries use information from the Frascati Manual surveys to determine economic ownership in case of domestic business sources. When the sources of funds are from businesses, many countries make the simplifying assumption that the funder of the R&D performance (as provided in the Frascati Manual surveys) is purchasing R&D services and hence becomes the owner of the R&D asset. Note that a significant share of R&D funding is internal to a firm so that the performer and the funder are often belonging to the same enterprise (group). Several countries also include specific questions in their surveys to obtain information on the type of funding, in line with the recommendations of the 2015 Frascati Manual. Only a few countries do not use the Frascati Manual based sources of funds, but

instead use information on R&D services from other sources such as Structural Business Statistics surveys.

Funded from non-resident sources

115. In case the funding is from non-resident sources, only a few countries use the Frascati Manual based non-resident funding as a source for determining whether the domestic performer retains the ownership of the R&D. Most countries use information from the Balance of Payments or International Trade in Services Statistics (and in a few cases Structural Business Statistics) to determine exports and imports of R&D services and use this information in deriving the GFCF flows (i.e. net imports are added to R&D output when deriving total GFCF of R&D). In case foreign funds concern grants from international organisations to promote R&D, the performer is considered to be the owner (in line with ‘transfer’ funds from the government sector). When looking at the information on non-resident funding, less than half of the countries is able to determine whether the source of funds is a payment for an acquisition of an asset or a payment for the use of an asset.

Funding from government sources

116. When the sources of funds are from the government sector most countries assume that the performer retains ownership of the R&D. Only a few countries record a transfer of ownership of the R&D performed by businesses to the government sector. However, countries that are able to distinguish between exchange funds and transfer funds are able to make a more informed decision. In that case, the government is regarded to be the owner when it concerns exchange funds. In a few cases, countries have made modifications to the Frascati Manual based surveys to obtain even more detailed information on source of funding, e.g. including breakdowns into ‘other public funding’, ‘higher education institutes’ and ‘private non-profit institutions’. This may provide additional information to allocate economic ownership. However, most countries are not able to make this distinction as this information is (currently) lacking from their surveys. In some countries, it also depends on who is the performer of the R&D. If it is a business that receives government funding then the business retains ownership, whereas in the case the performer is a government funded research institution or national university, the government is regarded to be the owner of the R&D.

5.4. Review of theoretical options for recording economic ownership within MNEs

117. As explained in the previous sections, determining the economic ownership of IPPs is not a trivial task. Although guidance has been provided in several handbooks and by the work of various OECD and Eurostat task forces, experiences in applying this guidance in practice, particularly in relation to recent events of some large companies relocating their headquarters (supposedly to be put on a par with the decision making centres) as well as their IPPs, have shown that the current guidelines do not fully address all the measurement challenges, especially regarding the allocation of IPPs within MNEs. This has reopened the discussion on how economic ownership of IPPs within MNEs should be determined and where (to which country) they should be recorded in national accounts. For that reason, the Task Force discussed several options. As these all have their pros and cons, and their implementation would have wider implications, the discussion of which would go beyond the mandate of the TF, all options are presented below. It is recommended that the statistical community explores these options in more detail, further assessing the feasibility of their implementation and the consequences for other statistics, including possible changes in data

sources to obtain the relevant information, as well as the impact on the results of various important macroeconomic indicators.

118. The TF distinguished four broad options for how to determine economic ownership within MNEs: (1) the unit that produces the IPP is deemed the economic owner; (2) the unit that is the legal owner of the IPP concerned is deemed to be the economic owner; (3) the unit that is the (ultimate) parent of the legal owner of the IPP is deemed the economic owner; (4) the unit that uses the IPP in the production of other goods and services is deemed the economic owner. One could choose to blend some of these options to create other scenarios. The options are discussed in more detail below.

119. One horizontal issue – which impacts on all options except option 2 (legal ownership) – is the need to introduce imputations for flows related to the income generated through the use of the IPP asset in production, as the related data will tend to follow legal ownership. These imputations would require cross-country coordination to avoid asymmetries between countries, with a corresponding resource impact.

Option 1: The unit that produces the IPP is deemed the economic owner

120. In many MNEs, dedicated R&D units (affiliates) develop the R&D which is then transferred, often without cost, to the parent or other affiliates. Where explicit sales of the entire asset occur (whether within the MNE, in line with transfer-price arrangements, or to non-affiliated parties), the producing unit will not be deemed the economic owner. However, often no explicit sales are made and instead the asset is made available for use by affiliated parties, de facto, for free. Under these circumstances, a case could be made that the producer is the economic owner, which would require imputing revenue streams for the producer, and subsequent outward foreign direct investment flows.

Option 2: The legal owner as default solution

121. The second option is to record economic ownership as equivalent to legal ownership. In this context, it's important to note that this applies whether or not the transfer of ownership between two parties is accompanied by an explicit transaction related to the sale of the IPP, and so includes transfers of legal ownership that may arise when an MNE restructures and relocates (and so instead, the 'transfer' may only be captured through FDI flows).

122. The use of SPEs and the increasing ability to relocate headquarters or IPPs to territories where it is fiscally advantageous to do so, has created a wedge between notions of de jure legal ownership and de facto economic ownership (see the specific section below on SPEs for more information). This has caused difficulties for the accounting world, and is at the heart of the discussion in this section and indeed the reason for the emergence of the other options presented here. That being said, despite these wedges, the option to follow legal ownership remains attractive as it presents a different view of economic reality (i.e. the tax situation) and it ensures that any subsequent revenues generated through the use of the asset (e.g. sales of licences to use) are in line with the position of legal ownership - which can be succinctly called a 'follow the money' approach. It is also in line with the default solution that is currently often applied by countries in assigning economic ownership of IPPs and, since it follows the legal situation, it also stays close to business accounting.

123. This is advantageous with regard to information that can be obtained from data sources and in that it also avoids creating imputations (and indeed oddities in the system, e.g. taxes paid in one country for revenues generated in another, which could arise if economic ownership was determined in an alternative way). However, it should be borne in mind that imputations would still be needed if the legal owner made the asset freely available to

affiliated parties (which may for example occur if the choice of the location of the asset was determined by factors such as stronger IPP protection as opposed to fiscal consolidation).

Option 3: The head office of an MNE group

124. The third option assumes that since the parent exercises some degree of control and ultimately receives the benefits (if not through the generation of income by production, then through direct investment income received from affiliates) and takes the risk, the parent is always deemed the economic owner of the IPP. This option is proposed in the paper of De Haan and Haynes (2018) and Moulton and Van de Ven (2018). Their preference for this option is very much related to the specific characteristics of IPPs.

125. The extent to which countries internationalize their R&D production varies by country, but it is probably too strong an assumption to assume that the parent explicitly pays for all R&D performed outside the country it is domiciled. Thus, it is unlikely that this type of implicit financing is recorded in international trade in services data. Therefore, imputations for the missing pieces (i.e. parents' imports of (unrecorded) R&D assets from their foreign affiliates; and corresponding exports of (unrecorded) R&D services from the parent to affiliates (or non-affiliated parties) using the asset) would be needed to fully implement this approach.

126. Apart from the practical consequences regarding the recording/imputation of transactions concerned, one should also identify the actual decision making unit. Statistically this could be challenging – indeed, it could lead to the allocation of ownership of these assets in significant scale to tax-havens. Furthermore, one has to be aware that the head office of an MNE group could differ from the legal situation. If the legal situation is decisive, it could also easily change from one day to another.

Option 4: The unit that uses the IPP

127. The fourth option assumes that the economic owner of the IPP is any unit in the MNE that produces goods and services for which it, directly or indirectly, makes use of the IPP. Since IPPs are non-rivalrous and can be used in multiple locations simultaneously, this may lead to a partitioning of the IPP asset among the different users, with consequent need for substantial imputations.

128. If use of the IPP by both affiliated and unaffiliated units is treated consistently this would mean that part of the IPP assets would also be allocated to unaffiliated units. When this is not accompanied by any explicit transactions, this does not correspond very well with the concept of change in economic ownership in the case of unaffiliated units. Therefore, one may want to apply different rules based on whether the units are affiliated or not. If the unit that uses the IPP in the production of other goods and services is an unaffiliated unit, then there is no transfer of ownership unless there is an explicit sale or purchase of R&D or software services. If the unit that uses the IPP in the production of other goods and services is an affiliated unit then the assumption under this option is that there is always a transfer of ownership (even if not evidenced by a transaction). So, in case of affiliated units this option may require an imputation to reflect a change of ownership of (part of) the IPP. This option also includes the possibility of using the IPP for physical production 'elsewhere'. Contracting out production (possibly abroad) but owning the IPPs concerned can lead to a 'factoryless goods production' situation.

129. Economically, this is an interesting option because it brings together production and the asset that is needed for that production. However, it is unclear whether there should always be a change of ownership or whether it can also be accounted for by an imputation of

the right to use the asset (service flow). Moreover, the practical feasibility to estimate the necessary imputations in a consistent way makes this option challenging.

130. An example of a specific application of this option is included in Rassier and Koncz-Bruner (2015). They demonstrate for the US a method of formulary apportionment of MNE profits based on compensation of employees and sales to non-affiliates. A similar method could be used to partition the IPP asset. While the indicators used for apportionment do not necessarily correspond with use of the IPP in the production process, it is one way to try to proxy use of the IPP by an affiliate. Moulton and Van de Ven (2018) also point out that the broad approach is highly sensitive to the means of apportionments. For example, an approach based on labour or compensation of employees, may see significant reallocations of IPPs to affiliates in countries engaged in labour-intensive activities, such as processing.

SPEs owning IPPs

131. An SPE (legally) owning IPPs is different from other SPEs. SPEs normally have no productive activities, but in case an SPE owns IPPs, these IPPs can 'produce' services. In that case, the revenues relate to produced assets and should therefore be regarded as deriving from services and not as property income. In general, the term royalty and licencing companies (R&L companies) is used. However, there may sometimes be confusion about their specific names and labels. Some companies with 'real' activities regarding the IPP (for example research and development activities) are sometimes labelled R&L companies, whereas they are not actually an SPE and should be recorded according to the SNA rules as 'standard' corporations. Furthermore, the term R&L companies may be used for SPEs that do not own IPPs, but which are most likely invoicing units or another form of a conduit. These units are left out of consideration here.

132. The general rule for SPEs is that entities with little or no physical presence are to be classified as institutional units when they are not resident in the same country as their parent, whereas those that are resident in the same country should be consolidated with their parent. In case of SPEs owning IPPs, one can distinguish SPEs that have transactions outside the group they belong to and those that have only transactions within the group.

133. If the SPE concerned has transactions outside the group it belongs to, the agreed treatment is to apply the 'margin' concept. When the entity acts as a conduit for R&L payments (i.e. it receives and transfers large gross sums), the 'revenues' should be seen in 'net' terms. When it has revenues but does not have corresponding R&L payments, then the 'revenues' should be seen in 'gross' terms (and feed into the operating surplus of the SPE).

134. If the SPE concerned has only transactions within the group it belongs to, the agreed approach is to calculate output as the sum of costs. Application of the sum-of-costs method would mean, in cases of an SPE owning IPPs, including potentially substantial amounts of consumption of fixed capital (with relevant impact on GDP and GNI). Of course, especially in case of SPEs having only transactions within the group they belong to, it could be questioned if these units are the economic owner of the IPPs concerned. In the current guidelines (UNECE Guide to Measuring Global Production) the default solution assigns economic ownership of the IPP concerned to these SPEs, in correspondence with legal ownership. Rerouting of ownership, and corresponding income flows, from the legal to the economic owner is not recommended (see para. 4.38 of the UNECE Guide), as it would require a lot of imputations that will need to be based on various assumptions.

135. Allocating economic ownership of the IPPs concerned (where legal ownership is in the country under consideration) to the rest of the world would need justification of that approach, as well as demonstration of the consistency with the relevant other country's

recording of these IPPs in their national accounts (i.e. the assets must be recorded somewhere). It is recognised that the allocation of legal and economic ownership over IPPs is a difficult issue in practice and practical implementation is still under discussion in the relevant fora. However, it needs to be assured that the IPPs are recorded somewhere. Moreover, for many other ('regular') institutional units owning IPPs and being part of an MNE group, one could ask the same question regarding economic ownership, i.e. considering assigning the ownership to the parent company. In this respect, the issue at hand is very much related to the above discussion on the economic ownership of IPPs, and there seems to be no reason to treat SPEs differently compared to 'regular' institutional units apart from SPEs often being brass plate types of units having no productive activities and no physical presence.

136. Finally, SPEs owning IPPs could well be a disappearing phenomenon due to tax reforms driven by international initiatives such as OECD's Base Erosion and Profit Shifting (BEPS). Requirements about the economic 'substance' of the units concerned could lead to a more hybrid situation where brass plate companies are replaced by 'real' establishments.

5.5. Conclusions

137. Use of 'R&D expenditure by sources and types of funding' data, as set out in the 2015 Frascati Manual, is recommended as this can provide useful insights into the nature of funding underlying the production of R&D output. In particular, it can be used to estimate the portion of R&D for which the costs of production are met using own funds or current/capital transfers received for R&D as opposed to R&D produced for sale - with the implication being that the latter is market output and should not be treated as GFCF of the producer but of the funding (i.e. purchasing) sector/industry.

138. In the absence of 'type of funding' information, the R&D output should be allocated to an owning sector/industry based on an assessment of whether the performer or funder is most likely to be the owner; such assessments should draw upon the combination of R&D producing and funding sectors/industries involved and any other relevant information available.

139. Disaggregating information at the Extended Balance of Payments Services Classification (EBOPS) level of detail for R&D and computer software services as well as separately identifying affiliated versus unaffiliated international transactions may allow for a more refined treatment of change in economic ownership. More generally, the next section lists a number of areas which may warrant further research.

140. The Task Force discussed the four options set out in section 5.4 for recording economic ownership of IPPs within an MNE, and was broadly split between favouring option 2 or option 3. Task Force members did not generally favour options 1 or 4, due to the drawbacks which were identified conceptually and in practice.

Recommendation:

36. Countries should bring their R&D surveys in line with the 2015 Frascati Manual guidance to breakdown government funding into exchange funds and transfer funds, and to distinguish funding flows between affiliated units from those between non-affiliated units.

6. Way forward

141. This report contains a number of recommendations regarding conceptual as well as practical issues on the recording and measurement of intellectual property products (R&D, Software and databases and Other IPPs). These recommendations should, after agreement of the appropriate Eurostat and OECD fora, be implemented as soon as possible, to improve the quality of the national accounts estimates concerned as well as the international comparability of these data.

142. In addition to the recommendations, the report has also raised several issues that may merit further investigation. Some of these will be in the area of the SNA research agenda, but others may be addressed by specific task forces. An overview of issues for further research is as follows:

- There is a need to further explore the issue of economic ownership of IPPs. The report lists four options which should be further explored with their pros and cons, not only looking at the impact of measurement of stocks and flows with regard to IPPs, but also assessing the possible impact of these options with regard to other statistics. Furthermore, it should be assessed what type of data would be needed to apply the preferred option
- Given the recommendations in the report on the 'sum-of-cost' approach for measuring own-account production of R&D and software assets, and their consequent impact on non-market producers, there is a need for government finance statisticians to discuss the recording impact in COFOG statistics.
- Whereas there is already quite a lot of guidance on R&D and on software and databases, the guidance with regard to 'Other intellectual property products' (AN1179) is currently very limited, creating confusion on what should actually be included in this category. For that reason, clearer guidance should be developed on the definition and delineation of this category.
- Marketing assets are currently recorded as non-produced assets and only included in balance sheets when their value can be derived from explicit transactions. However, this raises questions in relation to income flows that may be derived from these assets. It should be further explored how to deal with marketing assets, also in the absence of explicit sales and purchases of these assets, and whether they should continue to be treated as non-produced assets, or whether they may be regarded as (produced) IPPs.

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ANNEX A: Mandate of the Task Force

Background

The concept of compiling national balance sheets for countries is not new, but there is increasing demand, also in view of the causes of the economic and financial crisis, for complete balance sheets of countries. Yet data, especially data on non-financial assets, total and by institutional sector, are often not available. Because of this the G20 Data Gaps Initiative provided a template of minimum and encouraged stocks of non-financial assets by asset type and by sector. In response to interest on balance sheet data, the revised transmission programme for the European System of Accounts (ESA 2010) requires additional mandatory items for Table 26 'Balance sheets for non-financial assets'. In addition, the OECD collects information related to balance sheet items and is the primary data collector and validator for non-European member countries of the OECD. As such, OECD members are also requested to provide the balance sheet information for Table 26.

Recognizing the need for more practical guidance on the estimation of non-financial assets, a joint Eurostat/OECD Task Force (TF), including participation from the European Central Bank (ECB), was created in June 2012. The TF on Land and other non-financial assets established an expert group consisting of national statistical institutes and international organizations. The TF has issued a Compilation Guide on Land (AN.211), and then continued its work on the measurement of Inventories (AN.12).

Purpose and output of the Task Force

The purpose of the TF is to study possible sources and methods that will provide guidance to Member States and (other) OECD countries to compile estimates for selected non-financial balance sheet items. The output of the TF will be, for each of the balance sheet items to be studied, an extensive paper that will provide descriptions of available sources, methodologies and calculation methods.

In its next phase, the TF will study the major elements of intellectual property products (AN.117). The study will cover both the estimation methods for the total economy and for the institutional sectors of the economy. For (AN.117) Intellectual property products Table 26 of the ESA 2010 transmission programme requires estimations for total economy and the institutional sectors, however, the breakdown by detailed asset type (AN.117x) and by sector is voluntary in most cases.

The TF will focus on the following asset types³⁶:

- AN.1171 Research and Development
- AN.1173 Computer Software and Databases
- AN.1179 Other intellectual property products

³⁶ The other variables in this group are AN.1172 Mineral exploration and evaluation, and AN.1174 Entertainment, literary or artistic originals.

Unlike for the previous areas studied by the TF (Land, Inventories) there is already a substantial amount of background and guidance material available for both Research and Development³⁷ and for Computer Software and Databases³⁸; it will be seen in the TF what items countries record or wish to record under "Other intellectual property products".

The TF will therefore focus on the practical implementation by countries in these areas, drawing on existing metadata, and assessing if further guidance is needed.

The TF will also assess the implementation of the globalisation dimensions of IPP, and notably how the economic location of IPP assets is determined³⁹.

Organisation of the work

The TF members are expected to contribute to the work of the TF actively. TF members will:

- provide an outline of the main estimation problems they face in their countries regarding the variables to be studied;
- carry out studies, written in English, that propose solutions – suggestions for sources to be used, useful methodologies, calculation methods – for estimation problems;
- be prepared to inform other TF members by presenting national practice and results of the studies carried out in the TF meetings.

Eurostat will facilitate the work of the TF by organising the meetings and providing administrative support. The TF meetings will be commonly chaired by Eurostat and OECD.

Time schedule and communication

The TF will start its work on AN.117 from spring 2017. The work will be finalised by the end by October 2018. It is foreseen to organise 3 physical meetings during this period, likely in June/July 2017, January/February 2018, and September 2018⁴⁰.

In addition to the TF meetings, in which the produced documents and reports will be discussed, TF members will discuss questions and (preliminary versions of) documents electronically.

³⁷ For example the Eurostat Manual on measuring research and development in ESA 2010 – see <http://ec.europa.eu/eurostat/documents/3859598/5937049/KS-GQ-14-004-EN.PDF/eed4dfe2-9b89-4c30-8c49-f6152912c1a7>

³⁸ There was considerable work in Europe, and worldwide, in the 2000s after the capitalisation of software in SNA 1993.

³⁹ In this context, the UNECE Guide to Measuring Global Production devotes a chapter to IPP – see http://www.unece.org/8080/fileadmin/DAM/stats/publications/2015/Guide_to_Measuring_Global_Production_2015.pdf

⁴⁰ After discussion of the TF report at their meeting on 18-19 December 2018, the Directors of Macroeconomic Statistics (DMES) decided to extend the mandate of the TF to June 2019 to explore a couple of issues in more detail and to update the report accordingly.

A dedicated part of the Eurostat CIRCABC site will be available for storing the TF documents⁴¹.

Regular reports of the progress and the results of the work will be presented in the meetings of the European National Accounts Working Group and the OECD National Accounts Working Party. If desirable, the progress of the TF work will also be communicated with other working groups.

⁴¹ Please note that in the end an OECD-site has been used for this purpose:
<https://community.oecd.org/community/tfland/overview>

ANNEX B: Overview of recommendations included in the OECD Handbook on Deriving Capital Measures of Intellectual Property Products 2010

CHAPTER I: MEASURING INTELLECTUAL PROPERTY ASSETS

1. Small expenditures should only be excluded from estimates of intellectual property products gross fixed capital formation if there are good practical reasons.
2. Intellectual property products are not subject to wear and tear, but they can be subject to amendment and augmentation. Substantial planned improvements should be recorded as gross fixed capital formation, while minor, unplanned improvements are better recorded as intermediate consumption.
3. As a general rule, all expenditures on intellectual property products, either purchased or produced on own account, should be recorded as gross fixed capital formation if they are expected to provide economic benefits for the owner. Only in cases where units specialise in producing a type of intellectual property products for sale should acquisitions of that type of product be expensed, or if it is clear that they are completely embodied in another product: for example software copies purchased to be embedded in computers for sale, or other specific information exists such as the existence of a licence with a duration of one year or less.
4. Spillovers should not be considered in valuing fixed assets.
5. In deriving estimates of GFCF, the degree of product detail should be determined by the needs of users, data availability and the heterogeneity of the products, taking account of the rate of price change and variation in the service lives.
6. Whenever possible, estimates of purchased fixed assets should be derived using both the demand and supply-side approaches, and then confronted and reconciled with each other.
7. Whenever possible, estimates of own-account gross fixed capital formation should be derived using both micro and macro approaches, and then confronted and reconciled with each other.
8. When summing costs to estimate gross fixed capital formation of intellectual property products, all costs should be included irrespective of whether the activity is eventually successful or not. Values of assets that subsequently prove unsuccessful should not be written off in the other changes in volume account. Instead they should be depreciated in the same way as similar classes of assets that prove successful.
9. All expenditures by government on IPPs, including R&D, should be recorded as GFCF, if they satisfy the requirement that the IPP is intended for use in production, whether directly by government or by another user, for more than a year.
10. When asking units to estimate the costs of producing assets on own account they should be asked to itemize their costs, separately identifying purchases of fixed assets. The latter should not be included in the sum of costs. But estimates of the user cost of capital should be (but only the depreciation component for non-market producers). This can be done either by applying the perpetual inventory method to past estimates of capital expenditures or by making an imputation based on data for units specialising in the production of the particular intellectual property product.
11. Business records of asset acquisitions should only be used to derive estimates of gross fixed capital formation of intellectual property products with extreme caution.

12. For Intellectual property product originals that have a well-defined means of production, or a limited number of means of production, then the methods described for deriving price indices for unique manufactured products in the Producer Price Index Manual can be considered. Otherwise, other solutions should be considered. One possibility is to infer a price index using the revenue earned by market producers of original Intellectual property products and a satisfactory volume output indicator.
13. For products where price data are available and there is evidence of rapid quality change, as is the case for packaged software, a method, such as the hedonic method, that takes account of quality change should be used to derive price indices.
14. For products where price data are unavailable, pseudo output price indices should be derived if practicable, otherwise input price indices must be used.
15. When using the perpetual inventory method, it is important to have reasonably accurate service lives. The geometric model has a number of advantages and should be used unless there are strong conceptual or practical objections.

CHAPTER II: RESEARCH AND EXPERIMENTAL DEVELOPMENT

16. Ownership of an asset exists when the owner has effective management and control of the R&D output in order to ensure the expected benefits are obtained. There are more ways of ensuring this than patenting the R&D, for example by publishing R&D in a scientific journal. By doing this, others are prevented from claiming ownership.
17. As a practical solution, when the rights to benefit from the results of R&D are not clearly assigned by intellectual property protection, the owner should be deemed to be the purchaser or, in the case of own-account R&D, the owner is deemed to be the producer.
18. When ownership is deemed to exist, the only relevant question for determining whether R&D should be capitalised is whether it is expected to provide economic benefits for its owner. When it produces economic benefits for its owner, such as by increasing its productivity or reducing its costs, it should be capitalised.
19. As a general rule, all R&D purchased or produced on own account should be treated as gross fixed capital formation, except when the R&D original is produced for sale (in which case it should be recorded as GFCF of the acquiring unit).
20. Unless specific information to the contrary exists, all expenditures on purchases of R&D or on R&D production by market producers in the Scientific Research and Development industry (Division 72 ISIC Rev. 4) should be recorded as intermediate consumption, or otherwise expensed, on the presumption that such units produce R&D for sale, and any purchases are incorporated in products for sale. Only when specific information is available to the contrary should acquisitions of R&D be recorded as gross fixed capital formation, such as R&D performed by start-ups that do not yet have sales or cases when a unit takes out a patent and sells licences to use.
21. In principle, output, or pseudo-output, price indices should be derived for R&D. But at the present time no consensus has been reached on how such price indices could be derived. Until that time input-cost price indices should be used.

CHAPTER IV: SOFTWARE AND DATABASES

28. Own-account software updates or upgrades should not include the value of the “original” version, and instead should only reflect the increase in value. The value of the upgraded

software on the balance sheet comprises the value of the upgrade plus the depreciated value of the original version.

29. Sales of the “originals” should be treated as sales of pre-existing assets as specified in para. 10.38 of the 2008 SNA, unless it can be determined that they were produced for sale.
30. It is very important to distinguish between licences to use for more than a year and licences to use for a year or less. Expenditures on the former, purchased by production units and not embodied and sold on within other products, are recorded as GFCF, while expenditures on all other licences to use are recorded as consumption. Whatever the approach is used it is vital that the accurate discrimination between the two should be central to measurement.
31. The value of own-account software GFCF should include the costs of all expenditures in stage 2-6 above [i.e. functional analysis; detailed analysis programming; tests; documentation].
32. Industry sales data can only be used if they are sufficiently detailed. When implementing a supply approach from industry sales data, all sales of software products should be taken into account, including relevant businesses not classified under the category “computer services”.
33. In the supply approach, import and export definitions have to be consistent with definitions of domestic supply. Both should include royalty payments and licence fees.
34. In the supply approach, double counting of investment can be avoided by (1) excluding flows corresponding to sub-contracts, (2) excluding 50% (if no specific data) of purchased packaged software by the computer hardware industry, and (3) by excluding, in the macro-estimate of own-account production, costs of analysts and programmers corresponding to sales of custom computer programming services that have already been accounted for using the sales data.
35. In the supply approach, external costs of maintenance are to be excluded. When using either ISIC Rev. 4 or CPA-2008 all but that part of 6202 or 62.02 providing services for own-account software production should be excluded.
36. In the supply approach, consumption by households should be estimated through household budget surveys or other equivalent sources and excluded from sales (adjusted for trade margins and indirect taxes).
37. If a country does not have reliable data on the share of time spent on the various tasks of computer professionals, the share should be assumed to be no more than 50% in calculating the labour costs of own-account software production.
38. A database should be recorded as a fixed asset if a typical datum is expected to be stored on the database, or archived on a secondary database, for more than a year.

ANNEX C: How can accounting information on IPPs help to determine economic ownership (contribution by Belgium)

IPP assets in international accounting guidelines

International accounting guidelines are numerous and complex; only the most relevant to the analysis of IPP assets in a globalized context are pointed out here, namely guidelines related to recording of intangible assets (IAS38) and to business combinations (IFRS3).

International Financial Reporting Standards (IFRS) are issued by the IFRS Foundation and the International Accounting Standards Board (IASB) to provide a common global language for business affairs so that company accounts are understandable and comparable across international boundaries. Standards that were issued by IASC (the predecessor of IASB) are still within use today and go by the name International Accounting Standards (IAS).

IAS 38 “Intangible assets”⁴²

This Standard requires an entity to recognise an intangible asset if, and only if, specified criteria are met.

The asset should be:

- identifiable, that is either:
 - is separable, i.e. is capable of being separated or divided from the entity and sold, transferred, licenced, rented or exchanged or
 - arises from contractual or other legal rights.
- controllable: an entity controls an asset if the entity has the power to obtain the future economic benefits flowing from the underlying resource and to restrict the access of others to those benefits. The capacity of an entity to control the future economic benefits from an intangible asset would normally stem from legal rights that are enforceable in a court of law.

The future economic benefits flowing from an intangible asset may take the form of revenue from the sale of products and services, but also of cost savings, or other benefits resulting from the use of the asset by the entity.

An intangible asset shall then be recognised in the balance sheet if, and only if:

- it is probable that the expected future economic benefits that are attributable to the asset will flow to the entity. An entity shall assess the probability of expected future economic benefits using reasonable and supportable assumptions that represent management’s best estimate of the set of economic conditions that will exist over the useful life of the asset;
- the cost of the asset can be measured reliably (an intangible asset shall be measured initially at cost)

We are here quite close the ESA 2010 definition of economic ownership which states in its para. 7.17 “The economic owner of an asset is not necessarily the legal owner. The economic

⁴² http://ec.europa.eu/internal_market/accounting/docs/consolidated/ias38_en.pdf

owner is the institutional unit entitled to claim the benefits associated with the use of the asset by virtue of accepting the associated risks.”

The Standard also specifies how to measure the carrying amount of intangible assets, that is the amount at which an asset is recognised in the statement of financial position after deducting any accumulated amortisation and accumulated impairment losses. Note that for intangible assets produced for own account, the paragraphs 51-67 of the consolidated document on IAS 38 gives specific insight on how to evaluate and register the so-called “internally generated intangible asset”.

Finally, the Standard specifies numerous disclosures about intangible assets (para. 118 – 125), of which:

- distinction between internally generated intangible assets and other assets;
- service lives;
- amortisation method;
- reconciliation of the carrying amount at the beginning and end of the period;
- breakdown by grouping of intangible assets of a similar nature;

All that information can be of great help to properly evaluate IPP assets within national accounts.

IFRS3 Business Combinations⁴³

IFRS3 Business Combinations outlines the accounting when an acquirer obtains control of a business (e.g. an acquisition or merger). The objective of this IFRS is to improve the relevance, reliability and comparability of the information that a reporting entity provides in its financial statements about a business combination and its effects, namely how the acquirer recognises and measures the identifiable assets acquired.

In accordance with IFRS3, if an intangible asset is acquired in a business combination, the cost of that intangible asset is its fair value at the acquisition date. The fair value of an intangible asset will reflect expectations about the probability that the expected future economic benefits embodied in the asset will flow to the entity. In other words, the entity expects there to be an inflow of economic benefits, even if there is uncertainty about the timing or the amount of the inflow.

Therefore, the probability recognition of revenue and reliable measurement criteria set in IAS38 are always considered to be satisfied for intangible assets acquired in business combinations; those assets will be therefore capitalized, giving a reasonable indication of economic ownership.

IPP assets in European companies' financial statements

In the EU, companies listed in European securities markets are required to use IFRS in their consolidated financial statements starting in 2005⁴⁴. EU countries have the option to require or permit IFRS for unlisted companies as well as for parent company (unconsolidated) financial statements. For the companies using IFRS, registration of IPP assets can be considered as ESA compliant and is therefore a useful tool for national accountants. For

⁴³ http://ec.europa.eu/internal_market/accounting/docs/consolidated/ifrs3_en.pdf

⁴⁴ Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards.

several European countries, the IFRS consolidated accounts are synthesized in the database set by the ERICA (European Records of IFRS Consolidated Accounts) Working group⁴⁵.

For other companies, each Member State may have its own accounting standards for both non-consolidated and consolidated accounts, which often include specific features linked to the national fiscal treatment of transactions.

There, a Directive of 2013⁴⁶ aims to ensure the clarity and comparability of financial statements (other than IFRS) and applies to limited liability types of companies in the European Union. The directive sets out general financial reporting principles, as well as detailed rules over the presentation of the balance sheets, profit and loss accounts and the notes to the financial statements, as well as management reports, non-financial information, corporate governance and consolidated statements. The obligations may vary depending on a company's size; it is up to each EU country to decide on the extent of the allowed exemptions and simplifications.

As far as intangible assets are concerned, the balance sheet shall include them with the following provisions:

- (1) Costs of development, in so far as national law permits their being shown as assets.
- (2) Concessions, patents, licences, trademarks and similar rights and assets, if they were:
 - a) acquired for valuable consideration and need not be shown under goodwill; or
 - b) created by the undertaking itself, in so far as national law permits their being shown as assets
- (3) Goodwill, to the extent that it was acquired for valuable consideration.
- (4) Payments on account

Profit & loss accounts shall include value adjustments in respect of tangible and intangible fixed assets.

It appears here that registration is allowed to vary across countries, making it difficult to assess a priori if the registration is ESA compliant or not.

Finally, in considering a worldwide use of business accounting, it must be underlined that IFRS are not being adopted in the US, where US GAAP prevail, with sometimes significant differences in the allowance of capitalization of different types of intangible assets⁴⁷.

⁴⁵ <https://www.eccbso.org/wba/pubblica/wgdetails.asp?id=4>

⁴⁶ Directive 2013/34/EU on the annual financial statements, consolidated financial statements and related reports of certain types of businesses; EU countries had to incorporate it into national law by 20 July 2015.

⁴⁷ More details can be found in PWC (2016) « Similarities and differences: a comparison of IFRS, US GAAP and Belgian GAAP », Brussels, sections 5.4 to 5.7.

ANNEX D: A case study of a restructuring of IPP assets (contribution by Belgium)

Background: IPP assets in corporate accounts in Belgium

Non-consolidated accounts

Activation/capitalization of IPP intangible assets is **not mandatory**; to be capitalized, the following criteria must be met:

- the product/process must be separately identifiable
- it must generate economic advantages in the future: it must contribute to the purpose of the entity or improve its competitive position
- it must be controlled by the entity

Those criteria are similar to IAS38⁴⁸, and compliant with the ESA definition of economic ownership (see para. 7.17 of the ESA 2010).

For large enterprises which file the so-called mandatory “full schedule”, details are asked for outstanding amounts as well as for flows of intangible assets:

1. R&D
2. Patent, licences, concessions, know-how, trademarks and other similar rights (this item should include the part of software that is capitalized)
3. Goodwill

For SME, which file the so-called mandatory “abridged schedule”, there is no detail foreseen, and all IPP assets would be shown in the single rubric “Intangible assets”.

Consolidated accounts

In the optional Belgian Generally Accepted Accounting Principles (GAAP) schedule, the same level of detail in intangible assets applies for large companies, but company can choose to use it or not. About 500 to 600 Belgian companies are filing Belgian GAAP consolidated accounts.

IFRS consolidated accounts compliant with the IAS/IFRS guidelines are filed by about 150 Belgian companies, of which UCB, the IPP company at stake.

⁴⁸ PWC (2016) « Similarities and differences: a comparison of IFRS, US GAAP and Belgian GAAP », Brussels, p.5-9.

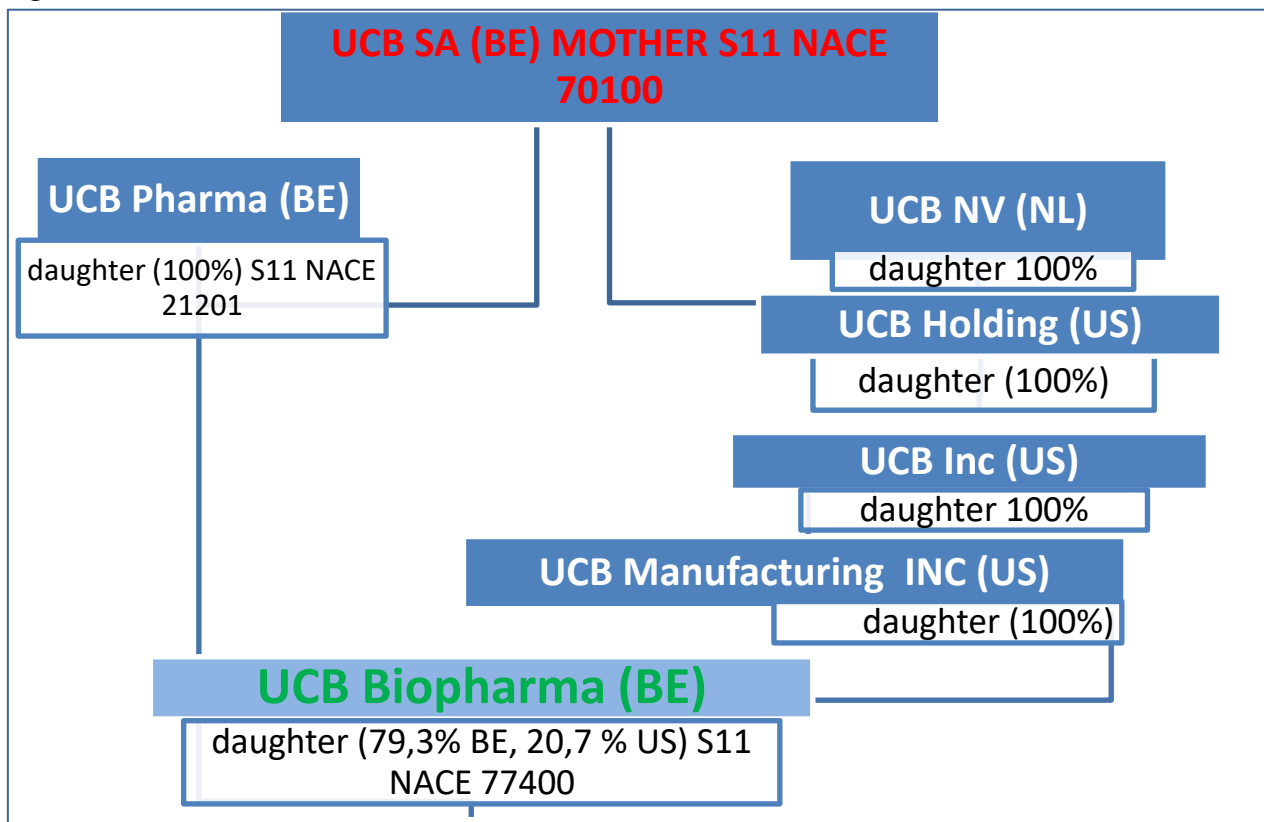
Case study: Restructuring IPP assets in the UCB biopharmaceutical group in 2014

UCB (Union Chimique Belge) is a **multinational biopharmaceutical company** headquartered in Brussels, Belgium. UCB is an international company with revenue of €4.178 billion in 2016, with a team of more than 7,700 people, a strong market presence in **approximately 40 countries**. It **focuses primarily on research and development**, specifically involving medications centred on epilepsy, Parkinson's, and Crohn's diseases. The Company's efforts are focused on treatments for severe diseases treated by specialists, particularly in the fields of central nervous system (CNS) disorders (including epilepsy), inflammatory disorders (including allergy), and oncology.

In 2014 large IPP assets have been transferred from several subsidiaries of the UCB group to a newly created Belgian unit: "UCB Biopharma" (shown in green in Figure1).

The structure of the units involved in that deal is the following:

Figure 1

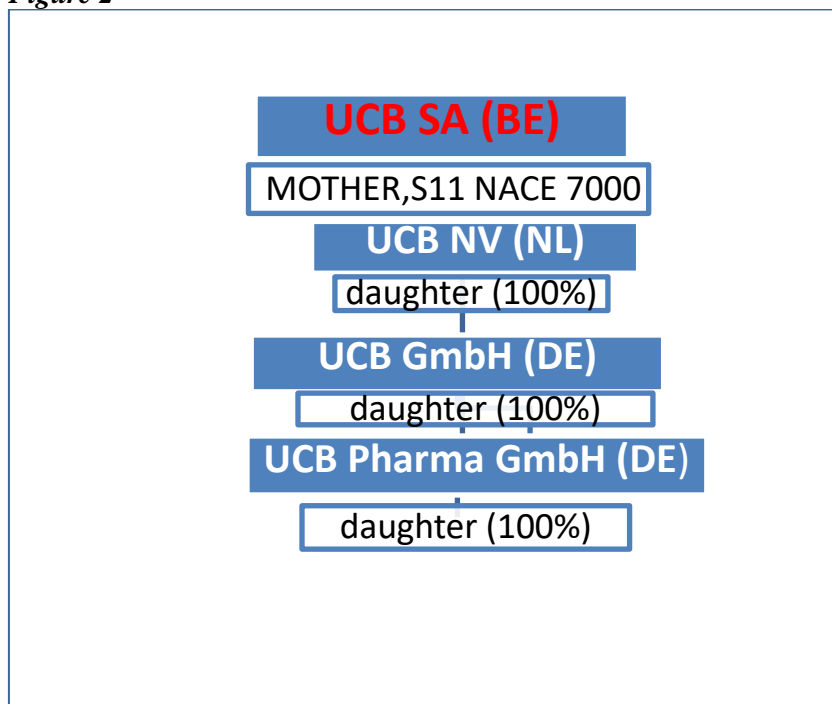


- On January 1st, 2014, most intangible assets of the Belgian UCB Pharma have been transferred to UCB Biopharma through a branch contribution, for a total accounting value of € 1487 million:
 - € 586 million of intangible assets
 - € 61 million of tangible assets
 - € 840 million of other assets

- On July 1st, 2014, UCB manufacturing, one of the US subsidiary, contributed in kind its economic property rights of all assets (patents & know-how) linked to one specific medicine to UCB Biopharma. Those rights were valued at € 1524 million (that is € 2724 million less associated financial debt of € 1150 million).

The legal ownership lied with another company of the group, UCB Pharma GmbH (DE, see Figure 2), which in turn transferred those legal rights to UCB Biopharma.

Figure 2



At the end of the road, it is thus confirmed that the economic property lies effectively within UCB Biopharma, which make them appear in its books, as shown in Table 3. This confirmed by the fact that UCB Biopharma shows in the following years the licence revenue from those assets in its profit account.

Note that in the IFRS consolidated account of the mother company UCB SA, the amounts are smaller than the sum of the subsidiaries' assets. This is partly due to the fact that “internal development costs are capitalized only if they meet the criteria of identifiability of IAS 38; because of the long duration of development and considerable uncertainties related to the development of new products (risks clinical trials, probability of authorization of marketing), the internal development costs of the Group as a rule do not meet the criteria for recognition as intangible assets. As of December 31, 2014, no internal development costs did meet these identifiability criteria”⁴⁹ The amounts that do appear are internal research costs.

⁴⁹ 2014 Consolidated annual accounts of UCB SA, p. 84

Table 3: 2014 transfer of IPP assets in the UCB group according to company accounts*(Millions of Euros)*

	UCB Pharma (BE)		UCB Manufacturing Inc. (US) ¹		UCB Biopharma (BE)		<i>pm UCB SA (BE)</i>			
	2013	2014	2013	2014	2013	2014	<i>non-consolidated</i>		<i>consolidated (IFRS)</i>	
							2013	2014	2013	2014
Outstanding amounts										
Total intangible assets (at accounting value)	1.527,5	678,7	?	?	3.473,1	0,2	0,2	1.312,0²	1.219,0²	
of which R&D	846,5	186,8			731,1	-	-			
Patent, licences & other IPP rights	681,0	491,9			2.742,0	0,2	0,2			
<i>pm depreciation of intangible assets</i>	<i>2.909,9</i>	<i>1.299,9</i>			<i>1.469,6</i>					
Total intangible assets (at acquisition value)	4.437,4	1.978,6			4.942,6	-	-			
of which R&D	3.225,6	1.045,4			1.828,2	-	-			
Patent, licences & other IPP rights	1.042,9	933,2			3.114,4	-	-			
Yearly flows (at acquisition value)										
Total intangible assets (proxy P.51)		- 2.458,8			5.380,8	0,2	-	106,0²	77,0²	
Acquisitions		1,9			5.381,1³	0,2	-			
Disposals (-)		2.460,7	<i>Estimate</i>	<i>2.724,0</i>	0,4	-	-			
depreciation		<i>1.873,2</i>			<i>1.383,8</i>					
<i>acquisition - disposal (at accounting value)</i>		<i>-585,6</i>			<i>3.997,0</i>					

¹ It has not been possible to find the accounts of this unit² Goodwill is not include³ This amount does not add up to the disposals of UCB Pharma and UCB Manufacturing, because some other small entities also brought some intangible assets into UCB Biopharma

As a consequence, the transfer of assets has been accounted for in the Belgian national accounts⁵⁰.

The net effects on the Belgian accounts are as follows:

- Transfer of assets between the two Belgian units cancel out;
- Investment by the new unit from abroad is booked as an increase in investments (P.51g) and imports of services (P.72), with therefore no impact on GDP, but increase in the capital stock (asset AN.1171) as the new P.51g feeds the stock computed with the PIM.

The estimated amounts for national accounts aggregates are however not coming directly from accounting figures, but are a combination of expenses as collected in the Frascati Manual survey by the Belgian office for scientific policy (Belspo) and of Balance of Payments flow. Accounting data is used more as a quality control tool, and comments to the annual accounts are generally useful to get background information on large transactions such as the one described.

⁵⁰ If we were only to use accounting data, the P51 at market value would be estimated as the amounts disposed by the transferring units, after subtracting the depreciation previously booked by those units, and adding capital gain, if any (none in this case).

ANNEX E: Impact of R&D on foreign direct investment flows and stocks (based on contributions by the Czech Republic and Ireland)

Among the changes introduced by 2008 SNA / ESA 2010 is an increase in GDP through capitalisation of research and development. However, both manuals do not explicitly explain how this capitalisation may affect the various flows related to foreign direct investment. This annex provides a detailed explanation on how these flows may be affected.

Profits of international corporations are transferred to their foreign owners (or shareholders) pro rata to their ownership shares (as measured by disposable income). The rationale behind this treatment is that the decision to retain some of the earnings within the enterprise reflects an investment decision on the part of the foreign direct investor. This means that the retained earnings are treated as if they were distributed and remitted to foreign direct investors and then reinvested by them by means of additions to equity in the financial accounts. For this purpose, the 2008 SNA uses items D.43 (i.e. reinvested earnings on direct foreign investments) and AF.5 (i.e. equity and investment fund shares).

The definitions are unequivocal. ESA 2010 para. 4.64 states that⁵¹:

*reinvested earnings on foreign direct investment (D.43) are equal to the operating surplus of the foreign direct investment enterprise
plus
any property incomes or current transfers receivable,
minus
any property incomes or current transfers payable, including actual remittances to foreign direct investors and any current taxes payable on the income, wealth, etc., of the foreign direct investment enterprise.*

A problem may occur, however, when the imputed disposable income is not derived on the basis of operating surplus, property income and/or transfers according to SNA concepts. This may occur when compilers only use business accounts' profits for the calculation of D.43 without any adjustment for flows that may not have been reflected in these profits. In the case of capitalisation of R&D, it may very well be that the creation or purchase of R&D is reflected as current expense and not as gross fixed capital formation. This will lead to an underestimation of profits and therewith of reinvested earnings, overvaluing GNI of the R&D producing country and underestimating GNI for the parent company.

A similar issue may arise when a company decides to sell the R&D assets after some period. This may be reflected in the business accounts' profits, whereas from a national accounts' perspective it should be regarded of a sale of an asset. Therefore, it should be excluded from the D.43 calculation.

⁵¹ The equivalent 2008 SNA paragraph is 7.139.

The example below assumes that the FDI enterprise has R&D expenditures and the output is used primarily by that enterprise. The non-financial asset should then be captured in the institutional sector of that enterprise. In this example the enterprise is owned for 100% by a foreign company. The example shows that it may frequently happen that the creation of R&D (in this example set equal to 100) is not reflected in an increase in reinvested earnings on foreign direct investment, leaving the R&D producer with a primary income of 100. However, the correct way would be to adjust reinvested earnings, which will lead to a primary income of zero, also affecting several other balancing items, such as net lending/net borrowing and net worth.

National economy - most used approach		National economy - recommended approach	
<i>Primary incomes</i>		<i>Primary incomes</i>	
	B2G 100		B2G 100
B5G 100		D.43 100	
		B5G 0	
<i>Capital Account</i>		<i>Capital Account</i>	
	B8G 100		B8G 0
P5G 100		P5G 100	
B.9 0		B.9 -100	
<i>Financial Account</i>		<i>Financial Account</i>	
			AF5 100
B.9 0		B.9 -100	
<i>Balance Sheets (closing stocks)</i>		<i>Balance Sheets (closing stocks)</i>	
AN11 100		AN11 100	AF5 100
	Net worth 100		Net worth 0

A similar issue may arise in relation to the consumption of fixed capital related to the R&D asset of a foreign direct investment enterprise. If R&D assets are not recorded on the balance sheet, it is very likely that no depreciation will be accounted for as current expense in the business' accounts. This may lead to

an overstatement of the profits and of the reinvested earnings, underestimating GNI of the R&D producing country and overestimating GNI for the parent company.

In summary, compilers need to be aware of the impact of the SNA treatment of R&D, when using business' accounts information in deriving foreign direct investment flows and stocks. Reporting companies may not consider R&D expenditure as gross fixed capital formation but as current expense, and they may not consider the need to depreciate the assets that are associated with previous and current R&D expenditure. As a result, the reported profit may diverge from the national accounts' and balance of payments' concept of reinvested earnings and may require specific adjustments to bring them in line.

ANNEX F: A case study of the use of the UNECE Guide to Measuring Global Production decision tree for determining economic ownership of IPPs (contribution by Italy)

The identification of economic ownership of IPPs within MNEs may present significant measurements difficulties. The UNECE Guide to Measuring Global Production (2015) highlights some characteristics of IPP flows that under certain conditions could help national accounts researcher to identify the ownership of an IPP.

Italy conducted a pilot exercise on the identification of ownership of IPPs using the UNECE decision tree.

To apply the decision tree in practice, it was necessary to collect available data that could support the identification of the ownership of IPPs. The following statistical and administrative sources were identified:

- Business Register of Enterprise Groups (ASIA-Groups Register): a database of all groups of enterprises, including MNEs;
- Survey on enterprise accounting system (SCI Survey): a census survey of enterprises, with at least 100 persons employed. It collects data on profit-and-loss accounts and (partly) balance sheets, together with other relevant variables. Since year 2016, a new set of questions referring to Intellectual Property (IP) has been introduced;
- Statistical survey on research and development (Frascati Manual Survey);
- INFOCAMERE archive: a database of financial statements of corporate enterprises;
- CCIAA archive: Financial statements of Chamber of Commerce;
- Italian Regional Tax on Production Activities (IRAP archive): current taxes on income in business accounting.

All data sources are collected and/or updated annually by the Italian National Institute of Statistics (Istat).

For the pilot exercise, a new database was created by linking and combining all data sources at enterprise level.

Based on available sources a test was created: each leaf node in the decision tree contains questions or criteria to be answered; each branch shows the flow from question to answer; the final leaf carries the decision about the ownership of IPPs. To answer the questions information on data sources were selected and adapted (Table 4).

Table 4. Test on ownership of IPPs

Node	Question	Answer
Root Node/ Node 0	Is the unit part of a MNE?	ASIA-Groups register provides the information required for identifying hierarchical relationships among enterprises of a MNE
Node 1	Is the unit an IPP producer?	1) Enterprises filling the FM Survey questionnaire; 2) Enterprises answering the question on production of IP (SCI survey); 3) Enterprises demanding a fiscal deduction for research-related employment (IRAP archive)
Node 2	What is the main kind of activity of the unit?	Economic Activity of the unit (Nace Rev 2)
Node 3	Is the unit expected to use the IPP in its production process?	1) Enterprises answering the question on use of IP (SCI Survey); 2) Enterprises filling the FM survey questionnaire (with the exception of enterprises classified on Nace 72)
Node 4.1	Does the unit receive income from royalties or license to use for IPPs ?	1) Enterprises declaring to receive income from Royalties or Licences of IP (SCI Survey)
Node 4.2	Does the unit pay royalties or license to use IPPs ?	1) Enterprises answering the question on payment of Royalties and Licences of IP (SCI Survey)
Node 5	Does the unit receive compensation for IPP development?	Enterprise filling the section of intra-muros expenditure on R&D activities by founding sector (within the same group) (FM Survey)
Node 6.1	Does the unit sell IPP originals?	Enterprises declaring to have sold original of IP (SCI Survey)
Node 6.2	Does the unit purchase IPP originals?	Enterprises declaring to have purchased original of IP (SCI Survey and INFOCAMERE)

To select the enterprise for the pilot exercise, the dimension and the relevance of the enterprises were taken into account. The total number of active enterprises in the Statistical Business register (Asia–Enterprises) was about 4.4 million in 2016, 414 thousands belonging to Groups and 111 to MNE groups. Only 2,736 MNE groups had at least one enterprise with more than 100 persons employed.

As result, enterprises suitable for the study were 3,805, with the following characteristics:

- classified in Business register of ASIA-Groups;
- with at least 100 persons employed;
- that have answered to Frascati Manual Survey or SCI Survey;
- that have asked for a fiscal deduction for research-related employment in the Regional income tax register (IRAP archive).

The final result of the application of the UNECE decision tree was that 68.8% of these enterprises could be classified as the owner of the IPP, 8.6% as not owning the IPP, and for 22.6% of the cases no solid conclusion could be found.

To test the results of the exercise, a set of enterprises were selected (for each branch, the most relevant in terms of persons employed was chosen). The analysis was carried out by checking the results with information from financial statements, management reports, and from websites. This check showed that not all the results on ownership as derived by applying the decision tree were confirmed.

The outcomes of the studies highlight some challenging aspects due to the particular characteristics of some branches, as well as inconsistencies arising from the data sources used. Some features of the decision tree, in order to be applied, seem to require qualitative information that can only be gathered via directly contacting the enterprise, or specific information that is difficult to standardise or to use in a deterministic way as was done in the pilot exercise.

As example, for branch 1.2.2 in the decision tree, referring to ownership of royalty and licencing companies (R&L companies), it was not possible for a particular type of SPE⁵² to apply the decision tree because of lack of information.

The priority of characteristics in some of the branches is also not always fully clear. For example, what is the priority when a node contains more characteristics, such as is the case for branch 1.1.2.2, i.e. “the unit receives income from royalties or licence to use, or does not receive any compensation for IPP development from the parent, so it can be assumed that it is expected to obtain income from royalties and licences to use in the near future”. In this case, according to the UNECE Guide, the ownership should be assigned to the unit. However, compensation for IPP development can also be received independently from income from royalties or licence. So, if the unit receives both, does it maintain the ownership?

Results also shows difficulties to find all the information needed to apply the decision tree. The 22.6% of non-treatable cases shows inconsistency between data sources or inconsistencies within the same source. Apart from possible mistakes, these can be due to: 1) new set of questions that may differ from the old ones; 2) different persons were in charge of answering the questionnaires (e.g. researcher for Frascati Manual survey, accountant for SCI survey); 3) the questions were not clear enough; 4) the questionnaires were too long.

On the basis of the experience with the pilot exercise, the research on how to identify IPPs ownership will be continued focusing on a smaller sample of enterprises and introducing a direct contact with the MNE. At the same time, a new analysis related to foreign trade of IPPs will be started. Hopefully this will improve the allocation of economic ownership and the treatment of the related R&D flows.

⁵² https://ec.europa.eu/eurostat/documents/737960/738007/Final_Report_Task_Force_SPEs.pdf.