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**STATISTICS DIRECTORATE
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Working Party on National Accounts

**CAPITALISATION OF RESEARCH AND DEVELOPMENT: REPORT OF R&D TASK FORCE AND
RECENT DEVELOPMENTS**

**To be held on 10-12 October 2006
Tour Europe - Paris la Défense
Beginning at 9:30 a.m. on the first day**

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CAPITALISATION OF RESEARCH AND DEVELOPMENT: REPORT OF R&D TASK FORCE AND RECENT DEVELOPMENTS

Introduction

1. At its meeting in July 2005, the AEG made a number of recommendations concerning issue 9, research and experimental development (R&D):
 - a) *Research and development should be treated as gross fixed capital formation in the SNA. It should be defined as in the Frascati manual, namely as “research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including the knowledge of man, culture and society and use of this stock of knowledge to devise new applications.” This definition should not be interpreted as including human capital as capital formation within the SNA.*
 - b) *In principle, freely available R&D should not be included as capital formation but in practice it may not be possible to exclude it. The assumption is that including freely available R&D would not lead to significant error.*
 - c) *By convention, since much R&D is carried out on own account, it should be valued at cost. In practice, the information collected in accordance with the Frascati manual will provide estimates of R&D expenditure; discussion is ongoing to make adjustments to the Frascati framework to meet the needs of the SNA more closely.*
 - d) *With the inclusion of R&D in the asset boundary, patented entities will no longer be separately identified as such in the system, but they will be subsumed into R&D assets.*
2. While it is considered by the Canberra II Group, the AEG and the ISWGNA that it is feasible for many countries to derive satisfactory estimates of the required R&D statistics, it also is recognized that its implementation will be a major undertaking for national statistical offices (NSOs). To help NSOs implement the recommendations and to foster the development of good quality and internationally comparable R&D statistics in the national accounts, two OECD task forces, the Canberra II Group and NESTI¹, have joined forces to address compilation issues and to develop compilation guidelines that will be incorporated in a manual on measuring intellectual property assets.
3. The first joint meeting of the two task forces took place in Berlin on 31 May and 1 June 2006, and was hosted by the German Federal Ministry of Education and Research. The agenda and draft minutes of the meeting are presented in attachments 1 and 2. The papers presented can be found on the Canberra II EDG.
 - a) The major topics discussed were:
 - b) The AEG’s recommendations.

1 The Working Party of National Experts on Science and Technology Indicators (NESTI) is responsible for the Frascati Manual.

- c) Using bridge tables to construct national accounts statistics from survey data conducted as per the Frascati Manual (FM).
- d) Measuring international flows of R&D output.
- e) Boundary issues
- f) Volume estimation
- g) Measuring capital stocks and other capital-related statistics
- h) Developing timely quarterly estimates.

The AEG's recommendations

4. The AEG's recommendation to capitalize R&D was warmly welcomed and there was considerable enthusiasm expressed at that meeting to get on with tackling the remaining obstacles to a successful implementation and developing the proposed manual. However, concern was expressed about the second of the AEG recommendations on R&D - recommendation (b). Some members argued that this recommendation could be interpreted differently by countries, with some deciding to include all R&D expenditures in GFCF and others deciding to exclude some (e.g. R&D undertaken by government). As a first step, it was agreed to draft a note describing what "freely available" means and hence what sort of R&D output should not be recorded as an asset in concept. The note would be sent to the ISWGNA for their consideration. This has been done and the ISWGNA has confirmed its conclusions - see attachment 3. The ISWGNA has re-drafted recommendation (b) and sent it along with attachment 3 to the AEG for their consideration.

"Research and development should be treated as capital formation and the value should be determined in terms of the economic benefits it provides. In principle, R&D that does not provide an economic benefit to its owner does not constitute a fixed asset and should be treated as intermediate consumption. Because it is difficult to quantify the benefits of R&D, by convention, it may be valued at the sum of costs."

5. The ISWGNA has come to the view that the criterion of whether the output of R&D is made freely available or not needs refinement. The ISWGNA proposes that R&D output should not be recorded as an asset if it is such that when made freely available it leaves the owner (or members of its collective group) with no economic benefits. Making R&D output freely available does not exclude the original knowledge from being an asset provided the expected benefits for the economic owner (or members of its collective group) are not diminished. What matters is the effective management and control of the knowledge asset in order to ensure the expected benefits are obtained.
6. It is also proposed to provide guidance on how to implement this recommendation in the forthcoming OECD manual on measuring intellectual property. A proposal (attachment 4) has been sent to members of the Canberra II Group and NESTI for their views.

Compiling R&D statistics in the national accounts

7. A number of countries have now compiled bridge tables between survey data collected as per the FM and the national accounts. It has been demonstrated that this can be done quite successfully by making some assumptions, such as the nature of financial transfers between different types of institution. With some modifications to the R&D survey forms better quality estimates could be obtained. A document describing the changes required was sent by the Canberra II Group to NESTI in 2005.

8. There is evidence that the quality of balance of payments statistics concerning the transfer of R&D output and services is relatively poor - another aspect of the growing statistical measurement problems associated with increasing globalization. This is a major issue irrespective of whether R&D is capitalized or not. Data from R&D surveys could provide at least part of the solution. This was a major topic of the meeting and it is clear that further work needs to be done.
9. There is a lack of good quality information about the service lives of R&D outputs and their distribution. At the meeting it was agreed that members should consult major R&D performers to seek information about their expectations of the service lives of R&D outputs. Presumably, major performers of R&D that undertake R&D over many years must have some sort of framework for assessing the costs and benefits of undertaking R&D. It has also been proposed that this consultation should be broadened to cover international trade in R&D between affiliated enterprises.
10. No country conducts quarterly R&D surveys, and so a means has to be found of deriving quarterly estimates of R&D production and expenditure. Three approaches were discussed: conducting quarterly R&D surveys asking fewer questions and with a smaller sample size than the annual survey; using proxy indicators such as employment data relating to appropriate categories; and an econometric model. It was agreed that further investigation of the first two alternatives was required.
11. Another joint meeting of the Canberra II Group and NESTI is to be held in Paris on 26, 27 April 2007. The major agenda items will be:
 - a) The R&D component of a preliminary draft manual on measuring intellectual property statistics.
 - b) Investigations into compiling R&D statistics for the national accounts
 - c) This meeting will follow a meeting of the Canberra II Group on 25, 26 April to discuss the revised OECD manual *Measuring Capital* and empirical matters concerning the measurement of capital.

Attachment 1

Joint Expert Meeting: Canberra II Group and NESTI – Capitalisation of R&D**Berlin, 31 May – 1 June***Draft agenda (version March 23)*

<i>Wednesday 31 May</i>	<i>Location: Ludwig-Erhard-Haus Fasanenstraße, 85, Berlin</i>
14:30	Introduction, objectives of the meeting, agenda – Chair, Fred Gault, Statistics Canada
14:45	AEG recommendations – summary by Charlie Aspden
15:00	Capitalisation of R&D: main issues <i>Overview of what is involved: basic framework, conceptual issues, measurement challenges, experiences with satellite accounts</i> – Barbara Fraumeni, US [30 min] <i>Q&A</i> [15 min]
15:45	Using bridge tables between Frascati data and National Accounts <i>Basic principles for constructing bridge tables, data sources</i> - Soli Peleg, National Accounts, Israel [30 min]
16:15	Coffee break [15 min]
16:30	Using bridge tables between Frascati data and National Accounts – continued <i>A Frascati to System of National Accounts Application to U.S. Data</i> – Carol Robbins, BEA, USA [30 min] <i>Updates from other countries</i> [30 min] <i>Discussion</i> [15 min]
17:45	Chairman’s conclusions and next steps
18:00	End of Day 1

Thursday 1st June	Location: Federal Ministry of Education and Research (place tbc), Berlin
9:15	<p>R&D international flows</p> <p><i>Measuring R&D Globalisation: the U.S. Experience</i> – John Jankowski, US National Science Foundation [20 min]</p> <p><i>Measuring R&D imports and exports, R&D of multinational firms</i> - Mark de Haan, National Accounts, the Netherlands [30 min]</p> <p><i>Discussion</i> [25 min]</p>
10:30	Chairman's conclusions and next steps
10:45	Coffee break [15 mins]
11:00	<p>R&D boundary issues</p> <p><i>Identifying R&D made freely available</i> - Mark de Haan, National Accounts, the Netherlands [15 min]</p> <p><i>Discussion</i> [15 min]</p> <p><i>Borderline issues: treatment of software and mineral exploration</i> – Charlie Aspden (OECD) and Mark de Haan, National Accounts, the Netherlands [20 min]</p> <p><i>Countries' experiences</i> [20 min]</p> <p><i>Discussion</i> [20 min]</p>
12:30	Lunch
14:00	<p>Volume estimation</p> <p><i>Using cost-based measures- overview of issues and ongoing work</i> – Alessandra Colecchia and Vladimir Lopez (OECD) [15 min]</p> <p><i>Countries' experiences</i> [15 min]</p> <p><i>Discussion</i> [30 min]</p>
15:00	<p>Estimating R&D capital stocks</p> <p><i>Estimating service lives and age/efficiency profiles, overview of issues and countries' experiences</i> - Charlie Aspden (OECD) [15 min]</p> <p><i>Country and/or expert presentations</i> [15 min]</p> <p><i>Discussion</i> [30 min]</p>
16:00	Coffee break [15 min]
16:15	<p>Quarterly R&D estimates</p> <p><i>Forthcoming need to produce quarterly estimates, interpolating and extrapolating from annual data, a note</i> – Charlie Aspden (OECD) [15 min]</p> <p><i>Discussion</i> [15 min]</p>
16:45	<p>Chairman's conclusions</p> <p>Summary, reviewing work plan, outstanding issues, possible Expert Group meetings</p>
17:30	End of Expert Meeting

Attachment 2**DRAFT****MINUTES****NESTI/CANBERRA II GROUP JOINT EXPERT MEETING ON THE CAPITALISATION OF R&D, BERLIN, GERMANY, 31 MAY – 1 JUNE 2006**

1. These are the minutes of the Joint Expert meeting NESTI / Canberra II Group held in Berlin from 31 May – 1 June, 2006 and hosted by the German Federal Ministry of Education and Research.

Introduction, objectives of the meeting, agenda

2. The Chair of the meeting, Fred Gault (Statistics Canada), welcomed participants and outlined the objectives and organisation of the meeting. The meeting was designed as an opportunity for R&D data collectors and national accountants to meet and discuss issues relating to the recommendation by the Advisory Expert Group (AEG) that R&D be capitalised in the SNA, including changes to R&D surveys to better support the needs of the national accounts and to identify topics for further work by members of the two groups.

AEG Recommendations

3. Charles Aspden (OECD, STD) gave a brief summary of the recommendations of the AEG concerning the treatment of R&D. It was recommended that expenditure on R&D should be treated as GFCF and defined as per the Frascati Manual. However, it was also recommended that “in principle, freely available R&D should not be included as capital formation but in practice it may not be possible to exclude it. The assumption is that including freely available R&D would not lead to significant error”.
4. Since much of R&D is undertaken on own account, it should be valued at cost and recorded as GFCF as it occurs, consistent with 1993 SNA recommendation for other own-account fixed capital formation. With R&D included in the asset boundary, patented entities would simply be subsumed into R&D assets and no longer be recorded separately.
5. Assuming these recommendations are accepted by the United National Statistical Commission (UNSC), the OECD has decided to prepare a manual that would provide guidelines for the compilation of R&D statistics in the national accounts. A principal objective of the manual would be to support a smooth introduction of these statistics into the national accounts and potentially maximise their quality and international comparability. The manual would also cover other intangible fixed assets, such as software and databases, and would be published at roughly the same time as the updated 1993 SNA. The meeting gave its support to the OECD initiative.
6. A number of participants asked for clarification as to what the recommendation to exclude freely available R&D really meant. Does it mean that in practice all R&D expenditure should be recorded as GFCF? Others challenged the assertion that the amount of freely available R&D was so minor that its inclusion would not lead to significant error. This matter was discussed further (under the topic boundary issues) later in the meeting and a resolution was reached – see paragraph 17.

Capitalisation of R&D: main issues

7. Barbara Fraumeni (University of Maine, NBER) presented an overview of the conceptual, methodological and data issues relating to implementing the capitalisation of R&D. She focused on the following five aspects:
 - a. International issues: estimating imports/exports of R&D services, measuring the R&D of multinationals, assessing cross-border spillovers.
 - b. Stocks and flows: estimating gross return to R&D capital, constructing R&D stocks, measuring investment.
 - c. Prices: using cost-based measures as a “second best” approach, information from research on intellectual property and detailed industry prices.
 - d. Non-market and freely available R&D: noting the problematic nature of the AEG’s recommendation and the need to better understand what is intended and what is included in this category (with particular emphasis on the higher education sector).
 - e. Software: how to address the overlap of software and R&D (similar problems with originals).
8. Barbara then outlined some areas for further work including collecting new data, implementing bridge tables, further experimentation with satellite accounts and the re-development of the OECD manual *Measuring Capital*, which would include guidelines on measuring capital stock, consumption of fixed capital (CFC) and capital services for fixed assets (including R&D), and would be published around the time of the revised 1993 SNA.

Using bridge tables between Frascati data and National Accounts

Basic principles for constructing bridge tables, data sources

9. Soli Peleg (CBS, Israel) presented an example of the implementation of Frascati/SNA bridge tables for Israel. Soli reminded the group of the ongoing collaboration between the Canberra II Group and NESTI, including 3 years of groundwork for preparing simplified bridge tables, which several countries are now testing. Three main issues were raised:
 - a. Bridges between the Frascati concept of GERD and the SNA’s output of R&D.
 - b. Bridges between classifications to link funder/performer with supply and use tables.
 - c. Bridges between sectors (in particular for the higher education sector).
10. Soli outlined some of the specific steps for these adjustments and presented some results for Israel. She then identified areas in which certain assumptions need to be made (e.g. R&D purchases and transfers, estimating CFC, net taxes on production) and highlighted additional sources that can be used to complement R&D surveys (e.g. BOP, business, and innovation surveys). She concluded by inviting countries to participate in a pilot study that could make some suggestions for possible changes to R&D surveys and identify topics to be considered for the next revision of the Frascati Manual.
11. In summary, it is possible to do the bridging with data available currently by making some assumptions, but better estimates could be obtained if the surveys conducted as per the FM supported the following:

- a. Extramural expenditures need to be classified by SNA sector and, most importantly, they need to distinguish between purchases and transfers.
- b. A breakdown of capital expenditure by asset type is required, although it would probably suffice if such data were only collected from time to time, say every five years from a sub-sample of R&D performers. Such a breakdown is needed for volume estimation and the derivation of capital measures.
- c. The FM surveys do not show taxes explicitly, but some are included in current expenditures, such as payroll tax. It would be helpful if the FM provided explicitly other taxes on production and subsidies.
- d. Better and more complete data of international trade in R&D are required. Some of this may have to come from sources other than FM surveys.
- e. The FM's higher education sector should be subdivided between general government, NPI's and corporations.

A Frascati to SNA Application to U.S. data

12. Carol Robbins (BEA) provided an overview of work in the US. The NSF has funded the BEA to produce satellite accounts for 2006 and 2007, with a view to a full incorporation of R&D into the national accounts by 2012. The satellite account includes time series for the period 1959-2002 and is consistent with the NIPA. Carol summarised the steps followed to produce these estimates including summing inputs, deflating by component, producing chained measures, and creating capital stocks with an aggregate depreciation rate. Several data sources were used including Frascati-based current expenditure data, data from the Economic Census for the R&D Services Industry, international trade data and data on R&D performance by multinationals. Many measurement challenges were faced including separating current/capital expenditures, identifying transactions between funders and performers, estimating consumption of fixed capital (CFC) and net operating surplus, developing appropriate deflators, assigning R&D assets to sectors, and identifying cross-border R&D flows. Carol summarised some of the steps taken to address these issues in the US, as well as some long-term challenges, including measuring R&D output, constructing industry-level depreciation rates and lag structures, integrating capital services into the R&D satellite account, and estimating rates of return for non-market R&D.

R&D international flows

Measuring R&D Globalisation: the U.S. experience

13. John Jankowski (NSF) tackled the issue of international R&D flows based on work done in the US linking the business enterprise R&D survey to FDI surveys. Among the main results, it was found that US affiliates of foreign companies accounted for 8% of total US business enterprise R&D (BERD), but 16% of basic research. The majority of their R&D expenditure was in development activities and funded by company or other non-federal sources. Conversely, US parents accounted for three-quarters of US BERD and about two-thirds of employment. With regard to foreign affiliates of US parents, about two-thirds of R&D was performed in 5 countries (UK, Germany, Canada, France and Japan). Further work is currently being planned to better understand the differences between the R&D activities of US and foreign-owned firms.

Measuring R&D imports and exports: R&D of multinational firms

14. Mark de Haan (CBS, Netherlands) reported on work done in the Netherlands to measure R&D foreign trade. The Netherlands is a net exporter of R&D services, but there are some data limitations in the R&D survey. For example, there is no differentiation between sales/purchases and transfers/subsidies, and a significant amount of R&D may be transferred within multinationals without any payment. A detailed study of eight of the largest firms conducting R&D (accounting for around 50% of Dutch GERD) reveals that 12% of their total staff and 42% of their R&D staff are located in the Netherlands. However, only two of the eight report a substantial amount of R&D exports (over 80% of their GERD), whereas the other six report no or very little R&D exports. This suggests that R&D exports are probably substantially under-estimated in the Dutch R&D surveys.
15. Mark raised some possible directions for discussion including the possibility of assigning ownership of R&D to divisions within multinationals (for basic research, as well as applied research and development), and to what extent could R&D surveys assist. During the discussion, several points were made including whether the exporting was of an original or a copy, whether tangible assets could provide a reasonable parallel, and the coherence with company accounting rules for which basic research is not considered as an asset.

R&D boundary issues

Identifying R&D made freely available

16. Mark de Haan (CBS, Netherlands) discussed some of the implications and problems relating to the AEG recommendation to exclude “freely available” R&D from the asset boundary in concept, but to possibly include it in practice. He reminded participants that this had been a compromise between divergent points of view but warned that given the current wording, different interpretations of the recommendation could lead to inconsistent results across countries. For example, in the Netherlands, all R&D undertaken by the general government sector (including all university R&D) is not currently capitalized in their R&D satellite account and this accounts for around 40% of GERD.
17. During the discussion participants agreed that clarification should be sought from the AEG concerning what is meant by “freely available” in order to assess whether it is feasible to measure it and worthwhile excluding it. Countries were also asked to reflect on how this would apply to their R&D data and what they felt would be reasonable to exclude. It was agreed to draft a note describing what “freely available” means and hence what sort of R&D output should not be recorded as an asset in concept. The note would be sent to the ISWGNA for their consideration. Once this definition had been settled the joint NESTI-Canberra II group would undertake an investigation to determine whether “freely available” R&D could be identified and if so what its magnitude was.

Borderline issues: treatment of software and mineral exploration

18. Mark de Haan (CBS, Netherlands) presented a note, prepared with Charles Aspden (OECD, STD), on the issue of double-counting GFCF on R&D and other assets, in particular software and mineral exploration. The problem arises when summing costs to estimate own account capital formation: the capital cost should be the cost of the capital services provided and not the cost of assets acquired in the period. Mark outlined a step-by-step approach for tackling this problem depending on whether the R&D contributes to only to the formation of one asset, or whether it contributes to various assets. The note also takes into account previous work within the Canberra II Group that provides suggestions on how to avoid such double counting in the case of software, partly based on the recommendations of the Frascati Manual.

Volume estimation

19. Vladimir López-Bassols (OECD, STI) introduced a short note, prepared with Alessandra Colecchia (OECD, STI), to highlight various issues relating to the need for constant price estimates of R&D expenditure. Ideally, an output-based R&D price index should be used, but in practice it is acknowledged that a second-best approach has to be used, using input-based measures, given that R&D is a unique and heterogeneous product which is often not traded. In practice, countries often use a GDP deflator, and sometimes a combination of detailed price indices for the input components. Nonetheless, the use of cost-based measures raises some important questions for discussion, including:
- a. R&D input structure: how stable is it across countries, industries, time?
 - b. Labour costs: which data sources do countries use? How can data from surveys of the R&D services industry be used? To what extent do data differ across institutional sectors?
 - c. Capital costs: which proxy series do countries use? How do countries tackle ICT investment and borderline issues (e.g. software)?
 - d. Intermediate inputs and outsourcing: this area presents the most difficult measurement challenges; how do countries address outsourcing? How do accounting rules affect these estimates?
 - e. Aggregation methods and index-number formulae: what methods do countries use? How do these affect their estimates?
20. During the discussion it was noted that while at an aggregate level the use of an input-based deflator produced results close to those obtained using a GDP deflator for some countries, for other countries and at the industry-level differences were observed. It was agreed that national accountants and R&D survey statisticians would be well advised to seek the assistance of price statisticians in developing price indices for R&D, if they have not already done so.

Estimating R&D capital stocks

21. Charles Aspden (OECD, STD) presented a note outlining recommendations for compiling estimates of capital measures of R&D (capital services, CFC, and capital stock). He noted that researchers have used econometric methods as well as the perpetual inventory method (PIM) in their studies. However, he indicated a strong preference for the PIM and noted that it was the standard method used by national accountants for deriving capital measures for produced assets. The use of the PIM requires price indices, service lives, asset-life distribution functions and age-price (or age-efficiency) functions for the assets concerned. Of these requirements, the first two are the most important.
22. Two quite different approaches have been used to estimate the service lives of R&D output. The first has been by using econometric methods and second has been to determine the length of time patents have been renewed. Both approaches have their weaknesses and not too much reliance can be put on the resulting estimates. Nevertheless, their results generally suggest that service lives of R&D outputs usually lie between 10-20 years, with significant industry variations. The note concludes that although further work is needed to estimate service lives, the situation is no worse than for other produced assets.
23. It was observed that performers of R&D must have some means of estimating the future returns of R&D output in order to justify their R&D expenditures. The meeting agreed that it would be a good idea to consult major performers of R&D to learn about their evaluation processes and, if possible, find out what are their expectations of R&D service lives and/or rates of depreciation. It was

proposed to use a form developed by Bart van Ark as a basis. The results will be reported at next year's joint meeting of Canberra II NESTI.

Quarterly R&D estimates

24. Charles Aspden (OECD, STD) presented a note which outlined the challenge of producing quarterly R&D data as well as more recent estimates than those obtained through regular annual R&D surveys. Three options were mentioned:
 - a. implementing a (smaller) quarterly R&D survey;
 - b. using proxy indicators; and
 - c. using an econometric model.
25. During the discussion some countries considered the first approach to be impractical, while others believed that the quarterly collection of a limited data set for a sub-sample of R&D performers might be a feasible way of interpolating annual estimates. Countries also cautioned against the use of the third method which might produce unreliable estimates. The second method (using employment and wages data from other sources to interpolate and extrapolate annual survey data for R&D labour compensation and using the PIM to estimate quarterly capital services²) received substantial support.

Chair's conclusions

26. The Chair summarised the outcomes of the main discussion points of the meeting as well as the next steps for the group. The principal action items are as follows:
 - a. The group agreed that further guidance was needed on how the asset definition is applied to R&D and what is considered "freely available". Charles Aspden is to draft text defining in concept what sort of R&D should be excluded from the asset boundary. After seeking comments from members of the Canberra II Group and NESTI he will submit the text to the ISWGNA for their consideration. Canberra II and NESTI members will then be asked to consider the practicalities of the ISWGNA-approved proposal and report back to the ISWGNA.
 - b. Members were asked to consult major R&D performers to seek information about their expectations of the service lives of R&D outputs. Given the evidence that service lives vary between industries, members should endeavour to consult performers from an array of industries. It was suggested that a survey form developed by Bart van Ark (available from Alessandra Colecchia) could provide a basis for questions.

Postscript: It may be useful to expand the above consultation to cover international trade in R&D between affiliated enterprises. If there are a number of members interested in conducting such a consultation, the OECD Secretariat would be willing to draft a questionnaire and prepare a consolidated report of the results. Interested members should contact Alessandra Colecchia or Vladimir Lopez-Bassols. (Note that NESTI has a task force concerning international trade in R&D between affiliated enterprises and this work would be coordinated with it.)
 - c. Concerning quarterly estimates, it was agreed that there should be further investigation into the feasibility of quarterly R&D surveys and the use of quarterly employment and wages data.

2 It was recommended by the 2002 OECD Software Task Force as a suitable macro alternative to using surveys to obtain quarterly estimates of GFCF of software.

- d. It is intended to hold another joint meeting of the Canberra II Group and NESTI on 26, 27 April, 2007 in Paris. This will follow a meeting of the Canberra II Group on 25, 26 April. Peter Harper (ABS) will chair both meetings. The major agenda items for the joint meeting will be:
- Preliminary draft manual on measuring intellectual property statistics in the national accounts
 - Investigations into compiling R&D statistics for the national accounts
27. The Chairman thanked the German Federal Ministry of Education and Research for hosting the meeting and the participants for a lively and productive discussion, and invited the latter to continue working on these topics and reporting back on progress.

Attachment 3

Freely available R&D

Charles Aspden (OECD)

Introduction

1. At its meeting in July 2005, the AEG made a number of recommendations concerning the recognition of R&D as a produced asset. Although the AEG expressed strong support for the capitalisation of R&D members were split on whether this should include freely available R&D. Eventually, the AEG agreed on the following:

In principle, freely available R&D should not be included as capital formation but in practice it may not be possible to exclude it. The assumption is that including freely available R&D would not lead to significant error.

2. At the joint Canberra II/NESTI meeting in Berlin in May 2006, a number of participants asked for clarification as to what this really meant. Does it mean that in practice all R&D expenditure should be recorded as GFCF? Others challenged the assertion that the amount of freely available R&D was so minor that its inclusion would not lead to significant error.
3. After some discussion it was agreed that a note should be drafted describing what “freely available” means and hence what sort of R&D should not be recorded as an asset in concept. The note would be sent to the ISWGNA for their consideration. Once this definition had been settled the joint NESTI-CII group would undertake an investigation to determine whether “freely available” R&D could be identified and if so what its magnitude was.
4. Accordingly, a draft description of what sort of R&D should be excluded from the asset boundary was prepared by Charles Aspden and submitted to members of NESTI and the Canberra II Group for their consideration. Of the six responses received, the majority expressed broad support for the proposals, but there were some suggested changes to the text. Subsequently, a revised draft was prepared and submitted to the ISWGNA.
5. The ISWGNA has now endorsed the following text, which attempts to define which freely-available R&D should be included in the asset boundary and which should be excluded. NESTI and the Canberra II Group can now proceed to the next step of examining the practicalities of implementing these concepts.

Defining the scope of R&D assets

6. In paragraph 13.12, the 1993 SNA defines an economic asset as an entity functioning as a store of value:
 - a. Over which ownership rights are enforced by institutional units, individually or collectively; and
 - b. From which economic benefits may be derived by its owner by holding it, or using it, over a period of time.

The economic benefits consist of primary incomes derived from the use of the asset and the value, including possible holding gains/losses, that could be realised by disposing of the asset or terminating it.

7. The rationale, expressed by some members of the AEG and Canberra II Group, for not regarding R&D output made freely available as an asset is that ownership rights are not enforced, which means monopoly profits are forfeited, and so the R&D output has no value to the “owner”. However, it is possible for R&D to be made freely available on condition that the owner's rights are recognised, for example when research work is quoted by other researchers. This satisfies the first condition to be an asset. Since the second specifies benefits "may" be obtained rather than "are" or "are expected to be" obtained, it is not clear such R&D necessarily falls outside the asset boundary even though monopoly profits are forfeited, and so the R&D output has no value to the “owner”.
8. A different case is where the owner still expects to get an adequate return on their investment in R&D despite making the results of the R&D freely available to others. This situation is commonly found in a non-competitive environment, particularly in the non-market sector, but it can also occur in the market sector.
9. Suppose a national statistical office, NSO A, develops some software for managing its data. Another NSO, NSO B, is impressed by the software and asks for a copy, which NSO A agrees to give free of charge. When NSO A developed the software it did so in the expectation that the benefits it would obtain were sufficient to cover its costs and there was no expectation of obtaining income by selling copies of the software. Thus, giving a copy free to NSO B in no way changes the value of its asset. The same applies to R&D undertaken by a NSO. R&D is undertaken by many NSOs to further their own interests; the knowledge gained produces benefits for them, and sharing that knowledge with other NSOs does not detract from those benefits. The same is true for many other types of R&D undertaken by non-market producers. For example, medical research undertaken by a government unit for use by associated government units in the provision of medical services.
10. Units, both market and non-market producers, may also choose to make their R&D output available to other units for the purpose of seeking their views and stimulating further R&D. As long as they enforce ownership rights and do not forfeit the expected benefits there is no reason why their R&D output should not be recognised as an asset. What matters is the effective management and control of the knowledge asset in order to ensure the expected benefits are obtained.
11. Much R&D output provides both private and social returns. The former are the returns obtained by the owner of the R&D output and the social returns are the benefits obtained by the community at large, including competing enterprises³. In the national accounts, only expenditures incurred in the acquisition of assets are recorded as capital formation. (Most R&D is undertaken on own account, which means summing the costs of undertaking the R&D.) Hence, only expenditures corresponding to private returns are recorded in the national accounts.
12. In a competitive market situation, the unintentional leakage of knowledge from the R&D originator to other units can lead to a reduction in the net worth of the originator and an increase in the net worth of the recipients. With no transaction occurring between the units, the only way to record these changes is via the other changes in volume account.

3 Leo Sveikauskas (*R&D and Productivity Growth: A Review Article*, Canberra II Group EDG, March 2005) gives the example of the development of statins (a class of drugs taken for the reduction of bad cholesterol) in which the pioneering enterprise failed to obtain most of the benefits of its R&D.

13. In practice, changes in net worth due to knowledge leakages of any kind (i.e. any transfer of knowledge for which there is no payment) are only likely to be reflected in the purchased goodwill of market producers and not at all for non-market producers.
14. Part (a) of the 1993 SNA definition of an asset (paragraph 5, above) refers to ownership rights enforced by institutional units either individually or collectively. This can be taken to mean that if an R&D output is produced by a unit that shares the benefits with other units, the R&D output is still recognized as an asset provided that in a competitive market situation ownership rights are enforced collectively by the group of units concerned. In a non-competitive, non-market situation, the critical issue is whether the intended benefits are realised by the group, not whether the ownership rights are enforced.
15. This still leaves the question as to what freely available R&D output should be excluded from the asset boundary. By a process of elimination we are left with R&D output that when made freely available leaves the owner (or members of its collective group) without any economic benefits. One example is the output of pure basic research made freely available to anyone. By definition such research does not have a particular objective, and ALL the economic benefits could accrue to other units. Another example is the development by a medical research institution, funded by government or a NPI, of anti-malarial drugs for use in developing countries free of charge.

Summary

16. The AEG recommendation that in concept R&D output made freely available does not qualify as an asset needs refinement. It is proposed that it be defined as R&D output that when made freely available leaves the owner (or the members of its collective group) with no economic benefits.
17. Making R&D output freely available does not exclude the original knowledge from being an asset provided the expected benefits for the economic owner (or the members of its collective group) are not diminished. What matters is the effective management and control of the knowledge asset in order to ensure the expected benefits are obtained.

Attachment 4**EXCLUDING “FREELY AVAILABLE” R&D FROM GFCF****Charles Aspden (OECD)****Introduction**

1. The ISWGNA has now clarified which forms of expenditures on R&D should, in concept, be recorded as gross fixed capital formation (GFCF) following the AEG recommendation to exclude that which is made freely available. The challenge now is to determine if and how this can be put into practice.
2. The ISWGNA believes that it is conceptually desirable to include all expenditure on R&D as defined by the Frascati Manual (FM) when measuring GFCF, except that which when made freely available leaves the owner with no economic benefits. Making R&D output freely available does not exclude the original knowledge from being an asset provided the expected benefits for the economic owner (or the members of its collective group) are not diminished. What matters is the effective management and control of the knowledge asset in order to ensure the expected benefits are obtained.
3. There are two ways that one could go about excluding the required “freely available” R&D expenditures from GFCF. The first is to ask survey respondents to indicate what they expect to do with their R&D output, and one could ask questions along the following lines:

- a. Do you expect to publish the results of some of your R&D or otherwise make them publicly available? If so, what proportion of your total R&D expenditures would this correspond to?

If you answered “yes” to the first part of question (a), could you please answer the following question:

- b. Market producers: do you (or associated enterprises) still expect to earn income from the R&D output you will make publicly available or use it with the objective of earning future income?
 - c. Non-market producers: do you (or associated institutions) expect to use the R&D output you will make publicly available to develop new applications or improve existing ones?
4. The second alternative is to use the information already collected by R&D surveys to obtain an approximate answer to which R&D expenditures should be recorded as GFCF. R&D surveys collect intramural expenditure by R&D performers by institutional sector (business enterprises, government, private non-profit, higher education and abroad) by type of R&D (basic research, applied research and experimental development). In addition, R&D performers are usually asked to attribute their intramural expenditures between own funds, funds from other units in the same sector or sub-sector and funds from other sectors or sub-sectors.
 5. The FM defines basic research (para. 240) as

... experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

and also states (para. 241) that

... the results of basic research are not generally sold but are usually published in scientific journals or circulated to interested colleagues. Occasionally, basic research may be “classified” for security reasons.

6. The FM defines applied research (para. 245) as

... original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

and goes on to say that (paras. 246 and 247)

Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems. In the business enterprise sector, the distinction between basic and applied research is often marked by criterion of a new project to explore promising results of a basic research programme.

The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. Applied research gives operational form to ideas. The knowledge or information derived from it is often patented but may be kept secret.

7. The FM defines experimental development (para. 249) as

... systematic work, drawing on knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

8. Table 1 shows the average (unweighted) proportions of R&D expenditure across 29 countries by institutional sector by type of R&D. It can be seen that relatively little basic research is undertaken by business enterprises and that most of it is undertaken by higher education institutions and government. By contrast, the bulk of experimental development is undertaken by business enterprises. For most, but not all, countries the private non-profit sector accounts for very little R&D. A number of countries either report zero values or do not report data for this sector.

Table 1: Research and development expenditure by performers
Unweighted average of percentages, 2003

	Business enterprises	Government	Higher education	Private non-profit	Total
Basic research	3.4	6.7	11.1	1.2	22.3
Applied research	17.0	8.5	8.0	0.6	34.0
Experimental development	35.9	4.7	2.6	0.3	43.4
Total	56.2	20.0	21.8	2.1	100.0

Notes: Compiled using data for Argentina, Australia, Austria, Chile, China, Czech Republic, Denmark, France, Hungary, Iceland, Ireland, Israel, Japan, Mexico, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Singapore, Spain, Slovak Republic, Slovenia, South Africa, Korea, Switzerland, Taiwan and United States from the OECD database. For those countries for which no data are available for 2003, data for a neighbouring year are used. For a few of the above countries data in respect of the private non-profit sector are unavailable and the values in this sector's column have derived from data excluding them. However, the data for those countries with zero values for this sector have been used. Data for some countries are not on a consistent basis. In particular, for some countries the data exclude capital expenditures. See the

footnotes in the attached spreadsheets for further details. There is a small discrepancy between the sum of the different kinds of R&D and the total. This is because some R&D expenditure for Japan is put in the category “not elsewhere classified”.

9. Behind the averages in Table 1 lie substantial variations between countries. For example, at the extreme, in Japan basic research accounted for 12% of total R&D expenditure in 2003, while in Hungary it accounted for 39%. In Hungary 37% of R&D was performed by business enterprises, while in Japan the figure was 75%.
10. Table 2 shows the average (unweighted) proportions of sources of funding to and from institutional sectors. The business enterprise and government sectors are the principal sources of funds, but a significant contribution to all sectors comes from abroad. In order to measure GFCF correctly, account has to be taken of the export and import of R&D output and acquisitions within a country, but this matter is not addressed here.

Table 2: Sources of funding for research and development
Unweighted average of percentage contributions, 2003

Source Performer	Business enterprises	Government	Higher education	Private non-profit	Abroad	Total
Business enterprises	82.0	8.7	0.2	0.2	8.8	100.0
Government	6.0	84.9	0.2	0.9	7.7	100.0
Higher education	7.9	77.4	6.7	2.4	5.5	100.0
Private non-profit	21.0	36.2	0.4	27.9	14.5	100.0
Total	48.6	40.2	1.8	1.2	8.1	100.0

Notes: Compiled using data for Argentina, Australia, Austria, Belgium, Canada, Chile, China*, Chinese Taipei, Czech Republic, Denmark, Estonia, Finland, France, Germany*, Greece, Hungary*, Iceland, Ireland*, Israel, Japan, Latvia*, Lithuania*, Luxembourg*, Malta*, Mexico, Netherlands, New Zealand*, Norway*, Poland, Portugal, Romania, Russian Federation, Singapore*, Slovak Republic, Slovenia, South Africa, Korea, Spain, Sweden, Switzerland, Turkey*, United Kingdom and United States from the OECD database. For those countries for which no data are available for 2003, data for a neighbouring year are used. For some of the above countries data in respect of the private non-profit sector are unavailable and the values in the “performer” row have been derived from data excluding those countries marked with an asterisk.

11. It would appear that expenditures on basic research by higher education institutions and government are strong candidates for exclusion from GFCF. It would seem likely that for much of this research there is no strategy in place to capture future economic benefits, with the possible exceptions of R&D funded by business enterprises and defence departments. Business enterprises have the profit motive and presumably think that their basic research will lead to future income, even if the results are published. Therefore, they can be expected to have a strategy in place to exploit the knowledge gained from their basic research.
12. Applied research and experimental development undertaken by government is very likely to be undertaken with the intention of obtaining specific benefits for the R&D performer, or associated institutions, and so all such expenditures should be recorded as GFCF.
13. Some applied research and experimental development undertaken by higher education institutions is expected to provide economic benefits for the performer or its associates, including that undertaken in partnership with business enterprises and that funded by government for the procurement of R&D output, but some may be undertaken with no expectation of economic benefits for the institution or its collective group. The FM recommends that when the government sector is the source of funds a

breakdown should be obtained between general university funds (GUF) and ‘direct’, with the latter comprising R&D contracts and earmarked grants. Many countries collect these data in respect of the higher education sector, as can be seen in the attached spreadsheets. Therefore, one possibility would be to record as GFCF only that part of higher education expenditures on R&D funded by business enterprises and directly by government under the implicit assumption that ownership rights would be asserted over R&D funded in this way. However, this could exclude too much expenditure on R&D from GFCF, because it is very likely that higher education institutions would also contribute funds from GUF in undertaking many such ‘directly’ funded projects. Furthermore, the relative sizes of GUF and ‘direct’ vary enormously between countries⁴, which suggests that such an approach could reduce the international comparability of the data. Given that on average applied research and experimental development account for less than half of total expenditures on R&D by higher education institutions and given the additional data requirements entailed, the best option is probably to include all such expenditures in GFCF.

14. For philanthropic private non-profit institutions that undertake R&D in order to give it away then none of their expenditure on R&D should be recorded as GFCF. However, there will be some private non-profit institutions that undertake R&D with the objective of gaining benefits, just like a profit-making private enterprise. It is therefore recommended that countries make a decision based on a judgement of the relative contributions of the different kinds of unit. In any case, for many countries this is not an important issue because of the small amount of R&D undertaken by this sector.
15. It should also be recognised that because the bulk of GFCF of R&D will be estimated by summing costs, it is to be expected that this will lead to a lower value than would be obtained if R&D outputs were all traded and market prices could be observed. This is due to the high risk premium required to undertake R&D, and it should be borne in mind when deciding which expenditure categories of R&D should be excluded from R&D GFCF.

Summary and questions

16. There are two ways one could go about excluding expenditures on R&D that are undertaken with no expectation of economic benefits for the performer and members of its collective group. One is to ask performers questions to elicit this information and the other is to use existing classification information. Which do you think is the better option?
17. If the second alternative is chosen, do you agree that expenditures on R&D by units in the groups marked by an “x” or “part” in the following table should be recorded as GFCF? The data presented in Table 1 imply this would lead to about 80% of total expenditures on R&D being recorded as GFCF. Although, the proportions would vary considerably between countries.

	Business enterprises	Government	Higher education	Private non-profit
Basic research	X			part
Applied research	X	X	X	part
Experimental development	X	X	X	part

4 It is for this reason that no cross-country average proportions are presented in Table 2.