

# *Ideas for New Indicators on Globalisation of R&D*

## **Abstract**

The paper is the result of work within the EU-funded KEI (Knowledge Economy Indicators) project. Globalisation of R&D is a phenomenon attracting more and more policy interest in these days. Indicators on globalisation of R&D exist in some countries, but mainly as results from ad hoc studies. The aim of the work is to propose for more regular production of a set of relevant new indicators, which could be produced at relatively low cost. The paper starts with a discussion of the policy context and user needs for new indicators. Various methodological options for producing data are presented. The focus is on the measurement of outward R&D where the gaps are the biggest. Several survey approaches are discussed as well as matching data from R&D surveys and company records. In the conclusions some ideas are presented for ways to go further in the development of indicators on R&D globalisation.

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**KEI**

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## 1. Introduction

Globalisation is a key word characterising many processes in modern economy. It is of course not a new phenomenon, but the development of the knowledge economy has given it a more significant role as one of its key elements. Globalisation is currently not very well covered by official statistics mainly related to activities carried out by national actors within national boundaries. The development of quantitative indicators to increase our understanding of globalisation has started, however.

This paper is based on work within the KEI project. The KEI (knowledge economy indicators) project is a project co-financed by the EU within the sixth framework program. More information on the project is available at [www.kei.publicstatistics.net](http://www.kei.publicstatistics.net). The aim of work has been to develop and test new indicators on the role of multinational companies for R&D. The main research topic, however, has been to develop and improve indicators on outward R&D (R&D in foreign affiliates of domestic companies) and inward R&D (R&D in affiliates of foreign companies), which could be produced on a regular level.

The basis for the work has as far as possible been the recommendations in the OECD globalisation manual (OECD 2005). The indicators were expected to be mainly derived from analyses of existing R&D survey data on the enterprise level but other sources like special surveys or companies own reporting have also been used as far as possible.

We start with outlining a kind of policy framework for development of indicators on the globalisation of R&D. Various available methodological options for how to go further is presented and pros and cons with various approaches will be discussed. The results of testing various approaches are presented and finally some preliminary conclusions will be drawn on how to proceed in the future.

## 2. Policy issues and measurement needs

According to a note prepared by prof. Reinhilde Veugelers for commissioner Potocnik's expert group on knowledge for growth, "the rising internationalisation of R&D has caused concern among policy makers of both net recipient and net source countries. Governments of *net recipient countries* on the one hand actively compete to attract foreign firms, but at the same time fear that foreign-owned firms may act as 'Trojan horses' since they may milk the national technology and production base while keeping the core of their innovative activities in their home countries. Countries that are *net sources* of foreign R&D investment are worried that the internationalisation of R&D may relocate ('hollow out') the domestic knowledge base to abroad". (Veugelers 2005)

The policy measures with respect to R&D globalisation could be divided into three groups

- policies towards attracting R&D units from abroad
- government measures to link domestic firms to knowledge from abroad
- policies towards the mobility of human resources

Policies of attracting R&D units from abroad relate to measures aimed at strengthening the scientific and technological capabilities of a country and non discrimination of foreign firms compared with domestic enterprises. Technology programs in a country may serve as platforms for attracting international experts and foreign firms.

Measures to link domestic firms to knowledge from abroad may include financial support for R&D abroad. This has up to now been rather seldom used. Various measures of promoting international and national networking are more common as well as giving services for establishing international contacts.

There are a lot of policies aiming at stimulating import of foreign talent. These relate to releasing barriers to immigration, income taxation, accreditation of foreign qualification, improving legislation on S&T and lessening cultural and structural barriers.

The aim of the short discussion above has been to put the discussion on the development of indicators later into a certain policy context and not to give any comprehensive policy review. The discussion of these issues is of course far from being exhaustive.

To monitor progress in these policy fields several indicators; both traditional as well as new ones especially focused on globalisation issues are needed. Indicators of relevance for monitoring these policy fields are among others general statistics on foreign direct investments, indicators on the qualification structure of the population and the mobility of qualified personnel. The basic questions on which countries are net recipient countries of foreign R&D and which countries are net sources of foreign R&D are not enough illuminated by statistics and most of this report is devoted to a discussion of the possibilities on improving indicators on these issues.

### *3. Methodological options*

#### *3.1 Indicators to be further analysed*

The aim of this chapter is to go deeper into various methodological issues. We will first choose a set of priority indicators, discuss various ways of producing them, and evaluate pros and cons with various approaches.

We will start with a discussion on how the recommendations in the OECD Frascati Manual (OECD 2002) deals with the globalisation of R&D. Primarily R&D statistics compiled on the basis of it relate to activities of units within national boundaries but there are variables shedding some light on R&D globalisation.

Suggestions for various kinds of indicators describing the internationalisation of technology have been presented in the OECD globalisation manual (OECD 2005). They have been divided according to data availability and priority into three groups: reference indicators, supplementary indicators and experimental indicators. The starting point for the choice of indicators is an evaluation of their feasibility for further data collection.

The indicators could be broadly divided into two main groups:

- inward R&D investment
- outward R&D investment

In this paper, inward R&D investments consist of R&D activities by affiliates of foreign companies in reporting countries (the ultimate beneficiary owner is foreign). These can be created from nothing as green field investments or obtained through acquisition of an existing company or relocation of an existing R&D unit abroad. The most common indicator is perhaps R&D expenditures but also R&D personnel or number of researchers could be used.

Respectively, outward R&D investment means R&D activities by affiliates of national companies abroad (the ultimate beneficiary owner is from the reporting country). Also these can be created from nothing or obtained through acquisition of an existing company or relocation of an existing R&D unit in the country to a location abroad.

### *3.2 Review of sources*

#### *3.2.1 Existing R&D statistics and its development*

It is possible to derive some information on the role of multinational companies from regular R&D statistics. The Frascati Manual §179 recommends the identification of enterprises belonging to a national group (with or without foreign affiliates) performing R&D and

enterprises belonging to a foreign multinational group. However, this recommendation is not implemented in all countries. Such a classification implemented in all countries could be helpful to identify parent companies in reporting countries and foreign affiliates relevant for the calculation of inward R&D.

Two variables in R&D surveys are relevant for illuminating globalisation of R&D. These are R&D financed by foreign enterprises belonging to the same group and extramural expenditures for R&D performed by enterprises abroad belonging to the same group. To a certain extent also other international R&D transactions like other R&D financing from abroad and other funding of R&D undertaken abroad is relevant.

Even if a question on R&D financed by foreign enterprises belonging to the same group is included in many surveys and reported in statistics, the interpretation of this is not clear. The borderline between own funds and funds from elsewhere within the group needs clarification. In several globally operating multinational companies R&D is funded either wholly or partially on the group level or on the level of the parent company. Especially if the R&D unit is serving the whole group and the group or the parent is financing all R&D the funding is very close to the own funding concept. Sometimes in R&D surveys this kind of funding is in practise inconsistently reported. In some cases it is reported under own funds and in other cases in funds from other enterprises in the group. In fact this 'basic funding' of the unit is something different from selling of R&D services to a foreign unit belonging to the same group, which of course also might occur.

Practical survey experience has shown that cost accounting for R&D is often on the group or group division level, which makes R&D transactions between enterprises of a multinational group difficult to record. Therefore it is probable that the R&D funded by foreign enterprises in the same group is underestimated.

In the last revision of the Frascati Manual more details were recommended for breakdowns of extramural R&D expenditure (expenditures going to R&D outside the unit). It was recommended in §312 to ask for extramural R&D expenditures to foreign enterprises belonging to the same group. It is unknown how this question has been implemented in national surveys. There are also, however, several reasons to believe this indicator does not tell very much even if implemented.

Few countries systematically include extramural R&D in their surveys for companies not having any intramural R&D. Many enterprises not performing R&D acquire R&D from outside as a service. Some very rough comparisons with data from surveys on trade in services show the data on extramural R&D being underestimated.

Due to the same difficulties reported above under sources of funds for multinationals to report internal R&D transactions it is likely that R&D funds going to foreign enterprises in the same group is underreported. Borderline between intramural and extramural R&D is also somewhat unclear. A lot of joint projects between various units are performed in multinationals, which makes the distinction between intramural and extramural even more difficult.

In conclusion it seems that the possibilities of ordinary R&D statistics to describe the process of R&D globalisation are rather limited. It is not possible to have information of either inward or outward R&D investments on the basis of existing R&D statistics. In the next chapter, we will go into more detail of additional measures needed for developing indicators on R&D globalisation.

### *3.2.2 Sources for inward R&D*

In several countries studies have been conducted to determine the share of R&D undertaken by foreign affiliates. The OECD has started to publish figures on the share of foreign affiliates in national R&D. Also the United Nations Conference on Trade and Development (UNCTAD 2005) has collected this information as part of the 2005 edition of the World Investment Report. The share of foreign affiliates varies a lot between countries. In Hungary are Ireland more than

two thirds of BERD is foreign controlled while the shares in United States and Finland are relatively low under 20 per cent.

These indicators can be derived from general surveys of foreign affiliates (like in the US) or matching of the enterprise level of data collected in the normal R&D survey with various registers on foreign affiliates. These registers could be of various kind:

- the usual official business register of the country (if the information on foreign ownership is included)
- special registers on foreign affiliates
- R&D surveys or innovation surveys having the information on foreign ownership

It is essential the information on ownership be based on the concept of ultimate beneficiary owner. This does not seem to be the case for all countries according to meta data collected by the OECD.

R&D is included as a variable in the FATS regulation by the EU intended to collect information on inward investments of foreign affiliates. This means that in the future these data will be produced regularly. Using the same source of information on which enterprises are foreign as the general statistics on foreign affiliates will secure the consistency and comparability of the information on inward R&D.

As the basic source of information in most cases is R&D statistics all the main variables from R&D surveys, such as R&D expenditures, total personnel and researchers could be included in the analysis.

### *3.2.3 Sources for outward R&D*

In principle there are two different approaches for the measurement of outward R&D. It is possible to get the information from various kinds of surveys but it is also possible to make estimations on the basis of comparisons of global figures from company accounts and figures on the national level based on surveys.

#### **Surveys**

Basically there are four different kinds of survey approaches, the pros and cons of which are described below.

(i) One option is including one or two questions on R&D in regular R&D surveys. This has been done earlier in Germany but has nowadays been abandoned. This is the approach used in Italy. The advantage with this is a very direct link with R&D surveys. One could assume that the definitions are entirely based on the Frascati Manual. The disadvantage is that the respondent for an enterprise in the reporting country does not necessarily know the R&D activities in subsidiaries abroad. There is also a risk that R&D performing subsidiaries of enterprises not performing R&D or not even included in R&D surveys in the reporting country will fall out of the survey. It is also difficult to collect any detailed information of what type of R&D is performed in the affiliate.

(ii) Detailed special surveys inquire data on the level of the foreign subsidiary or at least by country. These surveys should preferably be connected rather closely to the information from the official R&D survey. The data contents of these surveys are of course broader compared with R&D statistics or other approaches. This gives possibilities to collect complementary qualitative data like motives for conducting R&D abroad for a more in-depth analysis. These are clearly more resource consuming even if they are limited to only the biggest companies. Sweden performs such surveys every other year and the approach has also been tested in Finland in two special surveys.

(iii) An alternative to the previous approach is a small survey directed to only big companies with just a few questions on R&D abroad by country. The survey can be addressed to the contact persons of the R&D survey to find out who could respond on the group level including

foreign affiliates. This approach would give a good consistency with R&D data from the national R&D survey and give the possibility to ask some questions indicating the nature of R&D performed abroad. This approach has been tested in Finland within the KEI project and the experience is reported in chapter 4 here.

(iv) R&D could be included as a variable in general surveys of foreign direct investments. There might be some difficulties to ensure that the R&D concept applied is consistent with the Frascati Manual. The quality of the information has to be checked as R&D is not the main focus of FDI surveys and therefore the R&D variables may not be verified as carefully as in more R&D related surveys. The US, where the FDI survey is the main source of information for outward R&D, has tried to analyse the relations with official R&D data with rather encouraging results. The level of details in the information on R&D can not be so high if R&D is a part of general FDI surveys.

If sufficient resources are available to investigate outward R&D, option (ii) seems to be the best one as it is widest in details. If a more limited amount of resources is available, options (iii) and (iv) might be good alternatives taking into account the results of the testing described in the following chapter.

### **The EU Industrial R&D Investment Scoreboard**

The EU R&D Industrial Investment Scoreboards (European Commission 2004, 2005) include annual information on R&D financing on the group level. The use for the purpose of measuring outward R&D is focused on the lists by country of the biggest R&D performing companies in EU with information on their global R&D investments taken mainly from annual reports. Information on total funding of R&D (intramural R&D+extramural R&D-external funding of R&D) from the R&D survey can be matched with the global amount of R&D expressed in the scoreboard. The difference gives an indication of R&D financing of the company not directly attributable to the national part of the company reporting in the national R&D survey. This is not the same amount of money as is spent on R&D performed abroad as measured by in the survey based approaches described above. The amounts should theoretically be bigger as they also cover extramural R&D commissioned by the company to universities, research institutes and other companies. Nevertheless, it is assumed that this gives a sufficiently good indication of the order of magnitude for outward R&D.

This approach is already regularly used in Germany although on the basis of an own database of some 50 big companies. The feasibility of this approach has now been tested in and it will be reported in the following chapter. The results using this approach are also compared with the results from survey based approaches.

## *4. Collecting data on R&D globalisation*

### *4.1 A pilot study on outward R&D in Finnish companies*

#### *4.1.1 Implementation of the survey*

Statistics Finland undertook a survey on R&D globalisation in the major Finnish corporations in order to test its feasibility as a source of information and to obtain new figures on the extent of outward R&D. R&D expenditure and personnel data was completed by further information on motives for conducting R&D overseas. Additionally, questions concerning problems, reliability, easiness and confidentiality related to the given information were requested. The survey questionnaire was inspired by the one used in Statistics Finland's previous corresponding survey in 1998 and also the surveys conducted in Sweden.

Multinational companies included in the survey population were the biggest Finnish-owned companies according to their domestic R&D expenditure in the 2004 regular R&D survey. The ultimate beneficial owner (UBO) criterion was used in defining the country of origin.

The survey to multinationals was carried out mainly at the corporation level except a couple of companies, which were included at the division (business unit) level. The initial purpose was to get data from around 20 largest group of companies with the assumption that they were engaged in R&D activities not only in Finland, but also abroad. Therefore results would illustrate the R&D performance in the firms included in the study, not the total outward R&D for Finland. However, because of the great importance of these companies, further-reaching views and conclusions based on the results could be expected. Measured in terms of R&D expenditure, the coverage of this survey was about 69 per cent of total business enterprise R&D made by Finnish companies in Finland in 2004.

The questionnaire was sent by e-mail in the end of November 2005 and it was primarily addressed to the contact persons in Statistics Finland's annual domestic R&D survey. Overall, companies were well co-operative and the final reply was received by the end of January 2006. Eventually the survey was responded by a total of 30 corporations. 17 companies answered they conducted R&D operations also abroad and 10 that they had such activities only in Finland. Three companies refused to answer.

#### *4.1.2 Extent of outward R&D in 2004*

The 2004 figures<sup>1</sup> for the companies included in the survey show that almost 39 per cent of R&D expenditures and nearly 35 per cent of R&D personnel worked in foreign affiliates. In nine out of the 27 companies which replied the share of outward R&D expenditure was under 25 per cent, in five between 25 and 50 per cent, and three of them more than half. The single highest proportion of foreign R&D was 75 per cent in expenditures and 80 per cent in the amount of employees.

As regards to the geographical distribution of R&D expenditure the share of America was almost 50 per cent and that of the United States alone 45 per cent. 44 per cent of the expenditure was spent in Europe, where the EU-15 area accounted for the most of it with a proportion of 41 per cent. The most significant countries in terms of Finnish companies' R&D expenditure in Europe were Germany, the United Kingdom and Sweden. Only 5 per cent of all outward R&D was located in Asia and Australia. The rest 1.5 per cent remained unknown.

Electronics industry appeared to be completely dominating the scene in a further examination of Finnish companies' R&D activities abroad with a rather rough industry breakdown. The share of electronics industry was 86 per cent of all R&D expenditure in 2004. Metals and engineering accounted for slightly fewer than 6 per cent and wood processing industry close to 5 per cent. Thereby, the combined share of all the other branches was minor. A good 45 per cent of the R&D expenditure in wood processing was spent outside Finland. The corresponding shares for electronics industry was 40 per cent and for metals and engineering 35 per cent. Foreign subsidiaries' share of R&D expenditure was lowest in the chemical industry, only a few per cents.

#### *4.1.3 Motives for R&D activities abroad*

Another essential thing in focus was the motives for conducting research and development abroad. Respondents were asked to estimate a general view on the importance of different reasons in conducting R&D activities in the host countries. Six various motives were given and the level of importance of each and every one of them was requested to be estimated on a four-figure scale from 'unimportant' to 'extremely important'.

The most important motives for the internationalisation of R&D activities were demand-side factors. Giving support to local production and marketing was ranked the highest among all the motives for conducting R&D abroad. It scored a mean of 2.3 at the scale 0–3. 53 per cent of the respondents found this reason 'extremely important' and 29 per cent 'important'. Getting into closer contact with important markets was rated as an extremely important factor by 35 per cent and as an important by 41 per cent of the companies. Its mean value was 2.1. Other motives

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<sup>1</sup> Figures for 2003 were not complete enough to be extensively analysed except for some comparisons with 2004 data.

including supply-side factors were found clearly less important with means between 1.3 and 1.6. These four did not receive the figure 'extremely important' apart from a few exceptions. Good availability of skilled R&D personnel was estimated an important factor by 59 per cent, however. More than half of the respondents thought both acquiring technology and cost savings to be not more than just 'slightly important' as regards to outward R&D activities. Only 41 per cent of companies esteemed close connections with local universities and research institutes important. Overall, cost savings got the lowest mean (1.3).

It was also possible to add other motives and to give further information concerning motives for overseas R&D and their relevance. Acquisitions were mentioned as a reason for conducting R&D abroad. Good availability of know-how i.e. qualified R&D personnel was found very important especially in greenfield investments. Acquiring cost-effective R&D was reckoned a factor with increasing importance already from the year 2005 on. This provides that skilful personnel will be available in lower-cost countries like China and India. On the other hand, in certain industries skilled employees already begin to be available almost everywhere. One respondent found acquiring technology an unclear variable.

#### *4.1.4 Questions related to provided data and some general remarks*

Responses given by the companies were adequate enough to be further analysed in order to calculate shares of outward R&D in 2004. Overall, the survey can be considered rather straightforward from companies' point of view, since only a couple of them specified problems in providing the R&D data. Confidentiality of the data and response burden may sometimes set a limit in replying. Difficulties in breaking down R&D resources between various countries can be difficult, because companies' monitoring is often based on business units instead of geographical regions. A key to locate R&D expenditure between these sub-units around the world is sometimes simply missing.

Problems involved in reporting came up in a few answers. One corporation gave only numbers for R&D personnel divided by country of location and another company only the distribution of R&D expenditures, respectively. Missing data values for these companies were imputed by using external data sources. Furthermore, one company gave its R&D data only with the division between Finland and other countries and one other did not mention separately countries that were minor in terms of R&D activities. The problematic nature in the concept of funding vs. performing emerges again when R&D is performed between technology centres of a group, but reported to be conducted only by the unit, which is responsible for the costs.

Around 47 per cent of the respondents answered there was no difference between the two variables, when it was asked whether R&D expenditure or personnel gave a more reliable picture of R&D activities' country distribution in foreign subsidiaries of a corporation. R&D personnel was considered a more reliable variable by 29 per cent of the companies. When it was asked about the mutual easiness of these two variables as for providing data, 41 per cent of the responses were of the opinion that there was no difference. A good one third, 35 per cent, of the firms found R&D expenditure easier to give than R&D personnel, however.

We also asked how confidential the data concerning country division of R&D activities were from the company view. According to 41 per cent of the companies 'data can be released for research purposes and they are possible to publish at such industry level, which does not allow obvious identification'. Another 35 per cent of companies replied 'data are not disclosed'. However, many companies that answered this way, gave out data concerning country division of R&D activities anyway. This seems to show that question was not always understood right. Therefore responses in this category can be combined with the answers in 'data are released for research purposes and possible to publish only at total industry level'. Then a total of 59 per cent of all responses fell on these two categories. Not a single firm answered their data to be 'entirely public, to be released as such'.

## 4.2 Comparison with the EU Industrial R&D Investment Scoreboard data

Along with the objective to test the feasibility of the survey as a source of data and to produce some real estimations on outward R&D, another aim in our exercise was to match external sources on multinationals' global R&D with the national R&D survey data. Therefore the target was to find out and describe the usefulness of the EU R&D Scoreboard as an alternative way of providing data on R&D globalisation. It is possible to get company-specific information on funding of R&D activities by division Finland versus other countries as a combination of R&D data derived from Statistics Finland's annual survey and the EU Scoreboard. Scoreboard's information on globally financed R&D can be compared with what is funded nationally according to the official R&D survey for the domestic parts of the corporations included in the R&D Scoreboard (roughly intramural+extramural-externally funded R&D).

Data contents of the R&D Scoreboard include the total business enterprise R&D investment by country and sector of economic activity, among others. The 2004 edition contains data on 28 biggest Finnish firms (ultimate parent companies) in terms of R&D investments in 2003, and the 2005 edition data on 43 firms in 2004. Information presented in the publication have been prepared from companies' annual reports and audited accounts. R&D includes only investments funded by, and performed for, the companies themselves. R&D undertaken under contract is excluded always when clearly identified.

Funding vs. activity distinction must be borne in mind once again. It is not possible to calculate the amount of outward R&D directly by deducting domestic R&D expenditure (excluding external funding) based on annual surveys from the total R&D funding, which are available in the R&D Scoreboard. The reason is that the net difference contains both R&D performed abroad and outsourced (subcontracted) R&D which could either have been done in the home (Finland) or in the host (overseas) country.

The share of outward R&D of total R&D funding was 53 per cent in the 43 Finnish companies included in the EU Scoreboard. According to KEI pilot survey, the share of outward R&D expenditure was 39 per cent in 2004.

Table below includes a comparison of outward shares of R&D expenditure and personnel with the foreign share of R&D funding. The former are derived from our KEI survey and the latter from the EU Scoreboard. It appeared that complete data for a brief comparison like this was possible for only nine companies in 2004. KEI figures for companies in two enterprise groups were aggregated in order to make possible comparisons with the Scoreboard information.

We can see that in some cases the three R&D figures match fairly well. These are companies 2, 4, 7, 9 and 10 in 2004. Otherwise it seems the outward R&D shares based on KEI data Statistics Finland's annual survey have not much common with the Scoreboard information. In general share of overseas R&D funding derived from the latter are higher than R&D expenditure proportion which is expected because of the outsourced R&D which can be done either home or abroad.

## Comparison between KEI and EU Scoreboard R&amp;D data in 2004

2004 Company or group, no.	KEI survey		EU Scoreboard*
	Share of outward R&D expenditure	Share of outward R&D personnel	Foreign share of R&D funding
1	22.3	25.6	31.2
2	64.3	63.2	65.4
3	50.9	64.1	48.6
4	21.6	20.3	20.6
6	1.8	2.2	10.9
7	3.7	2.7	5.5
8	41.0	36.7	56.6
9	49.8	46.7	52.0
10	1.1	4.3	3.6

\* Domestic R&D funding (intramural+extramural-external R&D) by regular R&D survey in relation to total R&D funding obtained from Scoreboard.

In any case, the R&D Scoreboard appeared to be useful tool in the efforts of measuring the share of foreign subsidiaries of a corporation's total funding for research and development. Overall, it seems to work well as a data source for firms' R&D investments. The publication is, indeed, fairly comprehensive in the sense that it contains complete and selected information and this allows the user to avoid lots of time-consuming data collection. Information presented in the Scoreboard and in companies own financial reports matched precisely apart from a couple of exceptions. Noticed differences were modest.

The R&D Scoreboard does not include, however, a few Finnish groups, which are remarkable R&D conducting companies. Respectively it contains some foreign-owned firms. In this sense the 2005 edition is more precise than the 2004 publication, but the fact that one of the most important Finnish R&D performing firms lacks from both of them puts on a big question mark. This particular company does not publish R&D figures in its reports, which might be the explanation.

## *5. Conclusions and recommendations*

The results of the piloting exercises explained above show that it is possible to improve the information on globalisation of R&D by integrating the aspect of measuring outward R&D in several ways to existing statistics. A lot of experience is already available in countries and it is now an issue on further harmonisation of the data.

It is possible to develop a simple survey instrument to be used in connection with the R&D survey to collect information on outward R&D. Maybe it could also be possible to only add some questions on outward R&D in existing R&D surveys. This can be done for both R&D expenditures and personnel. Some details about country or country group breakdowns and some simple questions on reasons for having R&D abroad could also be included.

A matching between the company data of the EU R&D Investment Scoreboard and the corresponding company data from the R&D surveys is also feasible and can be done with rather limited resources (a few days work). This does not give the same result as the survey, but gives indication of the order of magnitude. Only outward R&D expenditures can be estimated in that way. Neither breakdown by country or motives for globalisation is possible to be evaluated.

Both for information on outward and inward R&D, it is very important to ensure the quality of the information on ownership. Multiple sources for information on the UBO ownership including special questions in surveys could be used to check the information.

As the activities of the multinational companies are becoming more and more global and a split of activities between various countries will be more and more difficult, perhaps in the future data collection on R&D and other variables will be on the group level, and less on the enterprise level, which is now the standard practise. Some exploratory work in that direction has already started in a joint ECE, OECD and EU project lead by Statistics Canada. The EU plans to establish a register over enterprise groups in EU also contributes to this.

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