Workpackage 6

Indicators on the Globalisation of R&D, Some Methodological Issues

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Preface

This report is the second deliverable of the workpackage 6 (WP 6, Role of multinationals for information on R&D) of the KEI-project (Knowledge Economy Indicators: Development of Innovative and Reliable Indicator Systems). KEI (`http://kei.publicstatistics.net`) is part of the Policy Orientated Research section of the specific programme Integrating and Strengthening the European Research Area in the context of the Sixth Framework Programme of the European Commission. The first part of this report discusses the various ways of producing indicators for the globalisation of R&D. Then, results of testing various approaches in practice is presented in the second part.

Chapters 1-3 and 5 were written by Mikael Åkerblom, chapter 4 by Tero Luhtala.

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Chapter 1

Introduction

The aim of work package 6 of KEI is to develop and test new indicators on the role of multinational companies for information on R&D in order to evaluate their effects on national R&D statistics. In deliverable 6.1 we presented a state of art report describing shortly the situation in various countries for collecting data on R&D globalisation. We also described some of the possible starting points for further work, such as the OECD Globalisation Manual (OECD, 2005) and the EU R&D Scoreboards (European Commission, 2004, 2005).

The aim of this paper is to go deeper into various methodological issues. We will first choose a set of priority indicators from the Manual, discuss various ways of producing these indicators and evaluate pros and cons with various approaches. The results of testing various approaches will be presented and finally some preliminary conclusions will be drawn on how to proceed in the future. The indicators are 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 will also be used as far as possible.

The work is being performed in close co-operation with four countries: Germany, the Netherlands, Poland and Sweden from which experience and opinions will be collected in particular for use in the formulation of recommendations. The results of the workshop arranged by the project in March 2006 is also taken into account.

Chapter 2

Indicators to be further analysed

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

In chapter 4 of the OECD Globalisation Manual suggestions for various kinds of indicators describing the internationalisation of technology have been presented. 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

With inward R&D investment is in this report meant R&D activities by affiliates of foreign companies in reporting countries (the ultimate beneficiary owner is foreign). These can be created from nothing (green field investments) or obtained trough 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. A specific subcategory mentioned in the OECD Globalisation Manual is affiliates performing R&D as the main activity serving exclusively the global entity they are part of. Such foreign owned R&D units could also be organised as parts (establishments) of enterprises. Also for consistency these units should be included in the same category.

With outward R&D investments is in this report meant 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 (green field investments) or obtained trough acquisition of an existing company or relocation of an existing R&D unit in the country to a location abroad.

Chapter 3

Review of sources

3.1 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). In

§412 it was recommended 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 include systematically 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 is it likely that R&D funds going to foreign enterprises in the same group is underreported. The borderline between intramural and extramural R&D is also somewhat unclear. In multinationals a lot of joint projects between various units are performed, 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 is rather limited. On the basis of existing R&D statistics it is not possible to have information of either inward or outward R&D investments. In the next chapter, we will go into more detail of additional measures needed for developing indicators on R&D globalisation.

3.2 Sources for inward R&D

As presented in deliverable 6.1, 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 UNCTAD 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 as can be seen in table 3.1 below. In Hungary, Ireland more than two thirds of BERD is foreign controlled while the shares in United States and Finland are comparatively low under 20 per cent.

These indicators can be derived from general surveys of foreign affiliates like in the United States or matching on 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.

Table 3.1: R&D expenditure of foreign affiliates as a percentage of R&D expenditures of enterprises in 2004 (source: OECD, 2006b)

Country	R&D expenditure (%)
Belgium	55.6
Canada	34.9
Czech Republic (1)	46.6
Finland	16.4
France (1)	22.6
Germany (1)	26.7
Greece (3)	4.5
Hungary (4)	78.5
Ireland (1)	72.1
Italy (1)	32.1
Japan (1)	4.3
Netherlands (2)	31.3
Portugal	24.6
Poland (1)	9.3
Slovak Republic (1)	22.4
Spain (1)	26.2
Sweden (2)	34.4
United Kingdom	38.6
United States (1)	14.5

(1) 2003 (2) 2002 (3) 1999 (4) 1998

In countries using weighting factors to raise sample values or adjust for non response, also the information for the foreign affiliates have to be raised according to the general weighting factors used in order to avoid distortions in calculations of shares of foreign affiliates.

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.

3.3 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.

3.3.1 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 normal 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 with this 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. Especially this gives possibilities to collect complementary qualitative data like motives for conducting R&D abroad for a more in-depth analysis. They 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 different 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 of this deliverable.

(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 checked 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 richest in details. If a more limited amount of resources are available, options (iii) and (iv) might be good alternatives taking into account the results of the testing described in the following chapter.

3.3.2 The EU Industrial R&D Investment Scoreboard

The EU R&D Industrial Investment Scoreboard was described in some detail in deliverable 6.1. The use for the purpose of measuring outward R&D is focused on the lists by country of the 700 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 it also covers 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 Finland and Sweden with satisfactory results and it will be reported in chapter 4 below. The results using this approach are also compared with the results from survey based approaches.

3.3.3 Estimations from data on inward R&D

Within the OECD task force on R&D globalisation a third option is tested to share data on the country distribution of inward R&D. For example, the R&D performed by Finnish companies abroad is estimated from what the most important destination countries reports as R&D performed by Finnish companies. Some preliminary results of this analysis (OECD, 2006a) show in a few cases a reasonably good fit but in most cases big discrepancies. These may be due to differences in the application of the ultimate beneficiary owner concept in different countries. For example the US information on affiliates of US companies in Finland is different from the Finnish information on US companies. These differences affect probably both the inward and outward information and may deserve further attention in coming work.

Chapter 4

Collecting data on R&D globalisation

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

4.1.1 Introduction

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 in foreign affiliates of domestic firms). This was completed by further information on motives for conducting R&D overseas. Multinational companies included in the survey population of this ad hoc study were chosen by the volume of research and development. These were the biggest Finnish-owned companies according to their domestic R&D expenditure in the 2004 regular R&D survey.

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.

4.1.2 Definition of company's country of origin

The definition used in this study was in line with the OECD recommendations of the concept of a foreign-owned firm where the focus was on ultimate beneficiary owners of firms. The UBO criterion was used in defining the country of origin. A company was considered domestic if at least 50 per cent of the shares with voting rights were in the

control of a Finnish owner. Companies in which total foreign ownership was high but also so highly diversified that no single foreign shareholder ultimately had over 50 per cent of the voting rights, were not classified under the foreign firms' category. Thus, a company was considered Finnish when its ultimate parent also had its registered office in Finland.

Ownerships between corporations were determined by using the information provided by Statistics Finland's enterprise group register. Foreign ownership was determined by comparing the FATS list of foreign companies with the R&D survey data. Data on foreign-owned enterprises in Finland (inward FATS) is collected by the unit of Business Structures in Statistics Finland.

4.1.3 Questionnaire

The survey questionnaire was inspired with a high degree by the one used in Statistics Finland's previous R&D globalisation survey in 1998 and also the surveys done in Sweden. Besides updates made by ourselves, ideas for modification of the form was requested also from the foreign counterparts involved in the project. The double-sided questionnaire consisted of issues dealing with the extent and motives for performing research and development activities overseas. To start with there was a question whether the company or corporation had foreign affiliates or subsidiaries which had conducted R&D in 2003 and/or 2004. If the answer was yes, then detailed information on R&D expenditure and personnel with country distribution were requested. Together with this there were some additional questions concerning problems, reliability, easiness and confidentiality related to the given information. Furthermore, firms were asked to estimate the importance of different motives for R&D activities in foreign host countries. The purpose of this was to shed some light on the reasons for globalisation in R&D. Survey questionnaire is included as attachment 1.

4.1.4 Implementation of the survey

In the first stage the survey questionnaire was sent to 28 companies or groups. Later it was sent to two more corporations that had been split up from the parent company after statistical year 2004. As for one group of companies, the survey was addressed to a total of five separate business units, of which only one would have been among the survey population as such. All these five units reported not to have had R&D activities overseas, however. The questionnaire was not sent to two major domestic R&D conducting corporations, since it was already known earlier that they did not had any R&D operations abroad. One company was excluded because of the fact that it had become under foreign control in 2005.

The questionnaire was sent by e-mail in the end of November 2005. Companies were informed in its accompanying message that Statistics Finland would contact them within a fortnight in order to agree with the ways of delivering data. The enquiry was primarily addressed to the contact persons in Statistics Finland's annual domestic R&D survey. A few companies replied even before giving them a call. Otherwise the returning of the questionnaire was arranged on the phone. Most of the respondents agreed on the deadline

in the latter half of December, but some needed a couple of more weeks to complete filling the form. Overall, companies were well co-operative and the final reply was received by the end of January 2006. Responses were often given by another person instead the initial one whom the questionnaire had been sent to. Typically the respondent was for instance a director either in technology, R&D or finance.

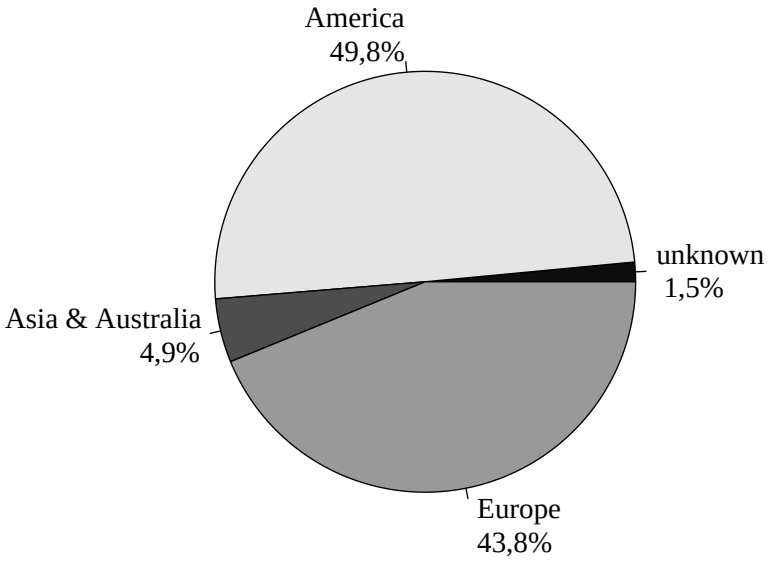
Eventually the survey was responded by a total of 30 company groups. One corporation had forwarded the questionnaire to one of its separate affiliated groups, which gave a reply even though it didn't exactly belong to the biggest R&D conducting companies in Finland. In two cases replies covered the whole corporation instead of the business unit which had been the original receiver. However, these particular units were responsible for most of the research and development work in their corporations anyway. 17 companies answered they conducted R&D operations also abroad and 10 that they had such activities only in Finland. Missing values consisted only of three companies, which refused to answer.

4.1.5 Extent of outward R&D in 2004

The 2004 figures 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 already told, 10 companies reported not to been involved in R&D activities abroad, neither in 2003 nor in 2004.

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.

Figure 4.1: R&D expenditures in foreign affiliates by region in 2004



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 (subclasses 30–33 of NACE Rev.1.1) was 86 per cent of all R&D expenditure in 2004. Metals and engineering (subclasses 27–29, 34–35) accounted for slightly fewer than 6 per cent and wood processing industry (subclasses 20–21) 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.

4.1.6 Motives for R&D activities abroad

Besides R&D expenditure and personnel, motives for conducting research and development abroad was another essential thing, which was in focus in this pilot survey. Respondents were asked to estimate the importance of different reasons in conducting R&D activities in the host countries. Instead of a country by country outlook, a general view was aimed to be valued. 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'. In addition to this it was possible to add other motives and to give further information concerning motives for overseas R&D and their relevance.

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 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).

Table 4.1: Motives for conducting R&D abroad

Motive	**Level of importance**, % of total					
	0	1	2	3	total	mean
Giving support to local production and marketing	6	12	29	53	100	2.3
Getting into closer contact with important markets (lead market)	0	24	41	35	100	2.1
Acquiring technology	13	44	38	6	100	1.4
Good availability of skilled R&D personnel	0	41	59	0	100	1.6
Close connections with local universities and research institutes	0	59	35	6	100	1.5
Cost savings in R&D	24	29	41	6	100	1.3

Note: Level of importance: 0 unimportant, 1 slightly important, 2 important, 3 extremely important.

A couple of respondents also gave comments on the motives presented in the questionnaire. 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. It remains to be seen if that has been mistaken more commonly too, because it was not considered as a very important motive, unlike in Statistic Finland's previous survey in the late 1990s.

4.1.7 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[1]. 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

[1]Figures for 2003 were not complete enough to be extensively analysed except for some comparisons with 2004 data.

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 three 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 estimated/imputed by using information obtained from a comparison between engineers' average annual incomes in capitals of various countries in 2003 (UBS, 2003). 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.

It was 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'.

4.1.8 Results of a similar study in Poland

[2]

GUS, the Central Statistical Office of Poland conducted also within the KEI project a short ad hoc survey on outward R&D. This effort to measure globalisation was based to a great extent on Statistics Finland's methodology. It revealed the current plans of some Polish companies to embark on conducting R&D abroad in foreign affiliates. The surveyed population was a small number of R&D performing technology-based companies that have recently succeeded in their endeavours to enter international markets.

[2] An adaptation of a paper by Dr. Grazyna Niedbalska

Nowadays, the main goal of Polish companies expanding their activities abroad and building foreign affiliates is to entry onto world markets with Polish innovative products developed by themselves or in co-operation with Polish scientific institutions. Hence, outward R&D becomes a kind of by-work. However, R&D can also be a principal activity of the foreign subsidiary, since there are firms that are now organising foreign affiliates first of all to perform R&D by setting up a subsidiary to conduct R&D using local experience.

Firms expanding their activities abroad plan to conduct R&D activity in foreign affiliates first of all in order to: (i) give support to local production and marketing, (ii) to get into closer contact with important markets, and (iii) to acquire technology. Another important motive was co-operation better than competition with local enterprises.

R&D personnel was considered to be a variable that is easier for providing data than R&D expenditure. As regards the reliability of R&D activities' country division by foreign affiliates given by the two variables, opinions varied. R&D personnel seemed to have a little advantage over R&D expenditure.

Firms were rather not eager to reveal their plans concerning R&D activities abroad in a voluntary telephone interview. Such information was considered to be confidential although possible to transmit for research purposes on certain conditions.

A brief comparison between results in Finland and Poland tells that the ranking of motives in both the studies was alike. The same does not exactly apply to questions dealing with the easiness and reliability of the variables in the study. With relation to them, in Finland most of the respondents did not see much difference between R&D personnel and expenditure, but the latter was found somewhat easier in contrast to Polish experience.

4.1.9 Comparisons with other Finnish studies

Table 3 presents a collection of results in various studies[3] on globalisation of R&D in Finnish companies. A comparison between them seems to show that the information on the scale of foreign R&D activities provided by our pilot survey would match rather well with earlier studies. Taking into account the progression and pace of globalisation in recent years and the number and type of companies included in each study, we can state that it's possible to obtain useful and current information by implementing a simple ad hoc survey like ours.

[3]These studies were presented in the first deliverable (D6.1, 2005) of KEI work package 6.

Table 4.2: Comparison between data provided by various studies

Study	No. of firms	Foreign share of R&D expenditure, %	Share of outward R&D, %				Foreign share of R&D personnel, %
			North America	Europe	EU-15	Electronics, metals and engineering industry	
Koskinen 1999	19	30.5	28.3	67.2		79.3	30.2
Lovio 2005b	16	44.3					37.2
EK 2006	312	34.7	*37.5		*47.7	92.1	23.1
KEI 2006	27	38.5	49.8	43.8	40.9	91.7	34.6

Note: * EK, Confederation of Finnish Industries, 2004, estimates for 2004.

Companies' R&D performance abroad has strengthened notably as regards to our new results in comparison to the previous corresponding study (Koskinen, 1999) conducted in Statistics Finland. The foreign share of R&D expenditure has risen eight percentage points and also that of R&D personnel nearly six percentage points from 1998 to 2004. The proportions of outward R&D expenditure and personnel in major Finnish corporations were around 30 per cent in 1998. Both electronics, metals and engineering as industry and North America as area of location have clearly increased their significance. In 1998 metals, engineering and electronics accounted for up to 79 per cent of all foreign-based R&D. Around two-thirds of R&D investments were performed in European countries and 28 per cent in North America. The share of Asia and Australia has remained unchanged at 5 per cent since 1998.

Following the results of the general investment survey by EK, the Confederation of Finnish Industries, 39 per cent of the R&D expenditure by Finnish manufacturing companies was spent abroad in 2004 (EK 2005). Thus, there is only a difference of one percentage point in the proportions of outward R&D expenditure provided by our survey and the general investment survey. This despite the fact that the samples of firms in these were totally of a different size. Probably the deviation in the result was minimal above all because the great majority of Finnish companies' overseas R&D performance is conducted by a rather few actors. According to both the studies as well, the share of electronics, mechanical engineering and metals branch was about 92 per cent of all outward R&D. Surely discrepancies can also be found, since the share of R&D personnel in foreign affiliates is remarkably low according to EK in comparison with the results in KEI. In addition to this the proportion of Europe exceeds that of North America along with the more extensive sample in the general investment survey. In accordance with the one-year earlier investment survey the estimated shares were 48 per cent for the EU-15, nearly 38 per cent for North America and 13 per cent for Asia.

On the other hand, in R.Lovio's studies the shares of outward R&D expenditure rose apparently higher than in the KEI survey. His data (Lovio, 2005a) gathered in the context of MEFIS (Multinational Enterprises in the Finnish Innovation System) studies showed the average foreign share in R&D for 13 Finnish-owned multinational corporations to be 47 per cent in 2002. According to the results of his further analysis (Lovio, 2005b) based on company information and author's estimates the foreign shares of R&D in 16

most relevant large Finnish companies were 44 per cent for expenditures (in 2001) and 37 per cent for personnel (in 2002). Hence, the difference in the share of R&D personnel was minor, only 1.4 percentage points compared with the KEI figure. The number of companies included in Lovio's studies was low.

Comparisons concerning motives for conducting R&D activities in foreign host countries can be done between Statistic Finland's studies. Practically their ranking order has not changed since late 1990s. Demand-side factors: giving support to local production and marketing, and getting into closer contact with important markets (lead market) were estimated the most important motives behind the internationalisation of R&D both in 1998 and in 2004. Supply-side factors like acquiring technology and good availability of skilled R&D personnel were found notably less significant in both years, respectively. Neither close connections with local universities nor research institutes did particularly motivate in either year. In 1998 local regulations and technology policy and co-operation with local enterprises had the least importance, in 2004 cost savings in R&D.

4.2 R&D comparison with the EU Industrial 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 this 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.

Tables 4.3 a–b include 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 seven companies in 2003 and two more 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 in the tables that in some cases the three R&D figures match fairly well. These are companies number 2, 4 and 7 in 2003, and number 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. Overall, 2004 figures correspond better than 2003 ones.

Table 4.3: Comparison between KEI and EU Scoreboard R&D data in 2003 and 2004

A: 2003	**KEI survey**		**EU Scoreboard***
Company or group, no.	Share of outward R&D expenditure	Share of outward R&D personnel	Foreign share of R&D funding
1	21.6	18.0	37.1
2	65.3	60.5	65.2
3	51.2	63.3	65.3
4	23.1	18.2	19.6
5	37.5	56.4	15.2
6	3.1	2.8	51.1
7	2.1	1.5	0.0

B: 2004	**KEI survey**		**EU Scoreboard***
Company or group, no.	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.

Statistics Sweden also conducted a brief comparison survey between Swedish national

R&D data and the EU Scoreboard 2003 data in order to find out the data quality and usefulness of an alternative data source for future needs. It focused on the 20 biggest groups spending R&D in Sweden and abroad according to the report 'R&D in international firms 2003' by ITPS. Former Swedish R&D firms, before and after they got foreign owned, were also compared. The aim in this exercise was to verify the 2003 EU R&D Scoreboard on an aggregated level as a proxy for outward R&D, for the companies in the Scoreboard.

In the 43 enterprise groups presented in the EU Scoreboard the share of outward R&D of total R&D funding was 49 per cent. The corresponding share for the 20 groups in the Swedish business enterprise R&D survey was 43 percent.

As regards to the 17 groups included in both the Scoreboard and Swedish statistics, the following table concerning the share of number of groups and difference between R&D costs resulted. The majority of the companies where inside ± 5 per cent interval and grade with 'very good', and only one out of five companies had a difference that was larger than ± 15 per cent.

Table 4.4: Comparison between the EU Scoreboard 2003 and Swedish national 2003 data

Very good	58 %	± 5 %
Good	18 %	± 10 %
Acceptable	6 %	± 15 %
Worse	18 %	> 15 %

As a conclusion the EU Scoreboard was noticed to include both undercoverage (some missing enterprises) and also overcoverage. Generally there appeared to be a good comparability between Swedish data and EU scoreboard data despite some problems.

Chapter 5

Conclusions

The results of the piloting exercises explained above show that it is possible to integrate 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. It could maybe also be possible to only add some questions on outward R&D to existing R&D surveys. A more concrete proposal will be included in the final report of work package 6 (deliverable 6.3). This can be done for R&D expenditures and R&D 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 desk 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 evaluate.

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

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Attachment: Survey questionnaire