

*Mobility of highly qualified manpower, a feasibility study on the possibilities to construct internationally comparable indicators*

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## 0. Executive summary

The starting point for this study was the OECD study on the policy needs for mobility indicators and the inventory of various available sources and special studies (Rosengren 1998). The objective of the study presented here was to acquire and study in detail some of the data sources and special studies identified in the Rosengren study and possibly identify additional national and international sources, with the aim to evaluate their usefulness for the construction of internationally comparable indicators on mobility of highly qualified manpower. Countries included in this study are Australia, Belgium, Finland, France, Germany, Korea, Italy, Spain, United Kingdom and the United States. A first attempt to construct indicators from the international sources and from national sources in three countries (the US, France and the UK) is included together with conclusions and some recommendations for future work.

Three types of mobility indicators were the object of the study:

- indicators on mobility between firms and other organisations
- indicators on mobility between research producing sectors and research using sectors
- indicators on international mobility

Four different types of sources are available for the calculation of mobility indicators.

- labour force surveys or related surveys (all countries in theory, CLFS)
- total registers (Nordic countries, Belgium on the basis of a special project)
- special longitudinal panels (at least the UK, Italy, Germany)
- special surveys (the US, especially the SESTAT-system)

The results of the study show that extractions from the Community Labour Force Survey (CLFS) and national labour force surveys or surveys closely related to labour force surveys in most countries give a rather good, but highly aggregated picture of mobility. This might be sufficient for analysis of trends in overall mobility and mobility between various industries and organisations, but the data are not detailed enough to monitor interactions between the research producing sector and the research using sectors. The sampling errors set limitations to the data. For all detailed analytical purposes registers or censuses seem to be the only possible source. The longitudinal panels might go into some additional details for specific aspects especially enabling analysis over longer periods of time.

The preliminary analysis of CLFS data and national labour force survey data give already now some interesting results, which should be taken as examples of results, which could be derived on mobility using labour force survey data.

- mobility rates have gone up to around 9 per cent at the EU level
- big variations exist between countries, from 15 per cent in Finland to 4 per cent in Italy
- mobility has increased rapidly in the ICT sectors
- mobility flows are concentrated to own sectors or close sectors

Some further work may be needed to resolve methodological issues in putting data from various sources together in order to achieve satisfactory comparability. It might nevertheless be possible in the future to produce a report on mobility using a combination of various sources. The bulk of the report would be based on the aggregated CLFS or other labour force data complemented with information available from registers and other special sources available only in a few countries.

The situation concerning possibilities to construct indicators on international mobility does not seem very promising until qualification and occupation is better recorded in general information on emigrants and immigrants. Partial survey based information may be available in various countries. The comparability of this information is rather limited. Shares of foreigners in total stocks of highly qualified are available from labour force surveys.

## 1. Introduction

The availability of appropriate human resources is one of the most important prerequisites for the development of science and technology. In 1994, the OECD and Eurostat adopted a methodological manual for the measurement of human resources for science and technology, the Canberra manual. Eurostat has further developed the concepts and definitions in the manual into a system of indicators of stocks and flows of human resources for science and technology (HRST). The flows indicators mainly include flows into and out from the stock of HRST. Issues related to flows within HRST have not been the subject of very much attention until now.

During the last years the OECD has in co-operation with Member States run a program for the development of new indicators for a knowledge based economy. One of the ten projects is related to the development of indicators on the mobility of human resources for science and technology. Another research program within the OECD is related to the description of national innovation systems. Within this program Finland, Sweden and Norway undertook a rather substantial pilot study of the possibilities to utilise the register-based statistical systems of the Nordic countries to develop mobility indicators (Nås et al. 1998). The study showed the rich possibilities available in the Nordic countries to develop various indicators related to human resources mobility.

Mikael Rosengren, Statistics Sweden, undertook for the OECD a study on the policy needs for mobility indicators by interviewing various experts in the field in all OECD Member Countries and some Non-member Countries. At the same time he also made an inventory of various available data sources and special studies, from which useful information related to HRST mobility could be derived. The results were documented in (Rosengren 1998). The study did not give any answer to the question, of whether it was possible, to develop internationally comparable indicators on mobility of highly qualified personnel. The study, however, gave a lot of useful information for a continued effort to construct at least some rough mobility indicators, which could be applied in several countries outside the Nordic area.

The objective of this study was to acquire and study in detail some of the data sources and special studies identified in the Rosengren study and possibly identify additional sources, with the aim to evaluate their usefulness for the construction of internationally comparable indicators on mobility of highly qualified manpower. The study looked at both international sources, like the Community Labour Force Survey (CLFS) and the European Community Household Panel (ECHP) and national sources for a particular set of countries, Australia, Belgium, Finland, France, Germany, Korea, Italy, Spain, United Kingdom, United States. A first attempt to construct indicators from the international sources and national sources for three countries (the US, France, the UK) is included.

This report starts with a discussion on the types of mobility indicators investigated in this report. Then the various identified data sources, relevant for the construction of indicators are evaluated. The report ends with a presentation of the results of calculations of indicators based on international sources and the three countries, conclusions and some recom-

recommendations for future work. More detailed descriptions of data sources investigated in various countries are given as annex 1.

Finally, I want to thank all persons listed in annex 4 for their contributions to this project, especially the people responsible for the data extractions in ONS, INSEE, NSF and Eurostat. Without their co-operation this project would not have been possible.

## 2. Types of mobility indicators

The aim of this chapter is firstly to discuss why mobility indicators are needed by policy makers and secondly to draw up a kind of framework for the kind of mobility indicators, which could be envisaged for the future.

In a knowledge based economy, one policy objective is to strengthen the effects of research-based knowledge. Tacit knowledge and skills embodied in highly qualified personnel is essential to interpret, evaluate and transform codified knowledge to forms and contexts facilitating use (Hauknes 1994). Mobility of highly qualified personnel is a measure of flows of tacit knowledge within the innovation system. It is an assumption that this circulation of knowledge is a major factor in the ability of national economies to generate and adopt efficiently new technologies (Nås et al. 1998). It is assumed that a certain degree of mobility in the economy is desirable, especially between the sectors producing research based knowledge, such as universities and research institutes and sectors using this knowledge (various manufacturing and service sectors) but also between the knowledge using sectors themselves.

Mobility is always a trade off between the benefits of the recipient of tacit knowledge embodied in a highly qualified person and the losses of the donor institution. A too high rate of mobility might therefore lead to negative effects as well.

Knowledge flows in and out from the country are of a specific interest for policy makers. Policy makers attention is more and more paid to issues related to brain circulation, to encourage people to go abroad for certain periods and come back with an extended tacit knowledge for the benefit of the home economy.

Very limited statistical information is available for the moment for the policy makers to base policy decisions on. This study tries to investigate the possibilities for improvement. Three types of indicators regarding the mobility of highly qualified manpower are addressed:

- indicators on mobility between firms and other organisations
- indicators on mobility between the research producing and research using sectors
- indicators on international mobility

This study does not address some other types of mobility, such as the flows of university graduates into employment and international flows of university students.

For all these three above-mentioned types of indicators, the focus is on institutional mobility i.e. change of employer or employment status. Various units might be possible to identify the employer. Change of employer can be defined as change of establishment (local kind of activity unit). In many cases a somewhat larger unit is preferable like the local unit. It is also possible to define mobility in terms of change of organisation (enterprise). In some studies mobility has been defined as change of industry, which of course is the most restricted definition. The data sources available in different countries will affect the defini-

tion to be used. In order to achieve comparability between countries, it would be useful to be able to apply uniform definitions as far as possible.

Mobility can be defined in a narrow sense to only include movements between various employers or in a wide sense to also include movements to and from unemployment or to and from the labour force.

The study is limited to mobility of highly qualified manpower. This is a narrower concept than HRST according to the Canberra Manual. This could be defined as:

- a combination of educational and occupational criteria as in the Canberra Manual or as in the US definition of scientists and engineers
- according to purely educational criteria
- according to purely occupational criteria

If educational criteria is used, a quite natural definition of the borderline is ISCED 6 and ISCED 7 according to ISCED (1976 version) or ISCED 5A and 6 according to the 1998 version. In practise, people having at least bachelors degrees or equivalent are included. For international purposes, occupations to be included have to be defined according to ISCO. Relevant categories include at least professionals (ISCO 2). A certain part of managers (ISCO 1) might also be relevant, but have in practise to be left out as there are difficulties in defining the appropriate categories according to ISCO and difficulties in translating national categories into these appropriate categories.

The actual limitation is dependent on the data sources available and on the possibilities of translating national classifications into international standards. Differences in the definition of highly qualified manpower between the countries will probably not affect comparability of mobility measures very much, so there is room for a certain flexibility.

Other classifications to be used in the analysis of mobility are gender, nationality and age of the personnel.

## **2.1 Indicators on mobility between firms and other organisations**

For indicators on mobility between firms and other organisations, the basic idea is for a particular industry (for example machinery NACE 29) to determine the share of employees changing employer or employment status from year  $t-1$  to  $t$ . The change could be to another employer or to unemployment, other changes of labour force status or out of the labour force (including migration to abroad). The result may take the form of a mobility matrix with delivering sectors and receiving sectors. In the table below, an illustration of one possibility of the matrix is shown taken from the Nordic mobility study (Nås et al. 1998).

For example, table 2.1 describes that the total number of highly qualified employees (by qualification) was 24,395 in manufacturing in 1994. Of these 5,944 or 24.4 per cent changed establishment between 1994 and 1995. In 56.8 per cent of the cases mobility was within manufacturing, in 0.9 per cent of the cases a former manufacturing employee went to a university.

Most of the sectors in the table represent clear aggregations of NACE categories for the enterprise sector and the figures shown are indicators on mobility between firms (establishments or local units). The details of the industrial classification, which could be used for this kind of analysis are dependent on the data source. Some specific sectors of interest could be identified, as for example the ICT sectors, which could be defined according to NACE codes 30, 32, 642 and 72. If total registers are used, as in the Nordic countries, very

detailed categories can be used. These are on the other hand difficult to analyse and more aggregated categories are preferred for the analysis. If the data used for the analysis have to be based on sample surveys the industrial breakdowns have in any case to be rather aggregated.

If data sources give data for several years, more complicated versions of the mobility indicators can be constructed to derive various kinds of mobility paths for highly qualified personnel. For example, if information is available for years t-1, t and t+1, the following types of employment categories could be distinguished

- same employer t-1 and t, new employer t+1
- same employer t-1 and t, not employed t+1
- same employer all three years
- not employed t-1, employed t, new employer t+1
- not employed t-1, employed t, not employed t+1
- not employed t-1, same employer t and t+1
- not employed all three years
- employed t-1, new employer t, same employer t+1
- employed t-1, new employer t, not employed t+1
- employed t-1, new employer t, again new employer t+1

This type of calculations can be made for various types of populations in terms of education and/or qualification, various age groups, etc. Employment may be further broken down by industry. If data are available for more than 3 years, indicators, such as the share of stable workers (workers not changing employment) and, characteristics of frequent movers can be computed.

**Table 2.1 Mobility of employees with a university degree in Finland**

Delivering sectors (1994)	Primary sectors, mining	Manufacturing	Utilities and construction	Trade, hotels, restaurants	Transport, storage, com.	Financial services, real	Business services	R&D institutes	Higher education institutions	Public adm. and defence, health	Other non-public services	From outside active workf.	N persons moving	N persons employed	Mobility rate in
Receiving sectors (1995)															
Primary sectors, mining, oil	17.0	0.3	0.4	0.5	0.2	0.1	0.5	1.5	0.1	0.1	0.6	1.0	377	2211	17.1
Manufacturing	5.8	56.8	11.4	11.7	5.4	2.3	10.7	9.9	5.3	1.2	5.4	14.7	8061	23576	34.2
Utilities and construction	0.3	1.5	34.5	0.7	1.5	0.2	1.9	0.5	0.1	0.1	0.3	2.0	888	2924	30.4
Trade, hotels, restaurants	3.5	5.9	2.8	37.6	3.7	1.6	4.1	1.4	0.9	0.5	2.6	7.0	3357	11992	28.0
Transport, storage, communications	1.0	1.4	1.0	2.2	47.7	0.7	1.9	0.4	0.2	0.2	0.7	2.3	1244	4588	27.1
Financial services, real estate	0.0	0.5	0.4	0.7	0.2	65.2	2.2	0.3	0.2	0.3	0.7	1.2	2087	6599	31.6
Business services	4.5	5.9	10.1	7.2	5.7	7.6	38.3	4.8	3.3	1.5	4.5	12.2	5777	20812	27.8
R&D institutes	0.6	0.4	0.1	0.2	0.1	0.2	0.5	39.2	1.6	0.3	0.3	1.3	794	3625	21.9
Higher education institutions	1.3	0.9	1.0	1.5	0.3	0.5	1.3	8.5	34.5	2.9	4.1	10.8	4787	11508	41.6
Public administration, health, social	6.7	5.1	5.5	6.5	4.1	2.9	7.5	7.3	11.4	67.2	14.9	38.0	28582	100638	28.4
Other non-public services	2.9	1.1	0.6	1.2	1.6	1.0	1.7	1.0	0.0	0.0	0.0	4.9	1184	11687	10.1
Out of active workforce	56.1	19.8	30.7	28.7	28.1	17.5	28.3	24.7	26.3	17.2	55.4	0.0	12229	19300	63.4
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>			
N persons moving	312	5944	690	2813	955	2416	4643	778	4327	27251	2447	19300			
N persons employed	2374	24395	3073	12838	4556	7012	21931	3830	13098	106511	12957	19300			
Mobility rate out	13.1	24.4	22.5	21.9	21.0	34.5	21.2	20.3	33.0	25.6	18.9	100.0			

## 2.2 Indicators on mobility between the research producing sector and the research using sector

Here, the research producing sector means universities, other institutions of higher education, research institutes and other major research units belonging to the public sector. These indicators are in principle rather similar, compared with indicators on mobility between firms. The difference is that in most cases they cannot directly be computed using the NACE/ISIC classification to classify the employer. The analytical use of this indicator is to look at the relationship between the public research or knowledge infrastructure and the business sector. The institutions involved have often to be identified from several NACE/ISIC codes. As the number of institutions is limited this is possible in theory to do by special coding of institutions.

In the first round, it would be useful to try to identify universities. This has been done in the experimental calculations in chapter 4 for the US, France and the UK. This seems to be possible by using detailed national codes or extracting them by using organisation numbers. For the CLFS the broader category education (NACE 80) has been used in chapter 4. In the future, it might be possible to also include the NACE category 73 (research units) in the same group.

A classification of types of institutions to include in the analysis has to be developed in the long run.

## 2.3 Indicators on international mobility

International mobility of highly qualified personnel is ideally identified as people employed in year  $t$  going abroad either temporarily or permanently for employment in another country and people employed in year  $t$  coming from abroad. The information should be broken down by qualification (field and study) and/or occupation and country of origin/destination. In order to address issues of brain drain, brain gain and brain circulation (people going abroad and coming back again) indicators of flows are necessary. Especially temporary migrants coming back would also be interesting to follow in order to monitor the phenomena of brain circulation.

In a Japanese study (Japan External Trade Organisation 1998) the following indicators were identified in US, Korea and Australia.

Foreign born scientists and engineers (US)

Permanent visas issued to immigrant scientists and engineers (US)

Foreign recipients of US PhD degrees (US)

Visas issued for the purpose of research and teaching to foreigners and visas issued for the purpose of research and teaching abroad to national citizens by country (Korea)

Arrivals and departures (no distinction by long term, short term) for scientists, engineers, university teachers by country group (Australia)

In countries largely applying visas some information on international mobility is available but these statistics reflect national systems and are not comparable. The Nordic countries, for example, have rather complete data on outflows, but only partial data on inflows due to incomplete information on the qualifications of immigrants.

There exists partial survey based information from various subgroups, such as participation in various exchange programs and limited to certain institutes or universities only.



In general migration statistics, it is very difficult to identify the qualifications and occupations of people migrating. This refers in particular to inflows. There seems to be no plan for improvement of the situation. It seems therefore unlikely that it will be possible to construct internationally comparable flow indicators in the near future. However, it is possible to get some impression of international mobility from an analysis of changes in the shares of foreign citizens in various stocks of highly qualified personnel.

### **3. Evaluation of data sources**

In order to achieve internationally comparable indicators, it would be useful to have rather uniform sources of information. In this section, two uniform general sources for data on mobility are described, namely the labour force surveys in various countries and the integrated European Community Household Panel. After that, a more general description and evaluation of various national special sources is given. Detailed descriptions of special sources at country level are given in annex 1.

#### **3.1 Labour force surveys**

Labour force surveys are usually sample surveys with sample sizes of about 0.5-1.0 per cent of the total population. The sampling unit is often the household or dwelling, in some cases the person. Many surveys ask for information on industry of employment in year  $t-1$  as well as in year  $t$ . Most labour force surveys use rotating samples in the sense that the same households are surveyed several times and usually included in the sample for at least one year and after that replaced.

It is therefore possible to follow the employment characteristics of one person between two years. This can be done by using the information on employment one year ago. For mobility analysis the important variables included in the labour force surveys are employment status, detailed industry of primary and secondary employment, other details of employers, occupation, formal qualification (broadly described), nationality, demographic characteristics, earnings.

As the labour force surveys also have data on nationality and the period of employment in the country, it is possible to analyse the shares of foreign citizens in various stocks of employees in order to have some idea on brain gain from abroad.

As the labour force survey is a sample survey there is the problem of sampling error, which will affect the accuracy of results for smaller aggregates. The sampling errors are more crucial for small countries. The sampling errors are discussed in chapter 4 in connection with presentation of the UK data.

In the European Union the contents of labour force surveys are in principle rather harmonised through an EU regulation. Eurostat is collecting micro data on the individual level from its Member States as a part of the Community Labour Force Survey. It is possible to make extractions on the basis of the question on employment the previous year. It is, however, not possible to link the micro data on the European level in order to do mobility analysis.

As the labour force survey exists in almost all countries and is rather harmonised, this could be a source for future indicators of mobility of highly qualified manpower. The use of the labour forces has been tested both using the Community Labour Force Survey and by using national surveys in two countries, United Kingdom and France. In chapter 4 the result of this test are presented.

In Australia and Korea, there are surveys closely linked to the labour force survey. These could be used as sources for mobility indicators. For more details see the sections on Australia and Korea in the annex 1.

### 3.2 The European Community Household Panel

The objective of the panel is to collect very detailed data on households and the people living in households in Europe. Almost all EU countries participate in the Survey. It is more harmonised in terms of contents and survey methodology than the Community Labour Force Survey, but the sample size is considerably smaller (around 60,000 households in Europe) and the relative sample size varies between various Member States. Eurostat is collecting micro data from Member States. These are released under certain conditions for researchers and are also made available for the institutions collecting the basic data. Eurostat is also making tabulations on the request from researchers.

In the Panel, it is possible to link records from various years. The most important information for the construction of mobility indicators are the following variables

- employment status
- occupation (ISCO 2-digit) and industry of employment (NACE 2-digit)
- information on previous employment and unemployment
- basic information on probable second job
- demographic information

The advantage of the ECHP is that all the information is uniform and available in one place. The disadvantage is considerably smaller samples compared with the labour force survey, especially for some bigger countries, like Germany. Nevertheless it has been tested. The results of the test are presented in chapter 4.

### 3.3 Special sources in various countries

In the Nordic countries, the registers are the best source for studying mobility. The use of registers is largely covered by the description for Finland in annex 1. Some main results are also presented. For a more extensive description see (Nås et al. 1998). The registers give potentially very detailed and accurate data. The register errors are minor compared to sampling errors from surveys. Certain variables, such as occupation, are difficult to have accurately registered. In Finland, the occupation variable has been deleted after 1995 due to difficulties to get the accurate information from administrative registers. The disadvantage with person registers is attached to slow processing. The registers are not ready for use before late year  $t+2$ .

Several countries have panels for longer periods. The Italian panel is based on social security archives and covers roughly one percent of employees in the private sector. In United Kingdom there is a panel based on the New Earnings Survey. It covers in principle the whole work force. Neither of these panels have information on formal qualification. Both panels are described in annex 1 together with some published results.

In the United States a special survey system has been developed to monitor scientists and engineers (the SESTAT system). This is nationally considered better than the national labour force survey for mobility analysis. This system is described in more detail in the section on the US in annex 1. In chapter 4 some results on the basis of extractions from the SESTAT-system are presented.

## 4. Results from attempts to compile indicators

In order to test the possibilities to construct indicators Eurostat has been asked to make some extractions from CLFS and ECHP (see annexes 2.1 and 2.4), US has been asked to calculate some indicators for 1993-95 on the basis of the SESTAT system (see annex 2.3). France and UK have been asked to calculate some indicators on the basis of the national labour force surveys for 1995-1998 (see annex 2.2).

### 4.1 Results from CLFS extractions

#### 4.1.1 Total mobility rates

In the following table 4.1 the basic results of the extractions are presented. The mobility rates refer to numbers of highly qualified personnel defined on the basis of qualification (ISCED 6+7) or occupation being occupied as professionals (ISCO 2) changing jobs as a proportion of total stocks of employees. For Germany, Luxembourg, Ireland, United Kingdom and the Netherlands the only criterion was ISCO 2. These differences might influence the mobility rates, but are not crucial for the analysis. Only movements between employers are recorded. Movements in and out from the labour force or from unemployment are excluded.

**Table 4.1 Total mobility rates for highly qualified personnel in EU Member States 1995-98 by sector (percentages)**

	ICT	Other manu- facturing	Other private services	Education	Other community services	Agriculture, construction	Total mobility
<b>Austria</b>							
1995	x	x	8	5	5	x	5.6
1996	x	x	9	4	6	x	6.6
1997	x	x	x	x	x	x	x
1998	..	..	..	..	..	..	..
<b>Belgium</b>							
1995	(11)	(6)	7	6	5	x	6.0
1996	18	10	7	6	5	x	6.5
1997	(11)	13	10	5	5	x	6.7
1998	18	14	11	7	7	(14)	9.2
<b>Denmark</b>							
1995	(15)	(10)	9	9	16	x	12.1
1996	(17)	18	8	7	14	(19)	12.0
1997	(13)	(8)	9	6	13	x	10.1
1998	(15)	x	13	9	13	x	11.0
<b>Finland</b>							
1995	x	x	(9)	9	9	x	8.6
1996	..	..	..	..	..	..	11.6
1997	..	..	..	..	..	..	10.3
1998	20	(9)	15	11	17	x	14.7
<b>France</b>							
1995	7	6	8	7	7	9	7.0
1996	9	7	8	7	7	(6)	7.3
1997	9	7	9	8	7	(5)	7.9

1998	8	8	11	8	7	(7)	8.4
<b>Germany</b>							
1995	5	6	8	5	7	9	6.6
1996	10	7	9	5	6	8	6.9
1997	10	7	9	5	6	8	7.0
1998	11	7	10	5	7	10	7.3
<b>Greece</b>							
1995	x	x	4	5	(3)	x	4.1
1996	x	x	4	5	(3)	x	4.0
1997	x	x	3	5	(3)	x	3.7
1998	x	(7)	4	7	4	x	5.1
<b>Ireland</b>							
1995	x	x	11	(7)	10	x	9.5
1996	(21)	(12)	13	8	11	x	11.4
1997	(22)	(12)	15	8	11	x	11.7
1998	..	..	..	..	..	..	..
<b>Italy</b>							
1995	x	(3)	4	4	2	(5)	3.5
1996	(7)	(4)	4	4	3	(6)	3.8
1997	(5)	(4)	4	5	3	(5)	4.0
1998	(7)	5	4	4	3	(4)	4.1
<b>Luxembourg</b>							
1995	x	x	x	x	x	x	(4.9)
1996	x	x	(8)	x	x	x	(5.2)
1997	x	x	(10)	x	x	x	6.0
1998	x	x	x	x	x	x	(5.1)
<b>Netherlands</b>							
1995	(8)	(6)	8	4	5	x	8.5
1996	(7)	9	8	2	5	x	7.6
1997	13	7	8	2	5	x	8.2
1998	9	10	14	3	10	x	11.4
<b>Portugal</b>							
1995	x	x	10	5	(3)	x	5.9
1996	x	x	13	8	6	x	8.3
1997	x	x	7	7	6	x	7.2
1998	x	x	11	11	7	x	9.4
<b>Spain</b>							
1995	(7)	13	15	12	10	16	12.1
1996	10	12	15	12	9	19	12.3
1997	21	16	15	13	10	11	12.9
1998	23	14	15	13	11	11	13.0
<b>Sweden</b>							
1995	..	..	..	..	..	..	..
1996	x	x	11	7	7	x	8.6
1997	22	14	12	(5)	8	x	9.6
1998	(11)	(12)	17	5	8	x	9.6
<b>United Kingdom</b>							
1995	11	11	13	8	9	9	10.2
1996	16	13	13	7	10	9	10.3

1997	15	14	14	9	9	14	11.1
1998	18	14	16	9	10	14	12.0
<b>Total</b>							
1995	8	7	9	6	7	9	7.7
1996	11	8	9	6	7	9	7.9
1997	12	9	10	7	7	8	8.1
1998	13	9	11	7	8	10	9.0

x = figure not reliable due to big sampling error or other reasons

() = figure uncertain due to considerable sampling error

.. = figure not available

ICT sector (NACE 30, 32, 64, 72)

Other manufacturing (NACE 15-37, except 30, 32)

Other private services (NACE 50-74, except 64, 72)

Education ( NACE 80)

Other community services (NACE 75-99, except NACE 80)

Agriculture, forestry, mining, utilities, construction (NACE 01-14, 40-45)

In the following table mobility rates by gender 1995 and 1998 are presented.

**Table 4.2 Mobility rates by gender 1995 and 1998 (percentages)**

Country	Men 1995	Women 1995	Men 1998	Women 1998
Austria	5.8	5.4	(1996) 6.0	(1996) 7.4
Belgium	5.4	6.5	9.2	9.3
Denmark	10.8	13.9	10.7	11.5
Finland	7.0	10.8	14.5	14.8
France	6.9	7.1	7.5	9.7
Germany	6.1	7.4	7.3	7.1
Greece	3.3	5.2	4.4	6.0
Ireland	8.3	10.8	(1997) 10.7	(1997) 12.7
Italy	2.8	4.3	3.2	5.1
Luxembourg	(4.6)	x	(4.8)	x
Netherlands	7.6	10.1	10.8	12.3
Portugal	5.5	6.4	7.4	11.1
Spain	9.9	14.9	9.7	17.0
Sweden	8.8	8.5	8.8	10.3
United Kingdom	9.7	10.9	13.3	10.4
EU total	7.1	8.6	8.5	9.7

x = figure not reliable due to big sampling error or other reasons

() = figure uncertain due to considerable sampling error

.. = figure not available

The following conclusions could be drawn from the table.

Taking the EU as a whole the mobility rate has risen from below 8 per cent in 1995 to 9 per cent in 1998. The mobility rate has increased in all countries except for Denmark.

The mobility rates vary considerably between sectors. Taken again the EU as a whole it was highest in the ICT sectors (13 %). The mobility rates have also risen most rapidly in these sectors. The second highest mobility rate (11 %) was recorded in other private services. The increase was also here bigger than in education and other community services, which recorded the lowest mobility rates (7 % and 8 %).

There are surprisingly big differences in mobility rates between countries. The mobility rate in 1998 was highest in Finland (15 %), followed by Spain (13 %) and the UK (12 %). The lowest mobility rates were recorded in Italy (4 %) and Greece (5 %). One could ask if these reflect real differences or are there differences between the national labour force surveys in the interpretation of the employer concept. In countries with higher mobility rates the rates seem to be comparatively higher in other community services and education sector. In Spain the mobility in the education sector seems to be particularly high (13 %)

The mobility rate for women is somewhat higher. On the EU level 1.2 percentage units higher than for men in 1998. The female mobility is higher in 10 countries, about the same in 3 countries and considerably lower in 1 country, the UK (for Luxembourg no reliable information).

An indicator, which could be of particular importance for describing knowledge flows in the innovation system is the share of overall mobility attributed to flows between the education institutions and other sectors. This refers to the second type of mobility indicators described in chapter 2.2 above. The education institutions are representing the knowledge producing and dissemination sectors and all the other sectors are assumed to be the knowledge using sectors. Due to small numbers this indicator can only be calculated for the EU as a whole and for the bigger countries. For the EU as a whole the indicator seems to go down slightly from 6.1 per cent in 1995 to 5.7 per cent in 1998. On the country level there is no clear trend, except for Italy where the share is going down.

### 4.1.2 Shares of foreign citizens in the total stocks of highly qualified employees

**Table 4.3 The shares of foreign citizens in the stocks of highly qualified employees in EU Member States (percentages).**

Country	1996	1997	1998
Austria	7	6	..
Belgium	4	4	5
Denmark	3	3	4
Finland	x	(1.2)	(1.0)
France	4	4	4
Germany	5	4	3
Greece	2	2	3
Ireland	6	6	..
Italy	(0.5)	(0.6)	(1.1)
Luxembourg	41	44	41
Netherlands	3	3	3
Portugal	(0.9)	(1.5)	(1.4)
Spain	(0.8)	(0.8)	(1.1)
Sweden	4	4	4
United Kingdom	4	4	4
EU total	3.4	3.4	3.1

x = figure not reliable due to big sampling error or other reasons

() = figure uncertain due to considerable sampling error

.. = figure not available

In most countries the shares are between 3 and 4 per cent of total stocks. The decrease in the share for EU total is at least partly explained by the decline in the share for Germany (a whole percentage unit). This might be due to technical differences in the German labour force survey. On the contrary there seems to be increases in the shares for some smaller EU Member States.

### 4.1.3 Problems of using CLFS

In addition to the general problem of sampling error there seem to be problems of identifying the highest level of education attained in the CLFS. In 1998 the CLFS already moved to the new ISCED and for many countries there will be breaks in the series of total stocks of highly qualified personnel (defined according to ISCED 6+7 old version or 5A+6 new version). For some countries there are problems of comparability of the stocks even before. It is a well known fact that the comparability of international data is far from perfect using ISCED. It is unknown how far the introduction of the new ISCED will improve the situation. This has led to the identification of highly qualified in some countries only on the basis of occupation. The use of the classification of occupations is also very problematic. These problems of comparability between different years for one country or comparability between countries might affect the mobility rates somewhat but may not be crucial.

The mobility rates calculated from labour force surveys are generally lower than recorded in the Nordic studies based on comprehensive registers (Nås et al. 1998, Graversen 1999). Calculated according to the same principles the mobility rates were in 1995-96, 16 per cent in Sweden, 18 per cent in Denmark and 19 per cent in Finland, compared with around 10 per cent in CLFS data. This is certainly due to methodological differences. Asking people about employment one year ago (self assessment) might give a different result compared with following the employment of people according to registers. There might be errors in the information on employment one year ago in labour force surveys. The registers may in some cases also produce too high figures on mobility. It might also be that changes from one establishment to another within an enterprise is not regarded as mobility in the LFS while it is regarded in the Nordic system of calculating mobility indicators from registers. These differences have to be analysed in more detail later.

In theory labour force surveys include data from which it should be possible to identify foreigners having been in the country for less than one year (foreign immigrants). In practice it was not possible to have reliable data for this in the current extraction from CLFS. This is probably due to missing information on qualification/occupation for these people in CLFS.

## 4.2 Extractions from national labour force surveys in France and United Kingdom

As the data available from the UK and France were rather uniform and detailed, these have been more systematically analysed. In the first section, an analysis of total mobility rates in the two countries is made. In the second part the analysis is extended to various sectors. In the third section we have calculated the shares of foreign born highly qualified employees of total employees in both countries.

The data presented in the following are presented as examples of indicators, which could be produced from the labour force survey.

Before proceeding to an analysis of mobility some figures on total stocks are presented.

The countries were asked to provide data for people belonging to ISCED6/7 or ISCO2. As the UK data only were available for ISCED 6+7 and ISCO 2 data separately, the population in all tables has been defined according to ISCED if not differently stated.

**Table 4.4 Total stocks of highly qualified employees (ISCED 6 and 7) in the UK and France (millions)**

Year	United Kingdom	France
1995	3.07	2.23
1996	3.21	2.30
1997	3.40	2.42
1998	3.55	2.48



In the following table some additional information for stocks are given with reference to 1998 as the ultimate aim is to have information according to a combined qualification/occupation criteria as has been indicated earlier.

**Table 4.5 Stocks of highly qualified employees in the UK and France in 1998 broken down by qualification and occupation criteria (millions)**

	United Kingdom	France
ISCED 6+7, not ISCO 2	1.99	1.24
Both ISCED 6+7 and ISCO 2	1.56	1.24
ISCO 2, not ISCED 6+7	0.83	0.57

The stocks of highly qualified employees seem to be slightly bigger in UK compared with France. In both countries the stocks are increasing steadily, which has to be regarded as normal. In all categories the numbers are bigger in the UK, which indicates a rather consistent structural pattern of employees in different categories. This table shows that if only qualifications is used as a criterion the population of highly qualified will be considerably smaller.

#### 4.2.1 Total mobility rates

In the following table 4.6 we have defined mobility in a narrow sense as shares of employees in year  $t$  having different employer in year  $t-1$ . The concept of employer is defined according to enterprise in the request for information. The United Kingdom supplied information on sampling errors, which has been taken into account in the analysis. It is assumed that the French sampling errors do not significantly differ from the UK ones.

**Table 4.6 Overall mobility rates in the United Kingdom and France 1995-1998, for highly qualified personnel (employees with ISCED 6 or 7 degrees), shares of persons with different employer one year ago (in percentages)**

Year	United Kingdom	France
1995	9.1	7.5
1996	10.1	8.4
1997	10.6	8.9
1998	11.3	9.0

The sampling error for the mobility rates (narrow) in this table are around 0.3-0.4%. This means that some tentative conclusions could be drawn. The mobility rates seem to be higher in the United Kingdom than in France. The mobility rates seem to be increasing in both countries. The mobility rates are slightly different compared to CLFS due to differences in the extraction principles.

The mobility rates could be calculated by age. The results of these calculations are shown in table 4.7.

**Table 4.7 Mobility rates by age (percentages)**

Year	United Kingdom		France	
	20-39	40-64	20-39	40-64
1995	11.5	5.4	11.4	3.2
1996	12.2	6.5	13.2	3.3
1997	13.6	5.9	13.1	3.9
1998	14.4	6.5	13.6	3.3

Mobility rates are clearly higher for younger people. Mobility rates seem to grow more rapidly for younger people. In the UK there seems to be some growth in the mobility rate for older people as well, which does not seem to be the case for France.

#### 4.2.2 Mobility in various sectors

In the following tables, the mobility rates are broken down by some broad industries. The industries are as follows:

ICT sector (NACE 30, 32, 642, 72)

Other manufacturing/manufacturing not ITC (NACE 15-37, except 30, 32)

Agriculture, forestry, mining, utilities, construction (NACE 01-14, 40-45)

Other private services (NACE 50-74, except 642, 72)

Universities or higher education (national subgroup of NACE 80)

Other community services (NACE 75-99, except national subgroup of NACE 80)

Rather broad sectors were used in order to facilitate the analysis. The ICT sector was separated as there were evidence from other sources of a higher mobility rate there. As these detailed tables on the flows between sectors are generally based on rather small numbers, in some cases even too small to be published the numbers should be regarded as orders of magnitudes only. They are nevertheless presented here just in order to give a general picture of the mobility pattern.

**Table 4.8. Mobility rates for highly qualified personnel (employees with ISCED 6 or 7 degrees), shares of employees with different employer by industry of employer one year before 1995-98 (percentages)**

	Total mobility rate	ICT-sector	Manufacturing, not ICT	Agriculture, construction, etc.	Other private services	Universities	Other community services
<b>ICT-sector</b>							
United Kingdom							
1995	10.8	5.6	1.2	0.0	2.7	0.6	0.7
1996	13.9	8.1	1.9	0.4	2.6	0.2	0.7
1997	18.9	6.9	2.8	0.9	5.5	0.9	1.7
1998	18.3	8.9	1.9	0.5	4.2	0.8	2.1

France							
1995	8.1	5.3	0.6	0.0	1.9	0.0	0.3
1996	9.3	4.9	0.8	0.3	2.4	0.5	0.5
1997	8.0	4.0	0.3	0.0	2.5	0.6	0.7
1998	9.7	6.4	0.3	0.0	2.7	0.0	0.3
<b>Other manufacturing</b>							
United Kingdom							
1995	9.4	0.5	4.1	0.2	3.1	0.2	1.2
1996	10.8	0.6	5.2	0.2	3.5	0.2	1.0
1997	12.0	0.4	6.7	0.5	2.2	0.6	1.4
1998	12.2	0.6	5.5	0.3	4.2	0.3	1.3
France							
1995	5.5	0.1	2.8	0.1	1.0	0.9	0.6
1996	7.4	0.8	4.7	0.0	1.5	0.4	0.0
1997	6.1	0.2	3.8	0.2	1.5	0.3	0.2
1998	7.7	0.6	4.8	0.0	1.8	0.3	0.3
<b>Agriculture, construction, utilities</b>							
United Kingdom							
1995	7.1	0.5	1.0	3.1	2.2	0.0	0.3
1996	11.3	0.6	1.2	4.9	4.0	0.2	0.3
1997	8.3	0.2	1.3	4.1	2.2	0.0	0.5
1998	9.8	0.6	0.8	4.3	2.2	0.4	1.2
France							
1995	6.1	1.4	0.0	2.4	1.1	0.5	0.7
1996	8.7	0.6	0.3	3.6	2.6	0.0	1.5
1997	6.8	0.0	0.3	4.1	1.8	0.6	0.0
1998	8.3	0.0	0.5	5.6	0.6	0.4	1.2
<b>Other private services</b>							
United Kingdom							
1995	11.1	0.4	1.1	0.2	8.0	0.2	1.3
1996	13.0	0.5	1.7	0.6	8.0	0.3	1.7
1997	13.2	0.7	1.3	0.4	8.6	0.4	1.7
1998	13.7	0.9	1.3	0.7	8.5	0.1	2.2
France							
1995	6.8	0.5	0.6	0.3	4.4	0.4	0.7
1996	8.1	0.4	0.6	0.3	5.1	0.9	0.9
1997	9.1	0.7	0.9	0.2	6.2	0.4	0.8
1998	9.6	0.8	1.1	0.2	6.7	0.3	0.6
<b>Universities</b>							
United Kingdom							
1995	8.4	0.2	0.8	0.2	1.2	2.9	3.1
1996	8.2	0.0	0.6	0.0	1.6	2.9	2.5
1997	4.6	0.0	0.3	0.0	0.5	1.2	2.6
1998	7.0	0.0	0.4	0.0	1.2	3.1	2.3
France							
1995	7.8	0.0	0.1	0.0	0.4	6.6	0.7
1996	8.0	0.0	0.1	0.2	0.5	6.5	0.7
1997	9.3	0.1	0.1	0.1	0.4	7.6	1.0

1998	8.1	0.1	0.1	0.0	0.6	6.9	0.5
<b>Other community services</b>							
United Kingdom							
1995	7.8	0.0	0.3	0.1	1.2	0.2	5.8
1996	7.6	0.1	0.4	0.1	1.3	0.4	5.2
1997	8.2	0.1	0.4	0.1	1.7	0.4	5.5
1998	9.0	0.1	0.3	0.2	1.6	0.5	6.3
France							
1995	6.8	0.1	0.3	0.2	0.9	0.9	4.5
1996	7.1	0.2	0.2	0.1	0.8	1.0	4.8
1997	7.1	0.1	0.3	0.1	1.4	0.3	4.8
1998	7.3	0.3	0.0	0.1	0.9	1.4	4.6

Several conclusions could be drawn from this table.

This table shows that in 1995 in the UK 10.8 per cent of the employees in the ICT sector had another employer in 1994. Of the employees over half was employed by another employer in the ICT sector. The other people changing jobs came from other sectors.

Based on UK information the standard errors for the total mobility rate in the ICT sector are around 1.3 per cent. This leads to several possible conclusions.

The mobility rates in the UK for the ICT sector are considerably higher than the average. In France the difference seems to be small. The mobility rates in the ICT sector are rising in the UK. No evidence of that in France. The ICT sector recruits people in addition from the own sector from other private services. In the UK, people are also coming from other manufacturing industries, but not in France.

The standard errors for mobility rates are around 0.8 per cent in the UK for other manufacturing. That leads to rather similar conclusions compared to the ICT-sector. The mobility rates are higher in the UK than in France and seem to be slightly increasing. The recruitment is mainly from the own sector and from private services.

The sampling error for the mobility rates is 0.6 per cent in the UK for other private services, which leads to a rather clear conclusion that mobility rates are higher in the UK than in France and rising in both countries. The recruitment pattern in private services seems to be more evenly spread than for other private sectors.

The university sector includes at least a part of the units producing research results. The interaction between this sector and mainly the private research using sectors are therefore especially interesting to study from the perspective of analysing knowledge flows in the innovation system. Part of the relevant units are included in other community services but are difficult to distinguish using labour force survey data.

As the university sector is rather small the sampling error is again bigger, around one per cent. A comparison of the mobility rates in the UK and France shows no difference in the overall rates. There is no evidence of any trend in either of the countries. An interesting feature is however a stronger recruitment from other community services in the UK compared with France. The reason could be proportionally more research units in this sector in the UK. The flows between universities and the private sectors are so small that they are seriously affected by the LFS sample errors

The sampling error for the mobility rate in the UK for other community services is 0.3 per cent, which leads to the conclusion that the mobility rates are on largely the same level in the UK compared with France.

### 4.2.3 Foreign born highly qualified employees

In the following table 4.9 we have presented the shares of foreign born highly qualified employees. For France the figures relate to the total population of highly qualified personnel (ISCED 6 and 7 or professionals ISCO 2). For the United Kingdom the figures relate to (ISCED 6 and 7) only. This might make the shares of France bigger.

**Table 4.9 Shares of foreign born highly qualified employees (percentages)**

Year	United Kingdom	France
1995	3.4	12.7
1996	3.9	13.4
1997	3.8	13.0
1998	4.3	12.6

The table shows surprisingly big difference between the UK and France. The explanation could be due to differences in defining and identifying foreign born in labour force surveys. The French proportion is also much higher than the proportion of foreign citizens of the stock of highly qualified employees calculated from the CLFS. For the UK the proportions are of the same magnitude. The proportion of foreign citizens seems to be a better indicator than the proportions of foreign nationals. This has probably to be investigated further, if this indicator is going to be used. Taking the sample errors into account, it is difficult to see any trend in these figures.

### 4.3 Extractions from the SESTAT-system in the United States

From the SESTAT-system it is possible to compare employment for scientists and engineers (according to the US definition) in 1995 with employment in 1993 in order to calculate some basic mobility rates. The mobility rate has been defined as the shares of employees being employed both years having shifted jobs.

**Table 4.10 Basic mobility rates for scientists and engineers in the United States 1993-95 (percentages)**

	Scientists and engineers with PhD-degrees	Scientists and engineers without PhD-degrees	Total	Total (foreign born)
Total	14.9	19.3	19.0	20.2
males	13.7	18.2		
females	19.9	21.8		
age 40-75	10.2	14.6		
age below 40	26.9	24.2		

The general mobility rate for the US (19 %) could be a little bit higher than for the EU if calculated on an annual basis as it has to be divided with something less than 2 to take into account people moving both years.

The following other observations could be drawn from the table

- mobility rates are lower for PhDs compared to other scientists and engineers
- mobility rates are higher for females
- mobility rates are higher for younger people

From the more detailed material made available it appears that mobility rates seem to be slightly higher for scientists and engineers with a background in mathematics and computer sciences.

Most of the mobility is within the same broad sector. A specific indicator with relevance to describe knowledge flows in the innovation system is the share of mobility attributed to flows from university to other sectors and from these sectors to universities. This share is around 8 per cent according to SESTAT data, which is higher than the corresponding figure for the EU 6 per cent.

The main problem of using the SESTAT data are quite different concepts and classifications compared with the labour force surveys. The classification of employers in SESTAT is very broad and not comparable with European data for broad industry groups based on NACE/ISIC. The advantage of the SESTAT for mobility analysis is its specific targeting on scientists and engineers and its ability to tackle doctorates separately and also analyse mobility in various fields of science.

#### 4.4 Extractions from ECHP

From the ECHP it has only been possible to construct the following simple table. In the ECHP it is not possible to distinguish between various third level educations so the extraction has been for the total number of employees with third level education or having ISCO 2 occupations. The mobility rates have been defined on the basis of the total number of highly qualified employees started there job in 1994 or 1995 (the survey year), not

working in their first job, have stopped their previous job not earlier than 1993 and were not unemployed between their previous and current job.

#### 4.11 Total mobility rates and mobility rates for women calculated from the ECHP (percentages)

Country	Overall mobility rate	Mobility rate for women
Austria	(8)	..
Belgium	4	(3)
Denmark	13	14
France	8	8
Germany	8	(7)
Greece	8	8
Ireland	12	15
Italy	(3)	(3)
Luxembourg	(8)	..
Netherlands	8	9
Portugal	(6)	..
Spain	6	5
United Kingdom	..	..

() = figure with low reliability due to non-responses or too few observations

.. = figure not available

Any EU total is not possible to calculate from ECHP data. The mobility rates seem to be rather consistent with the data drawn from the CLFS except for Spain with lower rates and Greece with higher rates in ECHP. Only data for mobility between 1994 and 1995 is available.

The problem with ECHP is too small sample sizes for this analytical purpose and lacking information on industry of employment the year before. In a later stage when information from more waves are available it might be possible to link records from various waves to investigate long term mobility.

## 5. Conclusions about possibilities to construct indicators

From the Community Labour Force and national labour force surveys it is possible to construct aggregate indicators on mobility for the whole population of highly qualified personnel and especially for bigger countries for broad industry groups like those presented in this study. Compared to the broad industrial classification used in this report, research institutes could probably be added to the education sector and deducted from other community services and agriculture and construction etc could be grouped together with other manufacturing sectors. The data could be further broken down into broad age groups and by gender. There are possibilities to construct the corresponding indicators from CLFS material on other non EU EEA countries and Eastern European Countries (Czech Republic, Estonia, Hungary, Poland, Romania, Slovak Republic, Slovenia) for at least one year.

The CLFS has the advantage to of being a rather harmonised source for information on mobility, even if there are comparability problems with single variables, like the education variable. For further work it would be rather cost effective to be able to collect data from a

single source instead of going out to 25 national offices. Therefore the use of CLFS for future work is recommended for these countries.

Nevertheless the experience from the UK and France in this pilot project has shown that national labour force surveys might be able to produce more detailed breakdowns and the quality problems of the qualifications data did not seem to be so severe as in the CLFS. At least the series of stocks were more consistent than in the CLFS. The quality problems may be more easy to tackle on the national level. The extractions could be made on the basis of more detailed national classifications.

For most other OECD countries national labour force surveys or related surveys may produce the same data, even if this has not been tested in this study. In further studies a combination of using CLFS data as far as possible and using national labour force surveys for countries not included in the CLFS or for some complementary information is one recommendation coming out from this study.

The other EU source, the ECHP, does not seem to be as good as a source, as employment changes from one sector of employment to another is not possible to follow. The sample size is also rather limited, which makes the sampling errors rather big.

Finland (and other Nordic countries) is able to construct almost any possible mobility indicator on the basis of the register based statistical systems. The problem is more to choose the most appropriate indicators. Some errors in the registers or some weaknesses in registration routines might also cause some problems for the analysis. The register based approach is on the other hand rather slow. Belgium might get similar possibilities as a result of the research project presented in more detail in annex 1.

The United States is able to provide some aggregated information from the SESTAT system. Due to different timing, classifications and coverage of the US data there are very limited possibilities for comparisons with European data. On the other hand, separate information on mobility for doctorates is possible to produce in the US but not on the European level using the CLFS. US data show clear differences in mobility between doctorates and other scientists and engineers. It would be interesting to test this more broadly on European data, but this seems to not be possible for the moment from CLFS. Some national labour force surveys are able to produce this data as in the UK for example.

The United Kingdom and Italy are able to provide complementary information, especially on long term mobility on the basis of the panels described above.

Some further work is needed to solve some methodological problems in order to have comparable data and to investigate how information from different sources could be put together. Especially the use of national labour force surveys in non European countries should be tested in order to evaluate their comparability with CLFS.

The register based data seem to produce higher mobility rates than LFS data. The reasons for that have to be investigated. The Nordic project starting soon will probably review this problem.

It might nevertheless be possible in the future to produce a report on mobility using a combination of various sources. The bulk of the report would be based on the aggregated labour force data from either CLFS or national labour force surveys complemented with information available from registers and other special sources available only in a few countries.



The situation concerning possibilities to construct indicators on international mobility does not seem very promising for the moment. The registration of qualifications and occupations of immigrants and emigrants has to be improved before it is possible to have better data. The indicator on share of foreign citizens in total stocks of highly qualified employees is a possible but a poor substitute. This is possible to produce from labour force surveys. The sampling errors in the LFS make the increases in stocks difficult to analyse. There might also be even more difficulties with the qualification variable for these employees in labour force surveys due to missing data.

## **Annexes**

### **1. Detailed country descriptions on special data sources and some results**

#### **Australia**

The main source of information for HRST mobility studies seems to be the labour mobility survey run by the ABS every second year. It is a survey supplementing the regular labour force survey, specifically addressing mobility issues.

Relevant educational variables included are:

- higher degree (doctor, masters)
- postgraduate diploma (short complement to bachelor or undergraduate)
- bachelor
- undergraduate

Relevant occupational categories included are at least

- managers and administrators
- professionals
- associate professionals

The occupational classification is according to the Australian Occupational Classification, its' relationship with ISCO is unclear.

The mobility indicators are in principle possible to derive from a couple of questions comparing employment February 1998 with employment February 1997.

The Survey of Employment Patterns and Unemployment patterns (SEUP) conducted by the ABS between 1995 and 1997 is another possible source, but unfortunately this survey is no longer conducted. The objectives of the SEUP were to provide information on the dynamics of the labour market to assist in the assessment of the impact of labour market assistance initiatives in alleviating the extent of joblessness in Australian society. SEUP is a longitudinal survey, in that information is collected from the same individuals (referred to as a panel) over a number of years (referred to as Waves). The panel includes people who were aged 15-59, and who were living in private dwellings in both urban and rural areas in the period April to July 1995. The panel comprises three subgroups: job seekers, a population Reference Group (PRG), and a sample of people known to have undertaken a subsidised employment placement and/or a labour market training program. The reference periods for the survey are as follows:

Wave 1: 5 September 1994 to 3 September 1995

Wave 2: 4 September 1995 to 1 September 1996

Wave 3: 2 September 1996 to 31 August 1997

For each respondent basic demographic data was collected. Each respondent was then asked to identify for the preceding 12 month period episodes of working, looking for work and absence from the labour market. For each of these episodes of labour market activity identified by the respondent, information on current weekly earnings, occupation, industry, permanent/casual status, whether job was in preferred occupation, hours worked, beginning and end date of job, etc., were asked.

Due to the nature of the survey it is possible to identify and investigate the labour market activities of respondents at any time of the survey reference period.

Another relevant survey is 'Labour Force Status and Other Characteristics of Migrants'. It is another supplementary survey to the Labour Force Survey. This is run every third year. From this survey detailed information is available on occupational and educational characteristics of immigrants to Australia and their employment status.

General information on immigration and emigration is available from the Department of Immigration and Multicultural Affairs, Statistics section. This section publishes regular (bi-annual and quarterly) statistics on both immigration and emigration.

The main result from the Australian mobility survey is that 14 per cent of those employed had changed jobs during the year, and that 8 per cent had started their current job during the year and did not have any previous job during the year before.

The emigration and immigration information for Australia is available according to vocational self-descriptions of scientist, engineer or academic teacher. In 1995-96 8,656 arrivals were noted, of which 1,395 born in Australia and 5,228 departures, of which 1,940 born in Australia. Of the foreign born people entering Australia 1,579 were from Asia NE and 1,061 from UK or Ireland (Japan External Trade Association 1998).

## **Belgium**

A research project by Catholic University of Louvain is ongoing to collect for the whole HRST population in Belgium in working age on the individual level the following data from the 1991 Census by the National Statistical Office.

- register-number
- sex, age
- ISCED, ISCO
- NACE
- social status

These data are given to the KruispuntbankSZ (a social security institution). This bank will give for the years 1993, 1994, 1995, 1996 and 1997 the status of each person in the labour market

- working or not
- unemployed/inactive or not
- NACE sector for employment, FT or PT
- size of enterprise
- mobility by NACE sector

This study seems to have potential to give very rich data on mobility when finished as it is based on the total population, not on a sample. The possibilities to have detailed data have to be explored further.

## **Finland** (and other Nordic countries)

In the Nordic countries each individual and each organisation (enterprise, establishment) has a unique identification number, which is used in a variety of administrative and statistical registers. For research and statistical purposes it is possible to combine information from these registers. The main administrative registers used are population registers, taxation registers, pension registers, student registers, registers of buildings and dwellings. The information from these registers is combined with information from statistical registers, such as business registers and registers of degrees.

These operations result in annual information for each individual in the Nordic countries on demographic variables, formal education, occupational status, actual occupation (not in Finland after 1995), enterprise and establishment of employment, salaries, etc. These registers are a very valuable and up to now rather under-utilised source of information for research and construction of mobility indicators.

Register information is also available on people leaving the country for at least one year, or entering the country for a period of at least one year. For people entering the country the information on education is unfortunately in around 80 per cent of the cases lacking. Information on country of destination and country of origin is available.

The table showed above in the section describing types of mobility is one illustration of the results of mobility studies in Finland and the other Nordic countries. The results shows on overall mobility rate of 24 per cent 1994-95 for persons with university education in Finland, which means that 24 out of 100 employees moved to another job or out of employment. The rate was higher than in Sweden and Norway, where it was 17-18 per cent. In Finland the mobility rate was particularly high for universities 33 per cent.

If the period 1993-95 is analysed, some 40 per cent of the workforce have entered the workplace since the previous year or left by the following year. The mobility of new entrants is twice as big as for experienced workers. The share of stable workers increases by age.

In 1996 1,300 Finnish born people with university degrees left Finland (122 with doctoral level degree). Of the migrants 281 went to Sweden, 167 to the US and around 100 to Germany and the United Kingdom. In the same year 732 Finnish born people with university education come back to Finland and 340 non Finnish born people with university education moved to Finland. Due to the partly lacking data on the education of migrants to Finland the balance is difficult to evaluate.

## **France**

No relevant data source was identified in addition to the labour force survey.

## **Germany**

Except for the labour force survey (mikrocensus) only the following source has been identified.

The DIW (Deutsche Institut für Wirtschaftsforschung in Berlin) runs a longitudinal household panel survey (GSOEP) since 1984. In 1990 the survey was extended to also cover the territory of former GDR. The GSOEP data supply information about objective and subjective living conditions, about the process of change in various areas of life and about the links between these areas and the changes themselves. The survey also covers foreigners

and immigrants to Germany. After special contract the anonymous micro data can be supplied to the research community. Currently about 400 research groups in Germany and abroad are working with the data.

In 1996 8,606 people from 4,445 households were in the sample, of which 3,882 people in 1,951 households actually responded. The representativity of the sample compared with the whole population in Germany is therefore comparatively low. The stability in the sample is reported to be rather high.

The questionnaire used in the survey is rather long, 117 questions: The most relevant questions for analysis of mobility are:

- has your job situation changed since the beginning of last year (to identify those mobile)
- occupation
- education
- employers branch

### **Italy**

One source for mobility data in Italy is the longitudinal sample of workers and firms based on the social security archives. The archive includes all private and public firms in the industrial and service sectors (except railroad). Public administration (mail service, state school teachers, army, government agencies) is generally excluded except for the National Health Service and local Government, which is included.

The following for mobility analysis relevant data items are included for employees:

- employer identification
- employee identification
- salary and time for which salary has been paid
- occupation (apprentice, manual worker, non-manual worker, manager)

For enterprises information on dates of registration or termination, total number of employees, total salaries paid, social security contributions, economic activity (in principle compatible with NACE) are included.

From this register system a longitudinal sample of all people born 10<sup>th</sup> of March, June, September or December is drawn. The sample includes about 100,000 workers every year. It is not possible to link the educational variable to the sample. The skills level is investigated through the occupational variable and wage level.

The database is maintained by a private company Ricerche e Progetti and the sample have been use for many projects in relation to labour market research. Some overall mobility rates can be calculated (Contini et al. 1996). An overall mobility rate of 23 per cent (share of employees shifting jobs) was recorded for total employees. For the higher skilled categories (managers and blue collar) the percentage was 18 per cent. The highest rate was recorded in construction 38 per cent. For total service industries the number was 22 per cent and for total manufacturing 21 per cent. The mobility was bigger in smaller firms. Mobility was also higher for younger people.

### **Korea**

One of the sources for an analysis of mobility in Korea seems to be the employment structure survey run every fifth year. It is a household survey with a rather large sample size (120,000 households) and it investigates inter-industry and inter-occupation mobility

for one year. In the report itself mobility of highly educated is not explicitly dealt with, but by processing the micro files, it should be possible to make extractions relevant for this kind of analysis too.

Other data sources mentioned by Korean experts are registers maintained by employment insurance authorities and the Korean labour force survey data itself. It is possible in the Korean LFS to link the records for a particular person for different years. The use of the Korean LFS is further facilitated by the fact that the Korean labour force survey sample remains the same for 5 years.

Information on immigration and emigration is available from the Yearbook on Immigration and Emigration management statistics in Korea published by the Ministry of Justice.

Information is available on foreigners getting visas for the purpose of teaching and research and on Koreans getting visas to go abroad for research and teaching purposes. The information is available by country of origin or country of destination. In 1996 3,382 foreigners entered Korea for research or teaching purposes, of which around half from the US. At the same time 15,813 Koreans left the country for research or teaching purposes, of which around one third to the US and one third to Japan (Japan External Trade Association 1998).

### **Netherlands**

Some information has been received on a comprehensive survey of the labour market situation for newly graduated. This source does not seem to be relevant to monitor the types of mobility being the target for this study. A pilot study on data collection on university and other scientific personnel including mobility is about to start by the Association of Universities in the Netherlands. No knowledge of any other relevant sources.

### **Spain**

Several sources have been reported on databases in relation to R&D co-operation. However, they do not seem to be relevant for the type of mobility covered by this report.

### **United Kingdom**

Several possible sources have been indicated in addition to the LFS.

The annual New Earnings Survey samples 1 per cent of the working population and collects data over time on their age, sex, employer, occupation, industry, earnings but not on education. The survey has been run since 1970 and has changed very little since 1975. A special panel (NESP) has been constructed for individuals remaining in the sample consistently. The panel does not include the information on employer. The principle is to sample all individuals in the UK whose National Insurance number ends with 14. The survey includes the employed (not including self employed). People not in employment disappear from the survey, but might be found from another sample of computerised claims for unemployment benefits (JUVOS). This does not correspond to the ILO unemployment definition.

The advantage of this survey is its size, bigger than the LFS and the possibility to follow mobility patterns over a long period of time. There may be some difficulties in linking the information on employers to the panel data set.

Also some other sources might be relevant, such as the British Household Panel Study at Essex University.

## United States

The main source of information for the investigation of mobility is the SESTAT database developed and maintained by the National Science Foundation. The system is constructed of three surveys:

- the National Survey of College Graduates (NSCG)
- the National Survey of Recent College Graduates (NSRCG)
- the Survey of Doctorate Recipients (SDR)

The surveys have been undertaken for 1993 and 1995 and will be repeated every second year. The target population for SESTAT is non-institutionalised US residents aged 75 years or less with at least a bachelor degree in a S&E field on 30 June the previous year or with a bachelor degree in a non S&E field but working in a S&E occupation in the survey week 15 April.

The NSRCG and SDR surveys are at least partly longitudinal facilitating employment comparisons between years. The sample sizes for the two surveys were around 60,000 and 50,000. After various kinds of non response follow ups the number of completed interviews were 53,000 and 35,000.

From the SESTAT, it seems to be possible to analyse mobility between the following kinds of sectors

- private for profit (company, business or individual, working for wages, salary or commissions)
- private not for profit (tax exempt or charitable organisation)
- self employed in own not incorporate business, professional practise or farm
- self employed in own incorporated business, professional practise or farm
- local government
- state government
- US military service
- US government (civilian employee)

A separate question was asked about employment in various kinds of educational institutions.

Subdivision by the following types of qualifications might be possible, if the sample size permits it:

- bachelor
- post baccalaureate certificate
- masters degree
- post masters certificate
- doctorate
- other professional degree

The basic source for information on immigrating and emigrating scientists and engineers is the Immigration and Naturalisation Service, which provides the National Science Foundation with basic data for the calculations of annual inflows of scientists from abroad. Objectives of data collection is to monitor:

- levels and trends in the immigration of scientists and engineers
- characteristics of scientists and engineers from abroad
- country of birth and last permanent residence for this personnel

The data include those classifying their occupations as scientists, engineers or technicians. The classification is based on educational or employment background. Researchers, teachers, managers or students are excluded. It seems to be possible in the US to distinguish within the R&D personnel between degree holders of various kind from US universities and other universities. between non-citizens and citizens and between US born and foreign born scientists and engineers.

In a study by Finn and Baker (1996) some calculations are made on mobility between academic and non academic sectors for doctorates between 1988 and 1993. The mobility from academic employment to non-academic employment is generally bigger than mobility from non academic to academic employment. For doctorates awarded 16-20 years ago the flows are rather equal. The same study also gives information on foreign-born PhD employment. For the academic sector for example, it is 24 per cent, most of them are either US citizens or permanent residents in US.

## **2. Request for the experimental calculation of mobility indicators from CLFS, the UK and France, the US, and ECHP**

### **2.1 Specification for extraction from CLFS**

The extraction has to be based on the following criteria:

- main status employed in year t (column 99, code 1)
- labour force status (column 24, code 1, 2)
- professional status (column 26, code 1, 2, 3)
- information available on industry of employment (column 27/28, code not blank)
- qualification (column 107/108, code 09, 10)
- if not qualification (column 107/108, code not 9, 10) then occupation (column 29/31, code 200 or all codes beginning with 2)
- also employed in year t-1 (column 114, code 1)
- information on industry of employment (column 116/117, code not blank)

Highly qualified personnel is thus defined as people employed in years t-1 and t and having (ISCED 6+7, equal to new 5a, 6 or ISCO 2) qualifications/occupations, The whole population of highly qualified personnel is taken together without any breakdown. Job change (mobility) could be defined on the basis of the question when the person started current job in (column 38/41). If this has taken place in year t, then job change has taken place between t and t-1. All tables should in principle be based on grossed up figures.

For each year 1995, 1996, 1997 and 1998 (for those countries possible) the following tables for each country

#### **Table 1 Total stocks of highly qualified employees, thousands), separate table for each country and year)**

See more detailed specifications below

#### Country

(1) Total stock

(2) - of which foreign nationality

(3) - of foreign nationality and resident in the country only 1 year

(4) Total number with changed jobs between t and t-1

(5) Mobility rate year t= (4)/ (1)

(6) Total stock (women)

(7) Total number of women with changed jobs between years t and t-1

(8) Mobility rate for women year t= (7)/(6)

(1) total number of extracted people

(2) column 17/18 other code than country concerned

(3) column 19/20, code 01, or column 118/119 other than country concerned

(4) job changes, survey year coded in column 38/41

(6) women column 10, code 2

(7) like (4) for women

(8) like (5) for women

**Table 2 The mobility rate broken down by industries of employment in year t and industries of employment in year t-1, table in percentages**

Country (separate table for each country and each year)

*Employment year t*

<i>Employment year t-1</i>	ICT-sector	Manufacturing, not ICT	Agriculture, construction, etc.	Other private services	Education	Other community services
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ICT-sector

Manufacturing, not ICT

Agriculture, construction, etc.

Other private services



Education

Other  
community  
services

**Total sec-  
toral mo-  
bility rates**

The industries of interest are

ICT sector (NACE 30, 32, 64, 72)

Other manufacturing (NACE 15-37, except 30, 32)

Agriculture, forestry, mining, utilities, construction (NACE 01-14, 40-45)

Other private services (NACE 50-74, except 64, 72)

Education (NACE 80)

Other community services (NACE 75-99, except NACE 80)

**2.2 Specifications for the extraction in UK and France (Mobility of highly qualified personnel between years t and t+1 in the UK and France)**

The information required is defined according to the table model below. In principle the idea is to have a matrix between employment and employment status in year t and t+1 for required populations and sub-populations.

**Table model**

	Same employer year t+1	Changed employer between years t and t+1 by industry year t+1	Not employed	Disappeared between years t and t+1
Employment by industry year t				
Not employed				
<b>Total</b>				

### **Change of employer**

This should primarily be defined according to change in enterprise or organisation (legal unit). If this is not possible or causes additional difficulties for the extraction, establishment (local kind of activity unit) or local units are acceptable as units.

### **Industries of employment of interest for the study are**

ICT sector (NACE 30, 32, 642, 72)

Other manufacturing (NACE 15-37, except 30, 32)

Agriculture, forestry, mining, utilities, construction (NACE 01-14, 40-45)

Other private services (NACE 50-74, except 642, 72)

Universities or higher education (national subgroup of NACE 80)

Other community services (NACE 75-99, except national subgroup of NACE 80)

### **Total population for the study**

The total population for the tables should be defined as the population of employees (aged 20-64 years) with ISCED 6 or 7 degrees or occupied as professionals (ISCO 2). One of these criteria has to be fulfilled for inclusion.

**Years:** (t)=1994, 1995, 1996, 1997 (t+1)= 1995, 1996, 1997, 1998

### **Tables**

The tables should preferably be expressed in total numbers (non-weighted if weighted is difficult) and percentages and computed for the following populations

- total population for the study
- total population for the study, foreign born
- total population for the study, 20-39 years
- total population for the study, 40-64 years
- total population for the study, with ISCED 6+7 degrees
- total population for the study, with ISCED 6+7 degrees, women
- total population for the study, doctorates (if possible to distinguish from masters degrees using national codes)
- total population for the study, doctorates, women
- total population for the study ISCED 6+7 natural sciences and engineering ISCED 42, 46, 54 and 58
- total population for the study ISCED 6+7, other fields
- total population for the study, professionals (ISCO 2)
- total population for the study, professionals (ISCO 2), women
- total population for the study, professionals (ISCO 2, ISCED 5 or lower)
- total population for the study, with ISCED 6+7 degrees not professionals (not ISCO 2)

If possible, sampling errors should be calculated for mobility rates calculated from the total population and one of the sub-populations (for example total population below 40 years).

### **Comments**

A separate category for the ICT sector has been chosen as it is politically interesting and other studies have shown higher mobility rates there. The definition corresponds broadly to

that adopted by the OECD. If this proves to be too difficult, it could be merged with other manufacturing and other service sector.

Universities and higher education has to be extracted from the national codes. The idea is to identify educational institutions performing research and giving education on at least master level.

If ISCED 6 +7 is not easily identified from national codings, national codes could be used to identify university or other qualifications requiring at least three years post secondary education.

With doctorate degrees is meant an advanced heavily research oriented degree, normally requiring four years of full time study after completion of first university degree.

With disappeared is meant people not found in t+1 but in principle still in the sample.

### 2.3 Specifications for the extraction in US (Mobility of US scientists and engineers 1993-95)

#### Table model

	Same employer 1995	Changed employer between 1993 and 1995					Disappeared 1993-95
		University	Other ed.	Firms	Government	PNP	
Employment 1993							
University							
Other education							
Firms							
Government							
Private non profit							

#### Total

The tables should preferably be expressed in total numbers (weighted or un-weighted) percentages and computed for the following populations

- total population of scientists and engineers
- total population of non US born residents
- total PhDs
- total PhDs women
- PhDs natural sciences, engineering (preferably old ISCED fields 42, 46, 54 and 58)
- PhDs all other fields
- PhDs below 40 years
- PhDs 40 years or over
- other education total

- other education women
- other education natural sciences, engineering
- other education all other fields
- other education below 40 years
- other education 40 years or over

## 2.4 Specification for extraction from ECHP

The extraction has to be based on the following criteria:

Basis for the extraction is the 1994, 1995 waves and the following variables

- ILO main activity status employed in year t (PE003, code 1, 2)
- information available on industry of employment (PE007A appropriate NACE 2-digit code)
- qualification, ISCED 5-7 (PT022, code 1)
- if not qualification (PT022, code not 1) then occupation ISCO 2 (PE006C, code 2)
- information on previous employment (industry PJ008 appropriate NACE 2-digit code)

Job change (mobility) could be defined on the basis of the question when the person started current job (PE011=t) and not being unemployed before (PE014, code 2) and also possibly by the year stopping working in last job (PJ002, questions PO2015, codes 1, 2)  
All tables should in principle be based on grossed up figures, if possible.

For each country the following tables

### **Table 1 Total stocks of highly qualified employees, thousands), separate table for each country and year)**

See more detailed specifications below

#### Country

- (1) Total stock
- (2) - of which foreign nationality
- (3) - of foreign nationality and resident in the country only 1 year
- (4) Total number with changed jobs between t and t-1
- (5) Mobility rate year t= (4)/ (1)
- (6) Total stock (women)
- (7) Total number of women with changed jobs between years t and t-1
- (8) Mobility rate for women year t= (7)/(6)

- (1) total number of extracted people
- (2) PM008 code not 1
- (3) PM006 year t or t-1
- (4) job changes, see above
- (6) from PD004 sex women
- (7) like (4) for women
- (8) like (5) for women

**Table 2 The mobility rate broken down by industries of employment in year t and industries of employment in year t-1, table in percentages**

Country (separate table for each country and year)

<i>Employment year t-1</i>	<i>Employment year t</i>					
	ICT-sector	Manufacturing, not ICT	Agriculture, construction, etc.	Other private services	Education	Other community services
ICT-sector						
Manufacturing, not ICT						
Agriculture, construction, etc.						
Other private services						
Education						
Other community services						
<b>Total sectoral mobility rates</b>						

The industries of interest are:

- ICT sector (NACE 30, 32, 64, 72)
- Other manufacturing (NACE 15-37, except 30, 32)
- Agriculture, forestry, mining, utilities, construction (NACE 01-14, 40-45)
- Other private services (NACE 50-74, except 64, 72)
- Education (NACE 80)
- Other community services

### 3. Sources used for the study

Below is listed the sources used for the study as being relevant for the kinds of mobility of interest for the study.

#### General sources

Eurostat(E1): The European Union Labour Force Survey, methods and definitions, 1996 and 1998 editions

Eurostat(E3): European Community Household Panel (ECHP): Methods, Volume 1, Survey questionnaires: Waves 1-3, 1996

Eurostat(E3): The European Community Household Panel (ECHP), Survey methodology and implementation, Volume 1, 1996

Graversen E.: Formal competencies in the innovation system of Denmark: An analysis based on register data with comparisons to the Nordic countries, Aarhus 1999 (forthcoming)

Hauknes J.: Modelling mobility of researchers, STEP report 9 1994, Oslo 1994

Japan External Trade Association: Study Report on Mobility of Researchers Among APEC Economies, Tokyo 1998

OECD: Science and Technology Labour Markets: Mobility and Flexibility, DSTI/STP/TIP(98)9

Svein-Olav Nås et al.: Formal competencies in the innovation systems of the Nordic Countries: An analysis based on register data, STEP report R-06 1998, Oslo 1998

Mikael Rosengren: An Inventory of National Priorities and Availability of Data in OECD Countries to quantify Science and Technology Personnel Mobility Patterns, Joint OECD NESTI/GSS/TIP workshop, 17 June 1998, Room Document 2

#### Country specific sources

##### Australia

Australian Bureau of Statistics: Labour Force Status and Other Characteristics of Migrants, ABS Catalogue No. 6250.0, Canberra 1996

Australian Bureau of Statistics: Labour Mobility Australia, ABS Catalogue 6209.0, Canberra 1998

##### Italy

Contini B., Revelli R. Filippi M., Pacelli L., Malpede C., Novarese M., Villosio C.: The R&P longitudinal sample of workers and firms based on Social Security Archives

Contini B., Pacelli L., Rapiti F., Revelli R.: Mobility Patterns in the Italian Economy, Proceedings of the Meeting comparative Analysis of Enterprise Data, Helsinki 1996

Contini B., Revelli R.: Gross flows vs. net flows in the labour market: What is there to be learned?, Labour Economics 4 (1997)

### **Germany**

Information from website [www-soep.diw-berlin.de](http://www-soep.diw-berlin.de)

### **United Kingdom**

ONS: NESP, The Information Pack, London 1997

ONS: Tracking People: A guide to longitudinal statistical sources, London 1999

Salt J. and Clarke J.: Flows and Stocks of foreign labour in the United Kingdom, Labour Market Trends, July 1998

Tate P.: Longitudinal Data From the Labour Force Survey, Groupe de Paris Meeting in London on 6 July 1998

### **United States**

Finn M. and Baker J.: Non-academic Employment Patterns of Science and Engineering Doctorates 1993, Oak Ridge, Tennessee 1996

Johnson J. and Regets Mark C.: International Mobility of Scientists and Engineers to the United States-Brain Drain or Brain Circulation, NSF, Issue Brief 98-316

Various information from the SESTAT website <http://srsstats.sbe.nsf.gov/>

## **4. Contact persons**

The following persons in participating countries have supplied the project with information of various kind.

### **Australia**

Dr. Kevin Bryant	Department of Industry, Science and Tourism
Mr. Bill Pattinson	Australian Bureau of Statistics
Mr. Timothy Wardrop	Australian Bureau of Statistics

### **Belgium**

Dr. Peter van den Hallen	Catholic University Louvain
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### **France**

Mr. Marc Christine	INSEE
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### **Germany**

Ms. Gerda Gladis	Statistisches Bundesamt
Ms. Sabine Kallwitz	German Institute for Economic Research

**Italy**

Ms. Sveva Avveduto	National Research Council
Ms. Claudia Villosio	R&P, Ricerche e Progetti

**Korea**

Dr. Sang Won Koo	Science and Technology Policy Institute (STEPI)
Ms. Hwa Young Lee	Ministry of Labour

**Netherlands**

Mr. R. Bennink	Association of Netherlands Universities
Ms. Marian Hulshof	Catholic University Nijmegen
Mr. Ger Ramaekers	Research Centre for Labour Market Research

**Spain**

Ms. Rosa Sancho	Comision Interministerial de Ciencia y Tecnologia
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**United Kingdom**

Mr. Derek Bird	ONS
Ms. Joanna Brown	ONS
Mr. Lester Browne	ONS
Mr. Anthony Craggs	Department for Trade and Industry
Mr. Peter Jones	ONS
Ms. Francis Sly	ONS
Mr. David Wilkinson	ONS

**United States**

Jennifer Sue Bond	National Science Foundation
Dr. Mike Finn	Oak Ridge Institute for Science and Education
Linda P. Hardy	National Science Foundation
Rolf Lehming	National Science Foundation
Mark C. Regets	National Science Foundation

**Eurostat**

Anne Clemenceau	ECHP
Ana Franco	CLFS
Sylvain Jouhette	CLFS
Christine Wirtz	ECHP