

EUROPEAN TREND CHART ON INNOVATION

Thematic Report:

The Use of Mobility Schemes in European Innovation Policy

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The European Trend Chart on Innovation

Innovation is a priority of all Member States and of the European Commission. Throughout Europe, hundreds of policy measures and support schemes aimed at innovation have been implemented or are under preparation. The diversity of these measures and schemes reflects the diversity of the framework conditions, cultural preferences and political priorities in the Member States. The ‘First Action Plan for Innovation in Europe’, launched by the European Commission in 1996, provided for the first time a common analytical and political framework for innovation policy in Europe.

Building upon the Action Plan, the *Trend Chart on Innovation in Europe* is a practical tool for innovation policy-makers and scheme managers in Europe. Run by the Innovation Directorate of DG Enterprise, it pursues the collection, regular updating and analysis of information on innovation policies at national and Community level, with a focus on innovation finance; setting up and developing innovative businesses; the protection of intellectual property rights; and the transfer of technology between research and industry.

The Trend Chart serves the “open policy co-ordination approach” laid down by the Lisbon Council in March 2000. It supports policy-makers and scheme managers in Europe with summarised and concise information and statistics on innovation policies, performances and trends in the European Union. It is also a European forum for benchmarking and the exchange of good practices in the area of innovation policy.

The Trend Chart products

The Trend Chart on Innovation has been running since January 2000. It tracks innovation policy developments in all EU Member States, plus Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Liechtenstein, Lithuania, Norway, Poland, Romania, Slovak Republic and Slovenia. The Trend Chart website (www.cordis.lu/trendchart) will provide access to the following services and publications, as they become available:

- a database of policy measures across Europe;
- a ‘who is who?’ of agencies and government departments involved in innovation;
- a series of country reports;
- a series of six-monthly trend reports;
- a number of benchmarking reports on specific themes;
- statistical reports such as the European Innovation Scoreboard;
- regular newsletters and bulletins;
- annual reports; and
- various other publications.

The present report was prepared by **Mark Boden and Paul Cunningham, PREST, University of Manchester**. The information contained in this report has not been validated in detail by the Member States or by the European Commission.

Contact: Christophe Guichard; christophe.guichard@cec.eu.int

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The Use of Mobility Schemes in European Innovation Policy:

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The Use of Mobility Schemes in European Innovation Policy

Executive Summary

Key dimensions of the performance of an innovation system include the intensity and effectiveness of the interactions between the main actors involved in the generation, diffusion and implementation of knowledge. The embodiment of knowledge in individuals, and their ability to implement and diffuse this knowledge, or at least the capacity to absorb and use knowledge, render the movement of researchers and other personnel engaged in the innovation process between organisations as highly relevant methods of exploiting and developing such linkages. Policy instruments which seek to promote and facilitate mobility are thus of particular importance in examining the knowledge transfer process.

This report examines the use of mobility schemes, defined for the purposes of this study as “Mechanisms to encourage individuals to work, frequently on a temporary basis, within other organisations, with a resulting exchange of knowledge and information, and which operate either within the national context or at the international level”, within the framework of national innovation policies in Europe. It draws on information on national innovation policy instruments, collected as part of the EU Trend Chart on Innovation Policy

Information on relevant policies and policy instruments was collected through a review of policy documents and Trend Chart country reports and through a questionnaire distributed to members of the Trend Chart network of national innovation experts.

The report uses a taxonomy of schemes whereby they can be classified according to aspects of their modality of operation and the characteristics of their intended targets. On this basis, it is possible to conduct some analysis of trends in innovation policy. In addition, comments, where appropriate, are made on the impact of such policy mechanisms and on future possibilities.

The priority accorded to policies promoting personnel mobility varies across the member states. There is widespread recognition of the importance of mobility as a means of knowledge transfer, and thus of its broad role in innovation, and there are examples of schemes specifically designed to exploit this. In addition, across the member states there are more specific issues addressed by mobility instruments, such as skills shortages, the needs of SMEs, and the role of personnel mobility in developing scientific and technological collaboration. Examples of such schemes are presented together with an overall summary of country-specific policies.

On the basis of a framework developed, in earlier reports, for the analysis of innovation policy measures more generally, it is possible to examine mobility measures in terms of two key characteristics: their modalities of operation and their targets. The former is concerned with how measures are implemented, whether through the provision of direct financial and/or structural support, and through the generation and/or transfer of knowledge. Further distinctions may be made between the level of operation, the nature

of the activity, the duration of the activity, and the type of funding. Targets are the organisational types and levels at which policy mechanisms are aimed. Mobility measures currently in place are analysed in the context of this taxonomic framework.

On the basis of three criteria (durability, impact and transferability), a number of measures have been proposed as potential examples of good practice. A listing of evaluated measures is also provided, together with the summarised results of their evaluations.

The report concludes that there is currently a large variety of schemes implemented across Europe, particularly in terms of the types of actors involved, with all types of public and private sector organisations involved. Although there is an emphasis on mobility from universities to industry, particularly the recruitment of researchers, examples of the reverse flow may also be found.

Moreover, there is substantial convergence both on the underlying policy rationale for the use of mobility schemes, namely the transfer of innovation relevant knowledge via the inter-organisational movements of individuals, and on the objective of improving cooperation between industry and universities. A second line of convergence concerns the shared concern for SMEs and the use of mobility schemes to improve their innovative performance. However, the report notes that there are more specific objectives related to the context of operation of schemes.

The impact of such schemes seems to be emerging, generally, as positive, with the majority of evaluations reporting schemes as successfully achieving their objectives. Common features of certain schemes do derive, explicitly from the transfer of elements of good practice between schemes. Other commonalities reflect shared policy concerns and recognition of the role of the individual in knowledge transfer.

Finally the report notes that despite the current diversity of mobility themes in operation, which provides a broad basis of experience from which to inform policy making, the trend towards some degree of convergence holds both advantages and disadvantages for the policy learning process.

The Use of Mobility Schemes in European Innovation policy

1. Introduction

The knowledge and learning capabilities of individuals play a central role in the innovation processes of organisations. This provides a clear rationale for the use of personnel mobility to facilitate the transfer of knowledge and technology. At national level, the promotion of mobility as a policy mechanism can contribute to national and industrial competitiveness, while both strengthening and exploiting the science base.

The aim of this report is to examine the use of mobility schemes in the context of national innovation policies in Europe. It draws on information on national innovation policy instruments, collected as part of the EU Trend Chart on Innovation Policy.

Against the background of national policy concerns, a taxonomy of schemes is developed, whereby schemes can be classified according to aspects of their modality of operation and the characteristics of their intended targets. On this basis, it is possible to conduct some analysis of trends in innovation policy. In addition, comments, where appropriate, are made on the impact of such policy mechanisms and on future possibilities.

For the purposes of the study, mobility schemes are defined as “Mechanisms to encourage individuals to work, frequently on a temporary basis, within other organisations, with a resulting exchange of knowledge and information”¹. They can operate within the national context or at the international level.

Information on relevant policies and policy instruments was collected through a review of policy documents and Trend Chart country reports and through a questionnaire distributed to members of the Trend Chart network of national experts. This included the following series of issues and structured requests for information:

- ***Policy relevance of mobility*** – (e.g. whether it is the subject of policy debate, the introduction of measures to address it, the production of specific studies or reports on this topic);
- ***Description of current policy measures*** directly or indirectly addressing mobility, in terms of primary objectives, the personnel targeted, the organisational and geographical levels of operation, the activities involved and the degree of novelty entailed;
- ***Evaluation of impacts*** of measures, and evidence of good practice or transferability;
- ***Future policy areas***, describing intended or potential future use of mobility instruments in support of policy objectives.

¹ See Table in Annex

Following discussion of the role of personnel mobility in the transfer of knowledge and the articulation of a framework for the analysis of policy instruments to mobility-related measures, this report systematically uses the information collected to provide a perspective on the situation of mobility related policy measures in Europe.

2. Mobility and the Transfer of Knowledge

Key dimensions of the performance of an innovation system are the intensity and effectiveness of the interactions between the main actors involved in the generation, diffusion and implementation of knowledge². The critical role of the linkages between a country's science base and its industry in fostering innovation has been examined, in the European context, in previous reports in this series³.

The embodiment of knowledge in individuals, and their ability to implement and diffuse this knowledge, or at least the capacity to absorb and use knowledge, render the movement of researchers and other personnel engaged in the innovation process between organisations as highly relevant methods of exploiting and developing such linkages. Policy instruments which seek to promote and facilitate mobility are thus of particular importance in examining the knowledge transfer process.

As subsequent sections of this report demonstrate, a range of mobility schemes can exist, depending on the overall policy objectives and the context of operation. The latter, in turn, depends on the organisational and individual actors in the innovation process and the type of knowledge and expertise being transferred.

Schemes aiming at the transfer of personnel can involve a full range of knowledge generating and exploiting organisations, namely universities, business and industry (either large companies or SMEs), public sector research establishments (Government laboratories), or independent Research and Technology Organisations. A large number of schemes aim at improving the flow of knowledge between universities and industry, although the reverse flow is also relevant. The individuals participating in mobility schemes may include both researchers from the public and private sectors and research managers. The latter case underscores the fact that scientific and technical knowledge do not form the sole types of innovation related knowledge amenable to transfer. Indeed the promotion of more strategic perspectives and commercial awareness may also be achieved through personnel transfer schemes.

In examining the types of knowledge and skills being transferred, a distinction can be drawn between levels of transfer. This is exemplified by student placement schemes where, at one level, the student gains industrial knowledge and experience, and the firm

²OECD, *Science, Technology and Industry Outlook – science and innovation*, Organisation for Economic Cooperation and Development, Paris, 2000.

³ Howells, J. and Cunningham, P. *The European Innovation TREND CHART, Thematic Report: "Industry-Science Relationships", July – December 2000*, Report to DG Enterprise Luxembourg, March 2001.

may gain research expertise together with a potential employee. At a higher level, however, the scheme may serve to cement a longer-term relationship between the academic and industrial supervisors, or a broader level interaction between the institution and the host company.

A recent OECD report on human resource mobility⁴, drawing on work coordinated by the STEP group in Norway, provides further empirical support and insights into the role of personnel mobility in the transfer of knowledge at both national and international levels.

3. Mobility schemes in European Innovation policy

The policy priority given to personnel mobility varies across the member states. Clearly there is widespread recognition of the importance of mobility as a means of knowledge transfer, and thus of its role in innovation, and there are examples of schemes specifically designed to exploit this. Across the member states there are more specific issues addressed by mobility instruments, such as skills shortages, the needs of SMEs, and the role of personnel mobility in developing scientific and technological collaboration.

3.1 Mobility and Knowledge Transfer

In *Denmark* there are currently four measures in place (DK_4, DK_11, DK_14, DK_15)⁵ which explicitly use personnel mobility to promote knowledge and technology transfer, two of which are new and form part of the Government's strategic plan for development of trade and business policy launched in February 2000 (the so-called "dk21 plan").

Likewise in *Finland*, the mobility of personnel is considered to be one of the most important mechanisms of knowledge transfer. However, as mobility between the universities and the business sector has been more modest than expected the Science and Technology Policy Council recommended in its 1996 review increased promotion of expert mobility.

3.2 Skills Shortages

There are common concerns for the level of scientific and technical expertise in member states, and its relationship to innovative activity and hence to competitive performance.

⁴ OECD (2001c), *Innovative People: Mobility of Skilled Personnel in National Innovation Systems*, OECD Proceedings, OECD, Paris.

⁵ DK_5 'Industrial researcher-scheme'; DK_15 'Industrial Innovator Scheme' DK_14 'Large Cross-disciplinary Research Groups' DK_11 'Innovation Post Doc'

Perceived shortages of expertise may be addressed by increased policy attention towards training researchers, or in the shorter term, by inward mobility from overseas.

In the case of *Austria*, the mobility of qualified personnel is of particular interest in attaining the government's aim of allocating 2.5% of GDP on R&D spending. According to the Council for Research and Technology Development, for the provision of additional R&D funding to be successful requires a doubling of the number of university graduates. However, as this cannot be achieved by increasing the capacity of local universities, attention has been turned to attracting the return of Austrian researchers working abroad, and to the creation of incentives for foreign workers to come to Austria, with an amendment to the current immigration quota. The Council for Research and Technology Development allocated additional funds for mobility schemes for young researchers at its July 2001 meeting.

In *Germany* there is an identified shortage in high-qualified personnel in ICT sector⁶. Policy debate has been focusing on education as a solution to this shortage rather than mobility. However, as in the case of Austria, mobility has been an important topic of policy debate, with respect to the immigration of high-qualified personnel.

In *Portugal*, there is increasing awareness of the need to promote mobility, both within the country, between different areas of activity, and with other countries, with an emphasis on learning and understanding different contexts, cultures and approaches. At the national level, mobility is seen as a key element for the education system, to better respond to the needs of industry, as well the development of linkages between University and Industry.

This issue is currently addressed by a number of Operational Programmes, namely the Operational Programme Education (POE), the Operational Programme Employment, Training and Social Development (POCTI) as well as programmes more concerned with innovation matters (e.g. POSI). Of particular relevance is the launch of a new measure for the integration of doctoral and masters graduates, predominantly in scientific and technical fields, in companies and technology centres (PT_22). This measure aims to improve the scientific and technical capabilities of the host company.

Two-way temporary mobility between companies and universities is also promoted in Portugal, under PROINOV, with the promotion of the temporary assignment of lecturers to companies and of corporate executives to universities. This is complemented by measures for the encouragement of curriculum-integrated training programmes and corporate-driven graduation projects, the improvement of the effectiveness of schemes for supporting labour market integration and the career development of graduates, including postgraduates, and the sending of trainees to international companies or institutions.

⁶ Whether this trend will continue in the light of a potential economic recession remains to be seen – several large ICT companies have already shed substantial numbers of staff, albeit largely from sales and marketing divisions.

In *Norway* no new measures targeting the mobility of students, research workers or teachers have been implemented recently. Statistics suggest that the mobility rate for well-qualified persons is already high, and that the major problem is the retention of researchers by universities and colleges into society. Consequently the Government has announced new measures to secure the recruitment of new permanent scientists in public sector research institutions. The Research Council of Norway (RCN) has also expressed concern over the lack of high quality expertise in the country. A further programme is planned to facilitate the import of researchers from abroad (see section 4.5).

In *Greece* mobility schemes have not been a major subject for either policy or policy debate. However, the movement away from Greece of graduate students and qualified scientists (“brain drain”) is a cause for concern, as in many other countries.

In *Ireland* two schemes aimed at facilitating technology transfer through personnel mobility (*Techstart*, [IE_11] which placed recent graduates in firms with a commitment to innovation and *Techman*, [IE_11] which did the same with experienced managers) were discontinued in 1999. However, the piloting of a new scheme, *Fusion*, which is similar to *Techstart*, by the all-Ireland development body, InterTradeIreland, reflects the continuing existence of demand for such schemes.

3.3 SMEs

The policy focus on providing support for innovative activities in small and medium enterprises in many member states extends, in a number of cases, to the use of mobility measures to enhance their scientific and technical competence.

In *Italy*, one measure [Employment in the field of research (IT_2)] aims at encouraging SMEs to employ qualified researchers, particularly graduates with research experience, such as those at masters and doctoral levels. The measure provides support for the temporary placement of such graduates, as well as the temporary secondment of researchers and technicians from public research organisations to industry for up to four years.

In *France* also SMEs are prioritised in the six measures currently addressing the issue of personnel mobility (FR_3, FR_6, FR_7, FR_14, FR_30, FR_31)⁷.

⁷ FR3: Support for recruitment of researchers and R&D engineers (“ARI” : aide à la recherche pour l’innovation); FR6: Support for the recruitment of technicians on innovative projects (CORTECHS); FR 7: Support for the recruitment of PhD candidates on an applied research project within an enterprise. CIFRE convention; FR 14: Support for the recruitment of post doctorate in SME’s; FR 30: Technological Research Diploma (DRT); FR31: Youth and Innovation

3.4 *Impetus to Collaboration*

Policy emphasis on mobility may also be driven by the perceived impetus to collaboration that the transfer of personnel between organisations may provide.

In *Cyprus* mobility is a key feature of the Greek – Cypriot co-operation programme [CY_21], whereby the exchange of scientists from the two countries is funded. Wider international mobility, particularly of students and university personnel, is also an area of importance.

As mentioned above the promotion of mobility in *Portugal* not only addresses human resource issues, but also aims at strengthening links between the public and private sectors. Similarly in *Spain* the transfer of knowledge through personnel mobility is seen as an essential strand of national innovation policy, where there is a strong emphasis on developing cooperation between industry and academia, while strengthening their respective knowledge bases.

In *Sweden* mobility is not a subject of policy debate, rather it is already accepted as important, particularly between universities and industry. There are no current measures in place, although certain measures have mobility as a secondary objective or relate to the exchange of researchers, such as publicly funded joint R&D programmes between university, industry and semi-public industrial research institutes.

Likewise, in the *United Kingdom* this topic does form a policy focus but, rather a means to an end, as part of the wider range of measures aimed at improving linkages between the science base and industry. The longstanding TCS (formerly the Teaching Company Scheme) [UK_18] is one of the key measures to promote the mobility of post-graduate students between businesses and higher education institutions. The equally longstanding CASE (Cooperative Awards in Science and Engineering) scheme [UK_58] is operated by the UK Research Councils to support post-graduate students who undertake doctoral research in collaboration with an industrial partner. Both these schemes are also connected to research training.

Also relevant are the Faraday Partnerships and the STEP (Shell Technology Exploitation Programme) schemes. The former provide a stable collaborative framework based around a specific industrial research theme and are expected to become self-financing through attracting a combination of support from business coupled with funding won in open competition from existing UK Government, Research Council and EU schemes. The mobility of personnel (especially of masters or other post-graduate students – including CASE students) forms a significant element of their operation. The latter is a national programme designed to help SMEs and community organisations develop their potential by making use of the skills of undergraduates, and also to encourage undergraduates to consider a career in smaller firms, through an eight week summer work placement on business-related or science, engineering or technology based projects identified by the host organisation.

Also in the UK, the Higher Education Innovation Fund (HEIF) aims to promote linkages between HEIs and their local/regional business community. Proposals from HEIs for this competitive funding may include specific student/staff placement schemes, although there is no general prescriptive format under which these linkages should be undertaken.

3.5 Summary of mobility schemes across Europe

The following table summarises national policy priorities with regard to mobility.

Summary table of mobility-related policy priorities across member states

Country	Policy Priority	Measures
Austria	Identified shortage of research personnel, need more graduates. Return of ex-patriots and recruitment of foreigners.	FWF Impulse Projects (AT_19) FFF Young researchers programme (AT_28)
Belgium		
Cyprus		Greece-Cyprus Cooperation Programme (CY_21)
Denmark	Overall Strategic plan for development of trade	Industrial researcher-scheme (DK_5) Industrial Innovator Scheme (DK_15) Large Cross-disciplinary Research Groups (DK_14) Innovation Post Docs (DK_11)
Finland	Seen as important and reviewed	-Sponsored and invited professors from industry -Part time or adjunct professors -Dissertation work and exercises for companies
France	Government priority	Support for recruitment of researchers and R&D engineers (FR_3) Support for the recruitment of technicians on innovative projects (FR_6) Support for the recruitment of PhD candidates on an applied research project within an enterprise. CIFRE convention (FR_7) Support for the recruitment of post doctorates in SME's (FR_14) Technological Research Diploma (FR_30) Youth & Innovation (FR_31)
Germany	Shortage in high-qualified personnel in ICT sector, issue of personnel mobility to SMEs Policy debate focuses on education rather than mobility, mobility is a hot topic with	Grants for R&D in SMEs in Eastern Germany (DE_19) ProInno (DE_28) Innovation Assistant (run on a

	respect to immigration of high-qualified personnel	regional level by several Länder)
Greece	Trans-border mobility and in particular Greek graduate students abroad and diaspora of scientists is an issue	Programme for the Reinforcement of Research Manpower (GR_41) Programme for the Placement of Researchers from Abroad to the Greek R&T System (GR_44)
Ireland	Schemes discontinued, but demand exists	Fusion – Pilot scheme
Israel	Not a priority	
Italy	There is a scheme to promote the recruitment of graduates by SMEs	Employment in the field of research (IT_2)
Luxembourg	No current debate	Research training grants (LU_7)
Netherlands	Not a priority - mobility is only one part of technology transfer. A scheme merged into knowledge transfer scheme	Knowledge Transfer Entrepreneurs SMEs (NL_35)
Norway	Some statistics indicate a rather high mobility rate for people with a high formal education. New measures to secure the recruitment of new scientists in PSREs Concern for the lack of high quality expertise in the country – planning to make overseas recruitment easier	SME Competence (NO_14)
Portugal	increasing awareness of the need to promote people mobility	Integration of Doctors and Masters in Companies and Technology Centres (PT_22)
Spain	Essential Issue	IDE action (ES_2) and the Ramon y Cajal Programme (ES_25)
Sweden	Increased mobility an objective	Competence Centres Programme (SE_4) New Graduate Schools (SE_7) New liaison functions at the new Universities and University Colleges for cooperation with SMEs (SE_9)
United Kingdom	Part of wider concern for science-industry linkages	TCS (UK_18) Faraday partnerships (UK_19) CASE (UK_58)

4. Innovation Policy Mechanisms: Modalities and Targets

On the basis of a framework developed by the authors⁸ for the analysis of innovation policy measures more generally, it is possible to develop a taxonomy for innovation-oriented mobility schemes. According to this framework, measures can be examined in terms of two key characteristics: their modalities of operation and their targets.

⁸ M. Boden, J. Butler, P. Cunningham, A. Salazar *The European Innovation TREND CHART, Thematic Report: "Technology transfer" November 1999 – June 2000, July 2000*

4.1 Modality of Operation

The **Modality of Operation** is concerned with how measures are implemented, whether through the provision of direct financial and/or structural support, and through the generation and/or transfer of knowledge. The following table shows how the principal mechanisms for the provision of support relate to aspects of the innovation system.

Modality	Summary Description
<i>The Mobility of Personnel</i>	Mechanisms to encourage individuals to work, frequently on a temporary basis, within other organisations, with a resulting exchange of knowledge and information.
<i>Legal framework</i>	The laws and regulations bearing on innovation.
<i>Tax & Financial Incentives</i>	The provision of financial benefits to encourage innovative activity.
<i>Coordination & Transparency</i>	These relate to the ways in which innovation related policy measures are formulated and implemented, and the steps taken to improve efficiency and effectiveness, and clarity.
<i>Infrastructure Development</i>	Activities such as the establishment of dedicated intermediary organisations to facilitate technology transfer, and which complement other structural modalities.
<i>The Transfer & Exploitation of Research Results</i>	Mechanisms to diffuse and support the application of research in innovation.
<i>Information Diffusion</i>	Mechanisms aimed at more general awareness of scientific and technological opportunities, and of related support schemes.
<i>Demonstrator Projects</i>	A more direct mechanism to diffuse and promote the adoption of innovations.
<i>Networks & Clusters</i>	The establishment and development of inter-organisational pathways used in the transfer of knowledge.

4.2 Modalities of Mobility schemes

Applying this more general framework to the case of the mobility schemes recorded in Europe, the core modality of the schemes under consideration can be seen to be the transfer of individuals between organisations, with a resulting exchange of knowledge and information, either from the incoming individual or to that person. However, the variety of measures in evidence can be further analysed in terms of a number of key characteristics.

Level of Operation

The level at which the scheme operates relates both to the its targets (see below) and the contexts in which it is implemented. Context includes policy operation, in terms of the domain of influence of a policy measure, such as whether it promotes mobility on a national, regional, sectoral or even international level. It also relates to the organisational context of operation, and whether schemes operate at the level of individuals, specific projects, research groups or laboratories, their parent organisations, such as companies, government organisations and universities, and so forth.

The majority of mobility schemes currently in operation in Europe are operated at the level of the individual members of research organisations, including firms, university research groups and public research institutes.

There is a particular emphasis on SMEs, which are prioritised by five of the six measures reported for France, as well as the three German measures, and both the Irish measures. In Italy, the Netherlands, Sweden and the United Kingdom, there is also particular attention to SMEs. In all of these cases, the main aim is promote the recruitment of university graduates and researchers to improve the technological competence and research capabilities of SMEs.

In certain cases, all types of laboratories are included, promoting mobility in both directions between the public and private sector. In Cyprus this occurs under the auspices of the common programme for scientific and technological cooperation with Greece (CY_21). In Denmark the recruitment of post docs by research institutes is promoted (Innovation Post-doc Scheme, DK_11). In Germany, there is a scheme to promote the temporary exchange of researchers between all types of research organisation (ProInno, DE_28).

There is also limited promotion of personnel mobility towards universities. In Finland there are two schemes to sponsor university professors from industry.

The development of new research-intensive organisational entities also draws on personnel mobility to develop their expertise. In Sweden, the Competence Centres programme (SE_4) aims to strengthen university-industry links. This programme, which is just over halfway through its ten-year lifetime, currently involves 28 Competence Centres at 8 universities together with 250 industrial companies. These Competence Centres represent a new feature of the Swedish R&D system, enabling new forms of university-industry collaboration between academic researchers and personnel from industrial companies to be tested.

Among the measures reported, while the practical level of operation is at the level of the individual and the research organisation, in certain cases, the scope is defined. In Finland and Norway, regional research institutions are explicitly covered (Sponsored and invited professors from industry in Finland and the SME Competence Programme NO_14).

Numbers of Measures by Level of Operation

Individuals	13
Project	1
Universities	12
Government labs	11
SMEs	20
Large companies	10

Sectors	1
Regions	2
International	1

The nature of activity

While centred on the embodiment of knowledge and skills, or the potential to acquire them, transferring personnel between organisations is generally associated with specific innovation related activities. In the case of researcher mobility, it is generally to strengthen the host organisation's capabilities in conducting scientific and technical research, either in connection with specific projects or more generally. The transfer of personnel may also develop an organisation's experience in collaborative activities and augment its competence in managing research.

Both parties are likely to learn from the experience of mobility, whether or not this a stated objective of the measure, while certain measures may be specifically designed to develop the knowledge and skills of incoming personnel.

Among the measures reported, the majority recorded that the main activities conducted through the personnel mobility occurring under the measure, were either scientific and technical research and development or scientific co-operation. In the UK the measures recorded (UK_18 –TCS and STEP) were also seen to have training roles. In a few cases (eg Large Cross-disciplinary Research Groups DK_14 and Support for the recruitment of post doctorates in SME's FR_14), the management of research was included. This emphasis is reflected in the stated objectives of most of the measures reported: a large number saw the main aim as to strengthen industry and/or to carry out scientific and technological cooperation, while the promotion of dialogue and the supply of skilled employees were also commonly cited.

A distinction was drawn between the aims of the measures with respect to scientific co-operation, between developing new co-operation and improving the effectiveness of co-operation. The majority of measures aimed at developing co-operation, some aimed at both, and the rest at improving the effectiveness.

Numbers of Measures by Objectives and Activities

Objectives	
Strengthen industry (of which SME)	13 (8)
Strengthen science base	3
Mutually strengthen	4
Promote dialogue	6
Supply of skilled employees	7
Technology Transfer	2
S&T cooperation	9
Aim to develop cooperation	24
Aim to improve the effectiveness	10
Activities	

Scientific cooperation	13
Technological R&D	10
Management	5
Project	3
Training	3

The duration of mobility

Mobility schemes differ in terms of the duration of the time spent in the host organisation. This can vary from a short period in a few cases, where the mobile person is temporarily transferred to another organisation, such as in a postdoctoral research fellowship or an exchange programme, to permanent recruitment, particularly of qualified scientists and engineers from academia into industry.

The majority of measures in place make provision for permanent transfers of personnel, although there are exceptions. The training-oriented programmes mentioned above provide examples of temporary mobility, such as the duration of a PhD studentship under the UK Teaching Company Scheme [UK_18] and its French SME-oriented counterpart (FR_7, Support for the recruitment of PhD candidates on an applied research project within an enterprise) There are also a few exchange schemes, as in the case of Germany (DE_28, ProInno).

Funding of mobility

Funding is another important dimension of the ways in which mobility schemes are implemented. Funding may be provided directly to the host organisation to cover or subsidise the costs of employing new personnel. In other schemes, the mobile person may be paid directly by a scheme. In almost all of the current and recent schemes in Europe, funding is direct. In the Danish Large Interdisciplinary Research Groups measure (DK_14) the aim is to stimulate funding from the private sector. In the three Swedish measures, mobility is not directly funded, but encouraged under broader measures aimed at developing university based competence (Competence Centres Programme, SE_4, New Graduate Schools, SE_7, New liaison functions at the new Universities and University Colleges for cooperation with SMEs, SE_9).

Less direct funding is also possible, whereby schemes aim at providing the right conditions for mobility to occur or where intermediaries broker the transfer of personnel, bringing organisations and individuals together.

4.3 Targets of policy mechanisms

The *Targets* of policy mechanisms are the organisational types and levels at which policy mechanisms are aimed. These range from individual researchers, through institutions, to groups of related organisations, such as clusters, sectors and regions. More specifically, the following table shows how targets can be categorised.

Target	Comments
<i>Researchers & young scientists</i>	Individuals are the focus of specific mobility and training schemes.
<i>Universities, Research institutes, & RTOs</i>	Play key roles in the generation of new knowledge, the training of researchers, and in the launch of new technology based firms.
<i>SMEs</i>	A priority across the member states, requiring support for their innovative activities, both in the diffusion and absorption of new knowledge.
<i>Large Companies</i>	Conduct R&D and frequently play influential roles in particular sectors.
<i>Sectors</i>	Particularly those closely identifiable with specific technological priorities, embrace a range of organisation types, which can play complementary roles.
<i>Regions</i>	In a number of case, the targets of more general policy mechanisms, to which innovative activities may contribute.

4.4 Targets of Mobility schemes

As in the case of modalities, application of the general framework, it is possible to further categorise European mobility schemes in Europe. As the general framework indicated, the targets of mobility schemes are the individual researchers and other personnel that are the foci of the measure. A large number of these are scientifically and technically qualified personnel, be they graduates, doctoral graduates, post-doctoral researchers or researchers from other public sector or industrial laboratories. Less qualified and experienced personnel may be targeted as appropriate for training-related mobility schemes, while highly experienced personnel may also be of interest, such as in the reverse flow of experienced industrialists into senior university positions.

Targets of Measures	
Students	15
Graduates	7
University researchers	16
Civil servants	2
Industrial researchers	9
Industrial managers	3
SMEs	1
Firms	1

As the above table shows, students (particularly postgraduates) are the targets of many measures. Certain schemes use PhD studentships as a means both to develop research skills and for companies to acquire, albeit temporarily, research personnel, such as in the UK TCS and its like (eg France, FR_7 and Germany DE_28).

Other university personnel are also popular targets, although, the status of doctoral researchers varies across the member states. The small reverse flow from industry to academia has also been noted above, notably with the Finnish schemes to recruit industrial managers to university chairs. It should also be noted that such schemes may be more prevalent than reported, as they may be operated at the level of specific institutions rather than nationally. General mobility schemes, such as in the abovementioned schemes in Cyprus (CY_21) and Germany (DE_28) and Denmark (DK_14 Large Cross Disciplinary Research Groups) target researchers in all sectors.

4.5 Future trends and forthcoming measures

A number of new measures are foreseen and many develop on the measures currently in operation in a number of ways, extending their scope or coverage, simplifying their implementation or bringing them into alignment with other measures.

In **France** ANVAR have planned two new measures for 2001 in order to complete the portfolio of measures subsumed under measure FR_31 (Youth and innovation), namely (1) the creation of a regional prize for the best projects with marketing opportunities and (2) financial support of the most promising pre-project which clearly aspires to enterprise creation. Also, simplification and harmonization between different complementary measures is planned, particularly in France (FR_30, FR_6, FR_14).

In **Ireland**, as mentioned above the Fusion Programme is currently being piloted as a replacement for the old Techstart schemes and contains many elements of the United Kingdom's TCS.

In **Norway** the "Come in" (Competence-based immigration) measure has not yet been implemented, and aims to better facilitate the "import" of educated and experienced persons, mainly researchers from abroad, into both the public and private sectors. The aim is to strengthen the knowledge base of the economy and knowledge institutions

In **Portugal** a measure on promoting R&D in firms as well as on strengthening University-Industry technology transfer is about to be launched

In **Spain** the Government is preparing modifications of laws to facilitate the mobility of researchers from Public Research Institutions to industry. Also, a new measure with the same orientation of the earlier MIT action [ES_11] is pending to be published in the next months.

In **Sweden**, as mentioned earlier public agencies (e.g. VINNOVA) are currently contemplating schemes for promoting mobility and exchange of researchers. These concern the exchange of university researchers between universities and mobility from industry to universities of a temporal kind. It is hard to say when such schemes may be introduced.

4.6 Summary Table of all Measures Recorded

Country	Scheme	Target	Level of Operation	Objective	Activity
Austria	AT_19*	U, E	In, En	TT¶	CR
	AT_28*	U	In	MS¶	CR
Cyprus	CY_21*	U, C, I	RU	PST¶	Ex
Denmark	DK_5*	S	RU	D¶	CR
	DK_15*	S, R	En	SB, D, HR	CR
	DK_11*	S, R	En	D,HR¶	CR
	DK_14	U, R	I, En	SB, D§	CR, M
Finland	Sponsored Professors from Industry*	I, M	Un, En, Regions	MS, D§	
	Dissertation work & exercises for companies*	S	RU	HR, D, MS§	CR
	Part-Time Professors*	I, M	U En	HR, D, MS §	CR
France	FR_3*	R	SMEs	E¶	R, RTD
	FR_6*	E	SMEs	E§	RTD
	FR_7*	S	SMEs	SB¶	C, M
	FR_14*	P, G	SMEs	SMEs R&D¶	M
	FR_30*	G, I	SMEs	MS¶	R
	FR_31*	S	New Projects	DES§	NF
Germany	DE_19*	R, G	SMEs	SI¶	RTD
	DE_28*	U, I	SMEs, RU	SI¶	RTD
	Innovation Assistants*	G	SMES	SI	RTD
Greece	GR_41*	U	In	D	CR
	GR_44*	R	I	L¶	CR
Ireland	Techstart& Techman*	S, G, M	SMEs	TT¶§	RTD, M
Italy	IT_2*	G	In, SMEs PSREs	SI¶	RTD
Luxembourg	LU_7*	P, U	In	HR¶	F
Netherlands	NL_35*	G, U	SMEs	SI, TT¶	F, M
Norway	NO_14*	G, SMEs	En, RR	SI¶§	RTD, R
Portugal	PT_22*	P, U	En, TC	HR, UI¶§	RTD
Spain	ES_2*	U	In	SI¶	RTD
	ES_25*	U	In, Un	SB¶	C
Sweden	SE_4	U, I, PSREs	CC	UI¶	C, RTD, M
	SE_7	P	Un, En	UI¶	C
	SE_9	U, E, S SMEs	Un, SME	UI¶	C
United Kingdom	UK_18* TCS	P	In	TT¶	T, RTD
	UK_19*	S, U	All	MS, HR¶	RTD
	STEP*	S	In, SMEs	E¶	T
	CASE*	P	In	HR, UI¶	T

* = Directly Funded

Targets: U = University Researchers (including post doctoral researchers), S = Students, C = Civil Servants, I = Industrial Researchers, E= Engineers, R= Researchers, M = Industrial Managers, P =

PhD/Postgraduate Students, G = Graduates, SMEs = Small and Medium Sized Enterprises, PSREs = Public Sector Research Establishments.

Level of operation: In = Individual, En = Enterprise, Un = University, RU = Research Units (public and private), RR = Regional Research Institute, TC = Technical Centres, CC = Competence Centre

Objective: TT= Technology Transfer, MS = Mutual Strengthening, SB= Strengthening Science Base, D = Encouraging dialogue, HR = Improving Supply of Human Resources, E = Improving Employment, UI = Developing University Industry Links, SI = Strengthening Industry, DES = Developing Entrepreneurial Spirit, L= Links Overseas, ¶ = Developing Co-operation, § = Strengthening Cooperation

Activity: CR = Cooperative Research, Ex = Exchange Activities T = Training, RTD = Research and Technology Development, C = Collaboration, M = Management of Technology, R = Recruitment, NF = Set up of New Firm, F = Financing.

5. Good Practice

To move towards an assessment of the quality and success of the implemented measures reported, and the subsequent identification of “good practice” examples, the following three main indicators can be used:

- The *durability* of a measure, in terms of duration of its implementation (eg TCS);
- The *impact* of a measure, particularly in line with its stated objectives, as ascertained by a formal evaluation; and
- The *Transfer* of a measure to another context.

To supplement data on the measures current in use, information on the evaluation and transfer of measures was also collected.

5.1 Evaluated Measures

A number of relevant measures, some of which have been described above, have formed the subject of evaluations. The results of these studies have been mixed. The following table summarises the evaluations conducted and their key findings.

Country	Measure evaluated	Key Findings
<i>Denmark</i>	DK 5: ‘Industrial researcher-scheme’	Very positive - companies establish links with the university involved and increase their research and innovation effort. Has led to the introduction of new a scheme called ‘Industrial innovator scheme’ – DK 15.
<i>France</i>	FR 3: support for recruitment of researchers and R&D engineers	Amongst the recruitment sponsored by ANVAR in 1998, 23% of employees had PhDs, 14.3% university graduates, and 57.7 % engineers. From 1989 to 1998, the total sponsored recruitment exceeded 5,000 with 1,055 in 1998 (+ 65% versus 1997) The computer sector represent 30% of recruitment (+ 7% cf. 1997) and two regions (Ile de France and Rhones Alpes) represent 34% of the recruitment. The scheme has been periodically evaluated.

	FR 6: support for the recruitment of technicians on innovative projects (CORTECHS)	An evaluation of the mechanisms was requested by the Ministry of Research at the end of 1998 and shows a steady increase in the number of technicians hired during the first half of the 1990s, and subsequent relative stability.
	FR 7: support for the recruitment of PhD candidates on an applied research project within an enterprise. CIFRE convention	90% of recruited graduate engineers end up completing their PhD. According to recent surveys, 80% of enterprises claimed to have benefited from the scheme in terms of increased expertise in conducting in-house research projects.
<i>Germany</i>	Systems evaluation of all R&D programmes run by the BMWi	Does not focus on personnel mobility (DE_17 will be evaluated next year)
<i>Greece</i>		
<i>Ireland</i>	Various evaluations	Point to the value of such an approach, both to firms and graduates/managers. In the latter part of its life Techstart incorporated a number of lessons from the British Teaching Company Programme (TCS), in particular a much more defined research and technology approach and stronger links back to the base college/university.
<i>Netherlands</i>	The former mobility scheme, KIM (NL_06 - predecessor to NL_35) evaluated in 1998	The scheme was a huge success and well appreciated by SMEs. Results were that innovation projects were undertaken which would otherwise not have occurred. Measurement of success is that a majority of the graduates are given a permanent position and in some cases the graduates are seen as candidates to take over the firm after retirement of the owner. As a result of the evaluation EZ increased the annual budget allocated to KIM.
<i>Norway</i>	SME Competence (NO_14) medium term evaluation	A medium term evaluation ⁹ found that SME-C contributes to companies starting strategic development projects at an earlier stage. Companies also build up new competences through interactions with the programme organisation and the programme advisers. However, the evaluators believe that the overall objectives of the programme are too wide and unclear, as it is targeted towards company development, recruitment as well as the development of a good environment for innovation. It was felt that SME-C should be used for the development of an innovation environment, focused on the interaction between companies and colleges.
	The Mobility Program (1994-98) internal evaluation	concern about the low number of researchers leaving the institute sector - a society based on competence needs a free flow of knowledge Most of the objectives were achieved, although the evaluators argued that the Mobility Program did not

⁹ by the research institute Møreforskning

		contribute much to this improvement in mobility, as the total funding was too small.
Sweden	Competence Centres Programme - evaluated in 2000 ¹⁰	Commended for their efforts to recruit industrial researchers as Centre Directors Academic participants are undertaking tasks that previously often have been outside their sphere of activity. The involvement of industry in the Programme, both large corporations and SMEs, is intense and ranges from financial support and strategic planning to direct participation in projects. Cooperation in the Centres is in many cases commendably based on the insight that the participation in a Centre are of much larger value than the possible risks because some personal knowledge may have to be shared with others. ¹¹
	“New liaison functions at the new Universities and University Colleges for cooperation with SMEs”	shows that the project has increased the legitimacy for the university colleges to work with the “third mission”, i.e. to co-operate with surrounding society. ¹² Furthermore, the public support has made it easier for other actors to make financial efforts in regard to the “third mission” of Universities. The main focus of the evaluation was not on mobility. However, according to the evaluation the programme facilitated mobility. On the other hand, this mobility was regarded as a negative side effect in relation to the measure. Key persons may leave the university for a company and this was viewed as a risk.
UK	TCS	An economic study, part of an independent review of TCS, found that each £1 million of TCS support generates 58 net additional jobs; £3.6 million extra value added; £3.0 million of additional exports; £13.3 million extra turnover; £1.5 million of extra capital expenditure and £0.2 million of extra R&D expenditure. Estimated that each £1 million of Government support for TCS generates: 47 new jobs; £2.23 million of one-off increases in company profit; £2.5 million annual increases in profit; and £1.3 million investment in plant and machinery. (Figures based on final reports by company participants whose completed TCS programmes were assessed in 1997-98)

5.2 Examples of Transferred Measures and Good Practice

¹⁰ [1] *The Competence Centres Programme Second, Midterm, International Evaluation*, Vinnova Information VI 2001:5

¹¹[2] Ibid

¹² Inregia AB, 2001. *An evaluation of NUTEK och the KK-fundation project, Co-operation between university colleges and companies*. (NUTEK och KK-stiftelsen project Samverkan mellan högskolor och näringsliv – En halvtisutvärdering)

Certain measures have been transferred, some with appropriate modification, within and between countries. A number of these can be highlighted as possible examples of “good practice”.

The French “Support for the recruitment of PhD candidates” measure (FR_7) was extended to other European countries in 1994, through the establishment of the EUNET Network, with the collaboration of the European Commission. In 1997, three other countries joined the network.

The UK Teaching Company Scheme (UK_18) has provided a model for schemes developed in Germany, namely the Innovation Assistant programmes run by the Länder, and the Irish Techstart scheme.

6. Conclusions

It is clear that there is currently a large variety of schemes implemented across Europe, particularly in terms of the types of actors involved, with all types of public and private sector organisations involved. While there is clearly an emphasis on mobility from universities to industry, particularly the recruitment of researchers, this report has shown examples including the reverse flow.

However, there is also substantial convergence both on the underlying policy rationale for the use of mobility schemes, namely the transfer of innovation relevant knowledge via the inter-organisational movements of individuals, and on the objective of improving cooperation between industry and universities. A second line of convergence concerns the shared concern for SMEs and the use of mobility schemes to improve their innovative performance. There are, of course, more specific objectives related to the context of operation of schemes.

The impact of such schemes seems to be emerging, generally, as positive, with the majority of evaluations reporting schemes as successfully achieving their objectives. Common features of certain schemes do derive, explicitly from the transfer of elements of good practice between schemes, particularly as exemplified by the UK’s long running TCS (formerly the Teaching Company Scheme). Other commonalities reflect shared policy concerns and recognition of the role of the individual in knowledge transfer.

Both the diversity and commonality of approaches and contexts in mobility schemes throughout the EU Member States are important features of the European innovation scenery. The experience gained from these mobility schemes is invaluable in informing policy makers as to which features are useful and which less so – as evidenced by the accompanying evaluation activities and transfer examples. For this reason, the trend towards some degree of convergence between measures, in terms of the underlying policy rationale and towards meeting the objectives of improved industry-university cooperation and improving the “absorbency” of SMEs for technology and know-how, may be viewed both as a good thing (in that it may be used as evidence of a policy-

learning process) and a bad thing (in that it reduces the experience necessary for such learning).

7. Documents

Correspondents were asked to list examples of any specific studies or reports/documents produced on the theme of mobility. These are listed below.

7.1 Finland

Finnish national statistics show an overall increase in the mobility of highly educated personnel increased during the 1990s. During 1998 nearly one in four highly educated employees changed job (compared to 17% in 1992). The mobility of educated research personnel was slightly higher, being clearly highest in the ITC sector. (Statistics Finland 2001).

According to the latest survey on the significance of measures aimed at increasing personnel mobility between industry and science, the most significant factors have been long-term relations between companies and universities in graduate mobility, co-operation in graduate education between universities and industry (e.g. joint supervision of doctoral and master's theses), and co-ordinating structures for considering the requirements of industry in university education programmes. Additionally, many doctoral and master's theses have been funded by industry in Finland.

However, according to the respondents in the private sector, the mobility of researchers is presently "not effective". Besides a lack of effective programmes for the promotion of mobility, the major limiting factor was said to be disparity in earnings. Although the respondents from the science sector mentioned that mechanisms for research mobility are under active development in universities, mobility was thought to be, at present, a rather uncommon way of collaborating with industry. (Kangaspunta 2001).

7.2 France

Within the website of the Education Ministry and the Research Ministry to the Directorate of Technology, one can find the description of the main measures implemented in France, in order to support the insertion in the economic life of young graduates: PhD, Engineers, Technicians. The assumption is that this insertion is one of the priority of the government. For more details, see:

www.education.gouv.fr/technologie/brochure/default.htm

or

www.recherche.gouv.fr/technologie/mesur/aides/drt.htm.

A document published by ANVAR is dedicated to "young, schools and enterprises" and describes 8 projects helped by ANVAR, and gives helpful links to find information on the subject. See www.anvar.fr "Le Courrier de l'Anvar" - issue n°128 - November 2000.

7.3 Germany

Schmoch, U., G. Licht, M. Reinhard (2000): Wissens- und Technologietransfer in Deutschland (Knowledge and Technology Transfer in Germany), Stuttgart: Fraunhofer-IRB-Verlag (available in German only, includes estimations on personnel mobility from public science to the enterprise sector)

7.4 Ireland

A number of formal and informal evaluations have been carried out, all of them indicating a high level of use and approval by SMEs. One of the pointers in this regard has been a relatively high retention rate (between 70% and 80%).

7.5 Luxembourg

The National Research, Development and Innovation Plan (2000-2003) document and the Workprogramme 2000 of National Research, Development and Innovation Plan presented the relevant points of the policy innovation related to this topics.

7.6 Norway

The OECD has recently finished a larger study of mobility under the responsibility of the Directorate of Science, technology and Industry/ The Working Group for Innovation and Technology Policy (*Innovative People: Mobility of Skilled Personnel in National Innovation Systems, OECD 2001*).

The work of the Focus Group on human mobility began in 1997, in Phase II of the OECD's work on national innovation systems (NIS). In the beginning, only the Nordic countries participated in the Focus Group, due to the availability of register data in these countries. In Phase III, it was decided to enlarge the Focus Group, but non-Nordic countries are not in the majority. This expansion underlines the growing interest in human mobility issues.

7.7 Portugal

A study on the subject is currently under preparation by INETI (Instituto Nacional de Engenharia e Tecnologia Industrial).

7.8 Sweden

One study (Formal Competencies in the Innovation Systems of the Nordic Countries, STEP report 1998 R-06) of the volume and character of mobility has been carried out. This is not a study of the impact of public measures on mobility. The mobility between 1994 and 1995 of employees with at least 3 years of higher education from HEI and

research institutes to other sectors of society was studied in the middle of the 1990s¹³. It examined how highly educated workers change jobs across sectoral boundaries. The method used identified the more highly educated employees in 1994 in HEIs and R&D institutes and then identified the employers of these individuals in 1995. Thus HEIs and research institutes are seen as delivering sectors. The study showed that internal flows were important, i.e. mobility within a sector. This is especially true for the mobility of HEI employees. The mobility flow rates from HEIs and R&D institutes were high, i.e. almost 25% of the employees in 1994 had moved out within a year.

Flows of employees concentrate around the higher education sector, due to its larger size compared to the R&D institutes. The dominant links for institutions of higher education are with the public sector, and account for 24 % of those leaving HEIs. R&D institutes also receive a large number of employees from HEIs, however this is a strongly asymmetric relationship as the flow in the opposite direction is very limited.

The flows to the goods producing sector (manufacturing) does not involve a large contribution from HEIs and R&D institutes, though in relative terms these links are far more important for the R&D institutes than for higher education institutions. One third of those leaving R&D institutes move to manufacturing industries, whereas only 8% of those leaving higher education institutions find new work there.

The net flow of persons with higher education qualifications move out of HEIs and R&D institutes to goods producing sectors and private services. The net flow is in the opposite direction for the public sector.

Within the aggregate group of private services, the subgroup ‘business services’ plays an important role as a recipient of personnel from R&D institutes. This link is stronger from R&D institutes than from institutions of higher education. However, it accounts for less than half the share of persons moving out of R&D institutes compared to the link with manufacturing.

To characterize the “degree of openness” towards sectors outside the HEIs and R&D institutes themselves, one can simply calculate the difference between total mobility and the share of persons changing jobs within these organisations. This reveals R&D institutes to be substantially more interactive with other sectors of the economy than institutions of higher education. In the latter case, around 50% of those leaving a position at an HEI change to another job in the same sector or to one in an R&D institutes. For those leaving a job in an R&D institute, the same share is only about 20%, meaning that these employees carry their expertise to a wider share of the economy. In addition, there is a somewhat higher mobility rate out of R&D institutes than from HEIs. In numerical terms, however, HEI departments are more important as they are larger, and consequently disseminate and receive greater numbers of highly educated workers. This is very clear, since HEIs are about 7.5 times larger than R&D institutes in terms of personnel with higher education qualifications.

¹³ Formal competencies in the innovation systems of the Nordic countries: an analysis based on register data. 1998.

A similar study of employees (and various subgroups) mobility rates over time (1988-.1998) in the Nordic countries is underway.

7.9 UK

None known on the specific topic of mobility although such schemes are dealt with in the context of broader HEI-university links in the report: Howells, J., Nedeva, M. and Georghiou, L. Industry-Academic Links in the UK, Higher Education Funding Council for England, HEFCE Ref: 98/70, December 1998.

Also relevant, in this general context, is: Research Partnerships between Industry and Universities, 1997, A guide to better practice produced by AURIL in collaboration with CBI and sponsored by DTI

Annex: Structure for TREND CHART Priorities and sub-themes

I. Fostering an Innovation Culture
I.1. Education and initial and further training
I.2. Mobility of students, research workers and teachers
I.3. Raising the awareness of the larger public and involving those concerned
I.4. Fostering innovative organisational and management practices in enterprises
I.5. Public authorities and support to innovation policy-makers
I.6. Promotion of clustering and co-operation for innovation
II. Establishing a Framework conducive to Innovation
II.1. Competition
II.2.* Protection of intellectual and industrial property
II.3 Administrative simplification
II.4. Amelioration of legal and regulatory environments
II.5.* Innovation financing
II.6. Taxation
III. Gearing Research to Innovation
III.1. Strategic vision of research and development
III.2. Strengthening research carried out by companies
III.3.* Start-up of technology-based companies
III.4.* Intensified co-operation between research, universities and companies
III.5. Strengthening the ability of companies, particularly SMEs, to absorb technologies and know-how

(*- measures in these categories relate largely to the four focus/priority areas of IPR, Innovation Financing, Creation of NTBFs, and research-industry technology transfer.)

Explanatory Notes

It is recognised that, as with any classification scheme, the following is far from perfect. However, although there will be some exceptions, the following notes should assist in allocating measures to one or two sub-themes according to their primary characteristics. Any measures which could be classed as “multi-dimensional innovation packages”, that is, measures that address a number of innovation objectives in terms of their targets and/or modes of action should have this characteristic highlighted in the Template “nature and main goals” section.

I. Fostering an Innovation Culture: Promotion of the benefits of innovation. Includes measures stimulating creativity, initiative and enterprise, calculated risk-taking, acceptance of social, geographical and professional mobility; Development of skills, including those dealing with information collection and processing and personal and social communication skills; Developing the ability to anticipate needs and improve organisational capabilities; Improving awareness dissemination and strengthening co-operation to transfer skills and experiences.	
I.1	Specifically this deals with education and initial and further training in the context of skills acquisition which may be relevant to enhancing the innovative capability of individuals, including technical training, vocational studies, etc. Broadly, it includes actions which “concentrate on imparting the skills that are needed to produce and implement innovation”. Lifelong learning should be included as should the acquisition of “a basic educational grounding which is essential to facilitate ongoing adaptation to the new skills that innovation requires”. Distance learning and multimedia should not be neglected. However, all activities in this category are external to the firm environment. Measures affecting

	the innovative capacity of firms are dealt with under I.4
I.2	This covers the mobility of students, research workers, engineers or scientists from one country or industrial sector to another, and from education or research to industry, which has the effect of encouraging the transfer of technology and the dissemination of know-how.
I.3	Innovation can develop and spread only if it is accepted by society. Actions here reflect the stimulation of public awareness and acceptance of science and technology, the stimulation of consumer demand for technological novelty, innovation in forms of social organisation and communication, and measures which affect the attitudes, values and positions of the social groups involved towards aspects of innovation.
I.4	This is, of necessity, a broad category. Innovation is primarily the responsibility of enterprises, and managing change is one of the main challenges with which they have to cope. Actions under this category range from promoting the ability of enterprises to: keep abreast of changes in markets and techniques and the related methods of design, production and organisation; stimulate the absorption of new techniques and know-how; modernise their structure and organisation, and reshape methods, roles and responsibilities; develop technological, economic and business “watch” capabilities; develop their human capital (training within the firm); and adopt benchmarking and the spread of “best practice” (both technical and managerial). It also includes the provision of technical, commercial and managerial advisory services.
I.5	Includes measures aimed at informing and raising the awareness of the importance of innovation and technology to politicians, senior officials, regional authorities, project and fund managers; improving performance and spreading innovation in the public sector and in government; promoting more active competition in the case of public invitations to tender; monitoring and analysis of innovation processes, results and impacts at the socio-economic level; comparative studies of innovation systems, policies and infrastructure. Actions encouraging the exchange of information and experience among the Member States and those stimulating the development of harmonised statistical information systems, including regular surveys on innovation in industry, services and SMEs, are also covered.
I.6	Actions dealing with intra-sectoral co-operation and collaboration. Includes aspects of promoting the dissemination of best practice, “cluster” and network development, measures facilitating the activities of trade organisations, development of sectoral information databases, etc.
II. Establishing a Framework conducive to Innovation: Permitting innovation to flourish and grow. Allowing co-operation to operate correctly; the effective and economical protection of intellectual property; reducing the burdens to enterprises whilst maintaining consumer safeguards; allowing access to funding and easing financial constraints to innovation.	
II.1	Involves measures designed to stimulate competition - one of the driving forces behind innovation. Measures covered include those designed to combat monopolies and to open and liberalise markets and those aimed at the deregulation of protected or compartmentalised sectors. Also covers measures which ensure transfer of technology and the exploitation of patents without undue distortion of competition; and harmonisation of the treatment of joint enterprises.
II.2	Covers harmonisation of intellectual property protection systems; reducing complexity and costs associated with patenting and the maintenance of patents; hastening the formulation and adoption of standardised patent criteria and rules of legal protection; exchange of IP best practice; dissemination of awareness and information on IP protection and patents; support for legal costs of cases of patent infringement.
II.3	Excessive bureaucratisation and administrative overheads are recognised as potential barriers to innovation. This category covers measures designed to streamline administrative practices and may include the provision of on-line application processes, specialised help-line or advisory services, “one-stop shops”, simplification or transparency of eligibility conditions, simplified payment procedures, streamlined tendering procedures, etc.
II.4	This includes a broad range of measures including: modifications to Company Law; adoption and amendment of regulations and standards; promotion of performance standards and voluntary agreements; promotion of standards awareness and dissemination of information; harmonisation and streamlining of the legal environment; lifting of restrictions on the creation of new types of businesses and enterprises. Could also cover measures on the impact of legal and regulatory frameworks on innovation performance.
II.5	Provision of finance for innovation activities. Includes measures designed to deliver, or stimulate the delivery, of financial support for innovation, including: mobilisation of private capital, equity finance, venture and risk capital; promotion of investment into RTD; creation of guarantee mechanisms; operation of stock markets, especially for growth enterprises; dissemination of information; development of specialist training; provision of advice; schemes to disseminate best practice and experience.
II.6	Covers all aspects of the fiscal treatment of innovation, not only direct measures such as R&D tax credits but also indirect taxes, social security measures, etc.

III. Gearing Research to Innovation: Improving the way in which the fruits of research are transformed into products, processes, services and, hence, contribute to competitive advantage and societal good. Includes strategic planning of innovation policies, support for the RTD process, identification of spin-offs and creation of new innovating firms, and stimulation of co-operation between the public, private and education sectors	
III.1	Covers initiatives aimed at developing long-term strategic approaches to research and its applications, particularly those targeted more closely at growth sectors of the market (including services) and at relevant gaps in national markets. Examples include initiatives such as “Foresight”, “Key Technologies” and “Delphi”. Similar measures which foster broad-based discussion of potential technology options, generate industry/research/public-sector/training/financing and other networks and initiate interdisciplinary and inter-sectoral thinking are also covered.
III.2	Broadly involves measures designed to encourage and strengthen the performance of research within industry. This might involve schemes which involve: the participation of industry in the definition of national research projects; increasing the contract activities of universities and research institutes for industry customers; promoting industry participation in collaborative schemes such as EUREKA; direct and indirect institutional mechanisms.
III.3	Actions for encouraging researchers and engineers to start up technology-based companies, within universities (“incubators” and “campus companies”), science parks or as spin-offs from larger firms. This will also embody aspects of measures for facilitating the spread of such practice (covering IPR, social rights, financial arrangements, administrative and legal simplification, etc.) and promotion schemes. Actions could also deal with the dissemination of best practice through pilot projects involving, for example, university technology-transfer departments and, the regional institutions concerned (e.g. local authorities, chambers of commerce), risk capital companies and technology brokers.
III.4	Includes actions which aim to promote the dissemination of knowledge between research institutions, universities and companies. This may cover the development of closer links between research and training (anticipating the needs of the productive sector); facilitating university company start-ups, legal and contractual arrangements between universities and public research organisations for the exploitation of results with industry; demonstrator projects; co-financing schemes and awards for academic/industrial research co-operation; stimulation of dialogue between the producers and users of technology (such as sectoral and inter-sectoral forums, technology clubs, etc.); creation and growth of science and technology parks, etc.
III.5	This category may be distinguished from I.4 above in that it deals specifically with those measures which aim to improve the ability of SMEs to undertake innovation activities, particularly those at the research end of the innovation continuum. Such measures would include those designed to improve firms’ access to new technologies, new techniques, etc. Examples could include direct R&D grants, collaborative schemes and training in research.