Innovative People

MOBILITY OF SKILLED PERSONNEL
IN NATIONAL INNOVATION SYSTEMS

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Chapter 20

HUMAN RESOURCES: THE STATE OF KNOWLEDGE AND POLICY CHALLENGES

by

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Policy transitions, capabilities and the systems concept

We are currently going through a period of policy transition, with policy makers seeking to reorient the objectives and instruments of policy to reflect the increasingly sharp awareness of knowledge creation and learning as drivers of innovation, growth, employment and wealth. Many of today's policy considerations stem from new findings coming out of innovation analysis – findings that challenge some of the key elements of past policy thinking. One widely recognised conclusion is that innovation performance depends, at the levels of firms, industries and countries, on the development and organisation of skills and capabilities. Innovation is not simply a process of converting R&D and other inputs into new products. Rather it is a complex process, unfolding through time, in which capabilities are produced and integrated, and through which learning occurs and knowledge is created. Innovation means novelty, and thus implies learning – but learning rests on human capabilities and interactions. Education, training and the acquisition of skills by the workforce are thus central to innovation performance and growth. This, in turn, places the development and mobility of human resources at the very heart of the growth process.

A second important result of recent innovation studies, and one which is strongly reflected in the other themes of this OECD NIS project, is that innovation is a collective phenomenon. The reason for this seems to be that the learning processes and knowledge bases required for innovation are extremely, and will probably become increasingly, complex. The knowledge resources required for innovation often extend beyond the boundaries of the innovating firm, calling for interaction with other agents – suppliers and customers, knowledge institutions, regulatory agencies, and so on. It is this complexity that imparts a systemic character to innovation processes, and that underlies the concepts of "innovation systems" explored in this project. Therefore, the emphasis on capabilities needs to be extended to include how people interact with each other across institutional boundaries and how they flow into and across occupations and sectors. From this perspective, the labour market is not simply a price-setting mechanism to adjust supply and demand, it also distributes skills and capabilities. Its operation is central to how the specific institutional structure of an economy operates, and to any economy's ability to respond either to shocks or to technological opportunities.

These kinds of insights – concerning complexity, collectivity, and so on – into the innovation and growth processes often raise more questions than they answer. They certainly raise problems for

policy makers, if only because they imply that a good understanding of the innovation performance of any sector or economy calls for new forms of knowledge. These tend to be forms of knowledge which we either do not possess, or which we possess in a rather fragmented way. For example, understanding capabilities – and hence understanding where policy intervention might be appropriate – may require a comprehensive understanding of industrial structures, inter-firm linkages and clustering, patterns of technological collaboration, levels and compositions of infrastructure provision, education provision and attainments, and labour force mobility patterns. This is a very demanding agenda, and the empirical study of such phenomena within an integrated systems framework has really only just begun. The goal of the OECD NIS project, in general, and of the present study of human resources and mobility, in particular, is to contribute to this enhanced policy understanding.

A new field of study

The study of the mobility of human resources (HR), particularly from a systemic perspective, is still in its early stage of development. The basic reason for this is not that the importance of the phenomenon of human resource mobility has not been recognised, but rather the lack of availability of data. It is only since the mid-1990s that data enabling the study of HR mobility have become available. From 1992, a significant proportion (although by no means all) of the European countries included the so-called retrospective questions into their Labour Force Survey (LFS). Unfortunately, there is still no detailed harmonisation of these questions. In the Nordic countries, register data became available for researchers in the mid-1990s.[1] It is a reflection of this that the first comparative pilot studies using, respectively, the Community LFS and Nordic register data were both published in 1998 (Åkerblom 1998; Nås *et al.*, 1998). Another indicator of how new this is as a field of study is that in Phase II of the NIS work, only the Nordic countries participated in the focus group on human resources. Only in Phase III – which ran from December 1999 to December 2000 – did other OECD countries join the focus group. Links with related fields of study such as "job creation and destruction" and general labour market issues still remain too weak.

Since data have only recently become available, HR mobility research remains preliminary; we are only in the phase of making data comparable by harmonising definitions and variables. In fact, we are still in an early phase even in terms of establishing the most important stylised facts about mobility. Consequently, there are very few attempts to link mobility rates to other innovation data or even accounting data. Even when this becomes possible, high-quality data and carefully designed studies will be needed to isolate the effect of HR mobility as a mechanism of knowledge diffusion.

As will be discussed in more detail below, the LFS is of limited value as a data source for HR mobility studies. One of the most important conclusions of our work is that the future belongs to register data. In the new digitised "information" society, register data are increasingly becoming a requisite for efficient public and private delivery of services such as social security benefits and Internet banking. There is a growing need for unique and stable identification of individuals and firms over time. The first non-Nordic HR mobility study based on Belgian social security registers is presented in this volume of papers. However, currently, for both historical and political reasons, register data are only available in a few countries. We believe that this situation will change.

Domestic mobility

What do we know about mobility? In the previous phase of the focus group's work, mobility rates were produced for the Nordic countries *between two years* using different breakdowns. The results pointed to *out-of-job mobility* rates in the range of 20%-25%. The rates were highest for

Finland, followed by Sweden, Denmark and, finally, Norway. The high rates in Finland can be explained by the restructuring of the Finnish economy which took place during the severe economic crisis of the early 1990s, partly caused by the implosion of the Russian market. Sweden also experienced more turbulent economic development in the 1990s than did Norway. However, any attempt to rank countries in terms of mobility rates shows how careful one must be. In fact, Denmark had the highest overall out-of-job mobility, at 27%, while Finland had 23%; but if one looks at the educational sub-groups, then the Finnish rates are higher. It is likely that the high overall rate in Denmark is caused by higher mobility of people in the 16-25 age group (which includes many people who have not yet completed their education). When mobility rates were produced for Belgium, the numbers were similar to those obtained for the Nordic countries; however, since the Belgian data cover only a sub-set of the "Canberra" HRST population, the numbers are not strictly comparable.

Comparing mobility rates over countries between *two years only* has its dangers. In Phase III of the NIS project, mobility rates were produced for the Nordic countries covering a whole decade. The results strengthened the hypothesis that Denmark's high overall out-of-job mobility (27%) was caused by higher youth mobility. Further, it showed that the business cycle plays an important role, since mobility rates differ by several percentage points over the cycle. In the Finnish case, the difference was almost ten percentage points from the bottom to the top of the cycle.

In addition, one has to take into consideration the effects of business demography. That is to say, the statistical rules used to count firms, how to treat ownership changes, change of location, major changes in what is produced, etc. From a HR mobility point of view, identification numbers need to be attached to the workplace, *i.e.* to the establishment. Since such has not been the rule, both Denmark and Finland have "corrected" the identification numbers in cases where a major share of the employees was observed at two different numbers in two consecutive years. This lowers the mobility rates. Since this has not been done in the Norwegian and Swedish case, the "real" differences are probably even larger. However, this may not be so – because the routines for managing the firm identification numbers might not have been the same. The importance of the routines for firm identification numbers, *i.e.* business demography, is most visibly demonstrated by the Norwegian case. Between 1986 and 1994, the mobility rates are "well-behaved". In 1995, a new system of firm identification numbers was introduced. At the same time, the routines for checking where people worked were weakened. As a result, the Norwegian rates began to fluctuate wildly – with variations of up to ten percentage points from one year to the next – although there is absolutely no reason to believe that Norwegian employees radically changed their employment habits.

The implication of this is that we are still at a stage of HR research where policy attention needs to be focused on the basic data. Serious data quality and measurement problems persist, to such a degree that when the numbers do not conform to our intuitions, we must check that this is not due to some statistical artefact. In addition, we should be careful not to base conclusions or rankings on differences of a percentage point or two, since variations in registration routines, in the treatment of firms with missing NACE codes, and all the minor deficiencies that are to be found in every data set, might be able to explain the differences.

Mobility rates based on Labour Force Surveys

The Labour Force Survey is the data source for all of the European countries. The LFS has long national traditions, and as a result of co-operation in Eurostat, there has been a greater harmonisation of national Labour Force Surveys. The results from the national LFS are merged into a database – the Community Labour Force Survey (CLFS). Mobility rates calculated on the basis of the CLFS are mostly in the 4%–10% range, *i.e.* they are markedly lower than those from Nordic register data. This

poses the question of whether we are seeing real differences in mobility or statistical artefacts. There are clear indications that the latter is the case. If one compares the CLFS rates for the Nordic countries and Belgium with the rates obtained from register data for the same countries, the Nordic countries are among those countries with the highest rates, often above 10%. Belgium, on the other hand, is in the 6%-9% range. There is thus a 5%-10% difference between the CLFS rates and the register rates. The difference is least for Norway at less than five percentage points. In the Norwegian case, calculations on the Norwegian LFS show mobility rates close to those based on register data (with the LFS rates a percentage or two point higher than the register data).

Turning to the country with the highest mobility according to the CLFS, namely Spain, with rates of around 12% for men and 16%-17% for women, our Spanish colleagues are sceptical of the numbers obtained. Their hypothesis is that the data do not represent real mobility but rather reflect the widespread use of temporary contracts in Spain. They argue that the sharp drop in the Spanish figures between 1998 and 1999 when the mobility rates halved is the result of measures taken by the authorities to reduce the use of temporary contracts. At the other end of the spectrum, Italy has mobility rates in the 2.5%–4.5% range. It is not easy to find another obvious reason why Italy and Spain should be so different in terms of HR mobility.

The fact that significantly different results are obtained from different data sources leads one to conclude that firm policy conclusions cannot be based on these numbers. More detailed research will be needed in order to pinpoint the causes for the differences in level between rates based on register data and rates based on CLFS and national LFS. Work to date has only served to highlight the problems.

Some core results

Keeping in mind the above caveats about data quality and reliability, the following stylised facts emerge:

- *There are marked differences between men and women, with female mobility being higher than male.* This is not the case everywhere: in Poland, the Czech Republic, Hungary and Estonia, HRST mobility rates are higher among males than among females. Why this is so is not an easy question to answer. One has to keep in mind that we are talking about job-to-job mobility, so that maternity leaves, women taking care of small children, and so on, should not influence the rates. One hypothesis might be that men are more likely to be in management positions that by their nature make it more important to be less mobile.

- *Mobility declines with age.* A very clear result is that the mobility is very high for persons under 25 years of age, with rates typically in the range of 30%-40%, and in some cases up to 50%. Mobility declines steadily with age: people aged between 35 and 55 have mobility rates of under 10%. It is very important to keep this in mind when comparing, for example, overall rates for the whole economy with specific educational groups, especially those with higher education; there will be a strong age bias in addition to the pure education effect. From a knowledge accumulation point of view, it is not obvious that the very high mobility rate among 16-25 year olds is necessarily a good thing. Certainly, there is a strong element of searching with the aim to test and validate occupational preferences, as well as creating a broader occupational experience. However, more stable employment might lead to greater knowledge accumulation and consequently reduce training costs for firms.

- *Mobility rates are pro-cyclical.* There is clear evidence from the Nordic countries that mobility rates are influenced by the business cycle (whether measured by the unemployment rate or by GDP growth over the period 1985–97). The LFS results only cover the period 1992-97, but they do point to a generally rising tendency over this period, which corresponds to the economic cycle. The basic reason for this is that people tend to cling to their jobs during a downturn, while an up-turn unleashes a pent-up need in the economy for reallocating human resources to expanding sectors.

- *The highly skilled are more mobile.* Results to date indicate that mobility rates for highly qualified persons whose skills are in high demand, are higher and more stable over the business cycle. The highly skilled are not "disciplined" by unemployment to the same degree as the average employee.

Is there a relationship between mobility rates and growth? Regrettably, we do not have reliable data to answer that question. Isolating the contribution of a specific factor or market mechanism to economic growth is, of course, very difficult, since there are no cases where everything else remains constant with the exception of the mobility rate. On the other hand, since the reallocation of human resources is important for economic restructuring – a prerequisite for economic growth, growth is likely to be incompatible with very low mobility. Looking at growth indicators such as multifactor productivity, one would expect to find a correlation between mobility rates and such indicators.

International mobility

Data from the United States show the special position of that country as the main receiving country for highly educated personnel. Although the United States faces tough competition from other countries for highly skilled human capital, data show that the tendency for PhDs to stay (and thus reduce circulation) is increasing.

It is a well-documented fact that foreigners and foreign-born constitute a non-negligible part of the US HRST workforce in key sectors of the economy, indicating that the United States benefits by employing people who were educated abroad, using their best years. However, in most cases, the rate of return to the home country is unknown, so the question of whether the international mobility of HRST is characterised by brain drain or brain circulation cannot be answered – and, in general, probably depends on the sending country. In any event, the United States is clearly a pole of attraction for people from all walks of life – including the highly skilled. This is not a new phenomenon, and has been going on for over 200 years.

Some economies are more open than others in terms of the stock of foreigners and mobility into and out of these countries. For example, France does not suffer from a brain drain as there is only a small outflow of highly educated personnel. However, the share of foreigners in France is low, at around 3% of professionals, corresponding to a low level of inflows. The United States is at the other end of the continuum, enjoying a high 50% share of foreign-born in the population of the highly skilled. Hence, national innovation systems differ greatly in their openness to new ideas and knowledge from other countries, and thus to the extent that they are able to benefit from the worldwide formation of human capital.

The role of HRST migration between other countries cannot be measured since there is no systematic registration of immigrants' education levels; however, partial evidence indicates that HRST mobility is fairly low. This is as expected since between countries with roughly equal living conditions, the push and pull forces are weaker. However, the large differences in the patterns of

international mobility are linked not only to differences in living conditions, but also to differences in career opportunities for selected groups of personnel.

A related issue in a systemic perspective is that of integration. Human beings are carriers of knowledge, but it is difficult to assess this knowledge on the individual level. Its value is fully realised when it is integrated with complementary components of knowledge, such as colleagues, regions and countries with similar cultures, etc. Hence, the real impact on knowledge transfer cannot be understood only in terms of mobility patterns as such, but rather depend on how and to what extent mobile workers are integrated in their host organisations, their new host countries, etc. English-speaking countries have a clear advantage in this integration process. Small and medium-sized firms may face problems in recruiting highly skilled personnel: the low levels of skills and education existing in the firm make the integration of highly skilled personnel more difficult, and such personnel often become mere "tokens" of their group rather than a knowledge asset. A case in point here is the recruitment of foreign-born scientists to UK universities. This is very unevenly distributed to the benefit of the larger, well-known and internationalised universities such as Cambridge and Oxford. This situation can lead to self-reinforcing mechanisms caused by imperfect knowledge of the scientific qualities of other, less famous, universities in the United Kingdom.

Mobility, labour markets and innovation systems

Mobility matters, and is key to the adjustment processes in any economy. The importance of mobility rates lies in their value as indicators. Mobility rates below 5% might be an indication that labour markets do not function well in terms of knowledge diffusion. Mobility rates of over 30% for highly trained software engineers have as a consequence that teamwork is disrupted, key personnel leave projects before they are finished, and so on. However, we should not automatically assume that high mobility is only for the good. For firms, it is rational to bid up wages to obtain scarce human resources, while for individuals, it is rational to accept substantial wage increases. However, the macroeconomic effect might be wages rising much faster than productivity, software projects being delayed because of too high turnover of key personnel and, of course, increasing transaction costs in general.

If mobility rates are seen as an indicator of economic transition, the high rates of Finland are to be expected. In the case of the Czech Republic and Hungary, the rates are not very high. This might indicate that the needed restructuring of the economy will take longer than many would have anticipated.

In the same vein, one would expect to find very low mobility rates among tenured university personnel. However, this is only the case when all other knowledge diffusion mechanisms function properly. Among those groups of academics with higher mobility (well-known examples are ITC and law), the "drain" away from the university could hamper the creation of new knowledge in the long and medium term. These examples illustrate that mobility rates are just an indicator that should be seen in its proper context – and we argue that the systemic approach is helpful in this respect.

Mobility, as studied in this volume, implies that knowledge flows are defined as the mobility of individuals with certain characteristics. From an innovation point of view, the mobility of groups of people – of knowledge milieus – might be just as important. Anecdotal evidence points to the fact that new technologies are often new combinations of known technologies. This presupposes close co-operation between different fields of applied science and engineering. Large firms often acquire knowledge by buying smaller, knowledge-intensive firms. Processes such as buy-outs, mergers and spin-offs are a natural part of firm demography.

Mobility of human resources – important as it is – must be analysed in relation to the broader patterns of interactions among firms, sectors, institutions and countries. It is no coincidence that the inflow of human capital to, for example, the United States, is associated with very high inflows of financial capital. Networking among firms often covers a broader pattern of interactive mechanisms; this is one of the findings of the focus group on innovative networks (OECD, 2001). Firms in networking relationships, *e.g.* in product development, engage in complementary interactions, such as exchange of personnel, exchange of prototypes and electronic interactions, thus generating a broader basis for knowledge flows in which human mobility, even of a temporary nature, plays an important role.

A crucial issue in the systems approach relates to institutions and institutional structures. Labour market and educational institutions – central as they are to the performance of innovation systems – vary markedly across countries. In the Nordic countries, for example, mobility between the research sectors and other sectors is quite diverse, but is related to the institutional set-up of the knowledge institutions as well as to national industrial structures. Comparative mobility indicators tell only part of the story. Further, the learning capabilities of innovation systems are based on domestic labour markets and the flows within them. Firms may generate and accumulate stocks of knowledge through advanced organisational and managerial practices (although these mechanisms are not explored in this volume). However, high levels of dynamism and interaction *within* organisations may be able to substitute for lower levels of mobility *among* organisations. The main issue for innovation systems is to ensure the continuous growth or expansion of knowledge. In cases where the flows of knowledge stagnate, enhanced mobility may play a "releasing role", enabling innovation systems to avoid lock-ins and stimulating them to generate new combinations of outputs with greater economic value.

Policy challenges

The challenge of enhancing the analysis of mobility and its role in innovation processes is closely linked to improving data and data collection methods. In this section, some important implications for policy are discussed.

The limitations of LFS in mobility studies

The LFS was not designed for studies of mobility and there are very clear limitations to its use. The basic problem is that of sample size – in short, there are too few observations to enable reliable estimates to be obtained for sub-groups. The LFS samples cover only 0.5%-1.5% of the population. This means that it is not possible to obtain mobility rates at the two-digit NACE level – there are too few observations in each sector. The estimate of the number of people working, for example, in the research sector varies considerably according to the LFS – even though we know from other sources that employment in the research sector is stable, and in most countries is growing slowly, but steadily. This problem is compounded when we look at a sub-group in each two-digit NACE sector; for example, the number of highly educated personnel, the number of mobile persons, and combinations of such characteristics. Since the estimates both for the number of mobile persons and the total number of employees are unreliable, the mobility rate of researchers (NACE code 73) cannot be calculated with any degree of reliability on the basis of the LFS.

With the present sample sizes, the LFS allows little more than computing rather general rates for the economy as a whole, such as, male/female, HRST for the economy as a whole, or at best broken down into four or five meta-sectors. Despite the inherent sample-size limitations of the LFS, however, it would be useful to harmonise the definitions used in the questions related to mobility at the OECD

and EU level. This would enable key mobility rates to be compared and would lead towards more harmonised methods of data collection.

From a researcher's standpoint, it is certainly easy to promote the wider use of registry data. The material in this volume strongly points to the value added of using register databases to analyse flows of human resources, in terms of both domestic and international mobility. However, for privacy and data security reasons, many countries place severe restrictions on the use of such data and on the integration of separate data registers. We cannot argue with countries' policies in this area. However, we would suggest that those countries which are part of increasingly integrated economic regions of (such as the EU and NAFTA, in addition to the Nordic region) harmonise their relevant public registers with the aim of enabling flows of human resources in these economic regions to be tracked. Once this has been done, they should facilitate access to the data by the research community for analytical purposes – this is a prerequisite for well-informed policies.

The need for better data

There are few adequate data and data sources allowing reliable analysis of international mobility of HRST. Consequently, the issue of brain drain or brain circulation cannot be fully analysed. The main sources of data for international mobility are surveys and administrative data, in particular immigration data. The problem with the latter is that they are not collected with the purpose of tracking knowledge flows. The number of migrants is registered, too a varying degree and with varying quality, but in the absence of data on education or occupation, the number of migrants in itself is not very useful. Even in the Nordic countries, the education levels of immigrants are not routinely recorded. Recently, both Denmark and Norway have sought to remedy this situation by conducting large-scale surveys of foreigners, in order to register their educational background. However, such large surveys are too costly to carry out on a regular basis. Seen in relation to the sometimes extremely detailed information requested from immigrants, it is paradoxical that very basic and useful information on immigrants' competences is not collected.

The key policy implication from the Focus Group's work on international mobility is that international collaboration is required to develop harmonised data collection routines and data sources in order to enable the analysis of internationally comparable data on mobility of human resources. Harmonisation would also make the data more conducive to showing the ways in which national innovation systems are inter-connected and inter-dependent.

Some implications for policy

In this section, we briefly discuss four aspects of policy related to human resources and mobility. First, there is the need for integration of people into organisations, or more broadly into the national innovation system. Second, there is the question of incentives for mobility. Third, there is the issue of educational investment. Finally, issues relating to the role of clusters and networks in promoting growth in human capital are discussed.

Integration: International mobility of highly skilled human resources may not be vast in terms of the numbers involved, but the relative importance of the knowledge flows is high. In some cases, these flows take place within highly integrated structures like multinational firms, which have their own policies for expatriates. However, the majority, which are not part of these privileged flows, will often require more specific measures to foster integration. Governments should design their immigration policies with this aim; for example, through mandatory language and cultural training in the host

country. The sizeable inflows to knowledge institutions imply that at the level of specific organisations and institutions, measures should be taken to integrate the foreign born in the workforce. Industrial associations could take a leading role to advance private sector practices in this respect.

Incentives: Financial incentives are usually the prime driving force behind the mobility of human resources. However, one could envisage other configurations of mobility and wage differences. In a situation with rather small wage differences, people might – and probably do – change their jobs because they feel they need new intellectual challenges. Relatively large wage differences, on the other hand, may induce people to move to sectors where wages are higher, but can also lock persons into jobs where they do not use their full potential. The fact that highly skilled nurses do not *en masse* decide to become software programmers indicates that wage differences might be more important as signals for young people deciding what they want to do in life, than for more experienced people who have already chosen their occupational orientation. Governments should consider appropriate incentive systems to stimulate a balanced flow of human capital. Some deregulation of employment conditions at knowledge institutions may be relevant to create an optimal flow from these institutions. The design of intellectual property rights and licensing agreements, etc., should take into account the incentives for the employees concerned. However, with a dynamic and ongoing restructuring of the economy, new growth sectors will only expand if the demand for human capital is met. This suggests that governments should leave the reallocation of human resources to the market and limit their role to ensuring sufficient endowments in human capital (see below), and adjusting systemic bottlenecks and disincentives to mobility, such as non-portable pension rights and other welfare schemes.

Human capital investments: It is imperative that mobility of human resources is not seen as a panacea to the necessary knowledge distribution throughout an economy. On the contrary, mobility should be viewed as a complement to the overall formation of human capital through education and training systems. Growth, and hence dynamism, in innovation systems is related to the growth of human capital, and the more this capital formation keeps up with demand, the less will be the disruptive effects caused by extensive mobility. Governments should therefore both ensure sufficient endowments of human capital through public spending in education and training, and make sure that the education system itself is responsive to changing demands for different types of competence.

Dynamic environments: Human resources are not necessarily attracted to countries or sectors, but to regions, specific geographical locations or firms, all of which represent dynamism and opportunities. To avoid the threat of a brain drain, governments should design policies with the aim of creating more dynamic environments in the respective countries, and thereby counteract excessive outflows or stimulate greater inflows. Greater attention needs to be paid to regional clusters, financial and working conditions for knowledge institutions and public-private partnerships. Further, such specialised environments may serve as nodes in worldwide networks for task-sharing and division of labour, and hence provide attractive and competent milieus in the emerging system of task migration which is taking place on a global scale.

NOTE

1.   The registers go back to the mid-1908s, but were only available on mainframes in national statistical offices. The PCs of the early 1990s were not capable of handling the amount of data, even for small countries like the Nordic lands. At that time, the machines had roughly as many megabytes as today's systems have gigabytes … and prices per megabyte were an order of magnitude higher per Mb.