

1. Introduction: moving people and knowledge – defining the research agenda¹

ABOUT THIS BOOK

This book explores the relationship between highly skilled, scientific migration and the transfer of knowledge within the European Union (EU). It addresses the effects of these forms of mobility on the individuals concerned, in terms of their career progression and well-being, and on the selected countries – both sending and receiving – in terms of sustainable scientific development and capacity. The book is grounded primarily in an empirical study of natural scientists, in the academic sector, moving between two sending countries (Poland and Bulgaria) and two receiving countries (the UK and Germany). It is based on fieldwork undertaken during the A8 countries' accession to the EU, in the lead up to Bulgarian and Romanian EU membership; a timely point to consider the 'human face' (Smith and Favell, 2006) of a new wave of East–West mobility. The study involved a range of methods including literature review, legal and policy analysis and face-to-face interviews with key informants and mobile scientists in the four locations.² Although the research was based in four individual countries, the countries concerned were part of an enlarging supranational body: the EU. Regionalization and Europeanization are highlighted as further dynamics shaping the processes of migration, providing different lenses through which to view to understand the significance and effects of mobility.

This book consists of nine chapters. This introductory chapter reviews some of the academic literature and research on highly skilled migration and brain drain. This review, coupled with a pilot study focusing on scientific mobility between Italy and the UK,³ played an important role in shaping the research agenda for MOBEX2 project (Mobility and Excellence in the European Research Area: Promoting Growth in an Enlarged Europe). It concludes with an outline of key issues raised in the literature that appear to be salient to an understanding of the impact of highly skilled migration. The empirical findings in relation to these issues and themes are then presented in subsequent chapters.

Chapter 2 goes on to examine the patterns of mobility exhibited by our respondents, with a focus on the frequency, duration and permanency of flows, including returns. The following three chapters examine migration motivations and triggers in more detail. Chapter 3 focuses on what can loosely be described as professional factors related to the quality of positions and ability to work effectively in science. This is followed by two chapters that look at the influence of more personal factors, including the presence of partners (Chapter 4) and children (Chapter 5) on scientific mobility. Together these chapters support a more grounded understanding of the factors shaping the patterns observed – why scientists move in the way they do – and the characteristics of migrants (that is, who moves). An understanding of these processes helps us to predict the potential for return but also, importantly, to understand the extent to which highly skilled migration is highly selective, as is often assumed.

Chapter 6 examines the role that networks and connections play in shaping both migration flows and the distribution of scientific knowledge and expertise. It details the characteristics of scientific connectedness and the relative importance of different forms of connections to mobility and the knowledge transfer process. Chapters 7 and 8 move on to consider the *impact* of highly skilled, scientific migration on the countries concerned with a focus on the relationship between migration and the sustainability of science. Chapter 7 focuses on the experiences of internationalization in the context of the receiving countries, whilst Chapter 8 examines the impact of mobility on the sending regions of Poland and Bulgaria. Finally, Chapter 9 draws together the key findings and presents some conclusions based firmly in our empirical data and the experiences of the scientists we have spoken to in the course of the research.

This opening chapter now proceeds to map out the overarching themes relevant to highly skilled migration that are addressed in greater detail in the subsequent chapters.

The language of brain drain entered the migration literature in the 1960s and focused primarily on the perceived losses of highly skilled workers from Europe – predominantly the UK – to the US, which Lowell (2003: 1) describes as the ‘world’s largest skills magnet’. While this concern persists and continues to dominate political debates in the UK, the research and policy agenda has shifted somewhat to encompass flows of highly skilled migrants from developing regions to the West. Despite evidence of significant imbalances in the geography of current intra-EU flows (Ackers, 2003; Williams, Baláz and Wallace, 2004; Van de Sande, Ackers and Gill, 2005; Williams, 2006), relatively little attention has been paid to this issue.

Recent research has begun to criticize the inherently negative connotations of brain drain, reflecting an appreciation of the complexity of the

phenomenon and the limitations of attempts to conceptualize highly skilled migration (HSM) as a 'zero-sum game'. Salt (1997: 5) describes brain drain in terms of 'net unidirectional flows of HSM' or the 'reverse transfer of technology'. According to this definition, brain drain occurs in circumstances where a direct relationship exists between the direction of flows and the transfer of knowledge. Presumably the size of these flows – in proportion to the science base of the regions concerned – is also important. Evidence of significant outflows of scientific talent – unmatched by compensatory inflows or returns, such as the case of Italy, for example (Gill, 2005) – may indicate a net loss of knowledge or scientific expertise to the sending country and a potential gain to the recipient(s). The concept of brain circulation supports a broader approach, encouraging us to conceptualize migration in terms of ongoing processes rather than single permanent moves, but also, importantly, to distinguish the issue of knowledge transfer from the physical presence of the individual migrant. It recognizes that forms of knowledge transfer may take place in other ways.

Meyer (2003) supports the circulationist perspective, arguing that mobility is varied: it may be temporary with occasional returns; it may be multi-directional instead of unilateral; and it may affect developed as well as developing countries or regions. Regets (2003: 1) similarly observes the emergence of new locations or 'hub' countries as 'the creation and transfer of knowledge, the emergence of a skilled and educated workforce, and the fostering of commercial ties are shared to some extent by countries on both sides of the "equation"'.

The brain circulation paradigm enables us to consider more carefully the potential consequences of HSM and its impact on regions and individuals. There is some danger that this new paradigm – which characterizes HSM as a 'normal' and even desirable process (Meyer, 2003: 1) – might induce complacency and throw a 'gloss' on these processes. The routine exchange of high-level skills reflects the healthy operation of labour markets and the transfer of knowledge. However, it is important to address the issue of reciprocity, balance and differential opportunity. In earlier work, Meyer, Kaplan and Charum conclude that, notwithstanding the 'polycentric' nature of HSM, 'the flows seem to always go from the less developed "haemophiliac regions" to the more competitive places' (2001: 309). Williams et al. (2004: 38) identify 'near unanimity in the migration literature that international migration flows effect net redistribution of resources and welfare from spaces of origin to spaces of destination . . . sending countries experience human capital losses and social investment embedded in individuals'.

There is also evidence in the literature of an acceleration in current trends. Mahroum (2001), for example, points to increasing levels of

specialization at the highly skilled end of labour markets, which, coupled with scarcity and 'imminent demographic decline', will support further the global sourcing of skills. He concludes that as migration is becoming an 'inseparable segment of national technology and economic development policies . . . competition for highly skilled labour will continue to be fierce' (ibid.: 27). Others predict 'enormous changes in the magnitude, composition and direction of international migration' (Iredale and Appleyard, 2001: 3), 'aggressive shifts' in policies to recruit highly skilled workers (Lowell, 2003: 2) and a growing skills war (Iredale, 2001).

The question is whether such numerical imbalances matter and whether existing explanatory paradigms take the debate and our understanding of the impact of HSM forward. According to Iredale (2001: 7) 'the current state of theory in relation to HSM is far from adequate in terms of explaining what is occurring at the high skill end of the migration spectrum'. Capturing the nature and impact of the HSM phenomenon demands new theoretical and methodological approaches capable of going beyond the mapping of flows to begin to explain the processes of migration and career decision-making and the relationship between these and knowledge transfer. King (2002: 89) explains that 'established forms of international migration . . . have for too long now shaped our thinking about how migration is conceptualised and theorised'. In particular, he notes the contribution of skilled and professional people and student mobility to these new and more diverse modalities deriving from 'new motivations, new space-time flexibilities, globalisation forces and migrations of consumption and personal self-realisation' (ibid.). Taken together, these changes in patterns and motivations blur the 'never straightforward boundary between migration and mobility [and] melt away some of the traditional dichotomies' (ibid: 90).

WORKING AND MOVING IN SCIENCE: KNOWLEDGE MIGRANTS?

Rather than discussing the processes shaping HSM in a vacuum, it is important to embed this discussion within the specific context of scientific migration and the nature of science careers. Iredale (2001: 15) points to the 'unique situation that pertains in each professional area and the need to differentiate by profession when examining skilled migration'. Chompalov (2000: 32) similarly refers to the 'specificity of scientific labour markets', which he describes as more internationalized, comparatively smaller and with relatively higher mobility than other labour markets. For Dickson (2003: 1) the 'universality of science has made the problem worse, since it means that those trained in one country can, almost more than in any other

profession, easily function in another that offers them better working conditions'. Our own work – which focuses on the natural sciences – has shown important differences both at disciplinary and national level in the relationship between migration and progression in science careers. It also identifies the different kinds of pressures faced by scientists in the academic sector and those in transnational companies (Ackers, 2005b). Recent work on scientific mobility has tended to focus on the latter group, highlighting the importance of industry-driven flows and the lubrication provided by companies and relocation agencies in these circumstances (Iredale, 2001; Baláz and Williams, 2004). Generally, scientists in the academic sector do not enjoy the 'ease of migration' provided via these 'organizational channels' (Peixoto, 2001: 1030). So, while academic science careers place enormous pressure on people to move in order to access the best opportunities and develop their skills, the kinds of structured organizational support associated with relocation policies of large multinational companies do not exist. Typically, academic scientists and their families are moving with little corporate support. Rarely do they receive assistance with accommodation, or support for partners in terms of finding employment or more general integration opportunities for their families. The nature of the process also differs. Scientific migration in the academic sector is not so much driven by industrial recruitment companies but rather takes place through networks, individual motivation and risk. Williams and colleagues (2004: 30) emphasize the role that 'ad hoc networks' play in the migration decisions of academics, arguing that previous studies have 'downplayed the role of other forms of recruitment, including self-recruitment, recruitment through networks of friends and family, recruitment from student mobility and "staying on" practices'.

Given the lack of practical and organized support for mobility in the academic sector, why do scientists move? A recent study of the migration motivations of highly skilled migrants in the UK – which included a sample of biotechnologists – found that 'while prospects for economic improvement in terms of earnings were a significant factor for some from developing countries it was not a dominant factor overall. As such, the surveyed migrants can be considered "knowledge migrants" rather than economic migrants' (DTI, 2002: 12). The report identified a number of 'motivational factors' that included: aspects of employment (that is, career advancement opportunities, the existence of global centres of excellence, wage differentials and quality of research facilities); wider economic and quality of life factors (that is, living conditions); and more esoteric issues such as the personal development associated with travel and experiencing another culture. Another report (Martin-Rovet, 2003: 1) places similar emphasis on occupational-related dynamics and identifies concerns around status

and autonomy that are less directly connected to economic rewards: 'researchers want centres of scientific excellence and access to the best and latest scientific equipment. They want increased research funding and better salaries. They look for a society where science is respected and where their social status is esteemed'. Other authors talk more generally of 'the drive of scientific curiosity' (Mahroum, 1998: 18) and the 'dream of self-realization' (King, 2002: 95) to describe some of the non-economic determinants shaping HSM.

Our own work with male and female scientists in the EU suggests that a wide range of concerns shape migration decisions and that both the menu and the priority attached to individual factors varies over the life-course. The reference to career advancement opportunities in the DTI report cited above is unsurprising and constitutes a clear motivational factor in most forms of labour migration. Certainly many scientists, particularly from countries with a weaker science base and more limited employment opportunities, move to access improved opportunities. However, experience of international mobility is not only a way of accessing better opportunities abroad: it is also a means of gaining necessary credentials for their subsequent progression in home labour markets. Career progression in scientific research *demands* a very high level of mobility in order to achieve the level of international experience necessary for progression.

In practice, the specific emphasis placed on what has become known as the 'expectation of mobility' differs significantly between disciplines (Mahroum, 1998) and national contexts (Ackers, 2003). Disciplines such as physics and more highly specialized areas of science – where physical access to key infrastructures is essential to the research or the development of new skills – place an even stronger emphasis on mobility. The premium attached to international experience (and having worked abroad) is generally much higher in most EU Member States than it is in the UK, partly explaining why so many EU researchers come to the UK and so few UK nationals leave (the level of internationalization and language proficiencies being other key factors). The pressure to gain international experience through mobility is particularly associated with those in the early stage of their research career (Van de Sande et al., 2005).

Where a strong 'expectation of mobility' exists and directly shapes the career prospects of scientists, it is difficult to speak of migration as either voluntary or forced in the traditional sense.⁴ It is thus perhaps useful to think in terms of a continuum of choices and constraints shifting over time and space and the life-course (King, 2002: 92). In most cases, and certainly in the context of HSM, this distinction between voluntary and forced migration is tenuous and potentially misleading. The extent to which moves in search of economic improvement or career progression constitute a form

of voluntary or forced migration depends on context and also the individual's perception of that. While income differentials and the cost of living constitute key variables, they are not exclusive governing factors. The respective weight attached to such considerations may vary between individuals and over the life-course as decisions are under constant appraisal and review. Where employment opportunities are unavailable, then the language of voluntarism is perhaps inappropriate. Similarly, while simple formulaic approaches prioritizing economic determinants might satisfactorily explain the mobility of young, single researchers, they may be less effective in explaining the moves of partnered scientists, particularly when (as is often the case) both partners are scientists and the needs of children or elderly parents come into the equation (Ackers, 2004a; Ackers and Stalford, 2007).

Scientists place considerable emphasis not only on their personal financial situation (and pay), but on the funding of science more generally and the impact of this on their ability to work effectively – that is, 'to do good science'. In his analysis of Italian scientific migration, Dickson (2003: 1) concludes that 'many scientists leave their home countries not so much because of wages but rather to seek an environment in which they can work effectively with enthusiasm and support'.

Working effectively in science often implies access to high-quality infrastructure, facilities and human capital (in the form of top-quality researchers). These kinds of resources are not randomly distributed but increasingly 'clustered' in resource-rich, often highly specialized, centres or institutes. Our previous research corroborates the emphasis in the DTI report mentioned above on the attraction of such global centres of excellence. The growing tendency of scientific opportunities to 'cluster' in this way – encouraged by national and European policy – reinforces the 'expectation of mobility' and the pressure on scientists to tolerate repeated international moves. For Mahroum (2003: 2), such centres have a 'magnetic' and multiplying effect, drawing 'star scientists' who 'though few in number, are critical to the movement of staff. They tend to go where the best facilities are, and their reputation attracts the best young talents'. Linked to the issue of 'clustering' is the progressive internationalization of science, which Mahroum (*ibid.*: 4) describes as 'a strong pull-driver of talent from overseas . . . a prerequisite for sustained participation in, and access to, the international pool of researchers'. Reinforcing this point, Meyer (2003: 2) refers to the international mobility of the highly skilled as a 'natural extension of the traditional cosmopolitan character of the world's scientific community'. Our own findings underwrite the importance of international environments and research clusters to both the migration and location decisions of migrant scientists. Science clusters in the 'golden triangle' region

spanning Oxford, Cambridge and London offer mobile scientists a wider range of opportunities and more cosmopolitan and international environments, which they generally prefer for scientific and social reasons. They also increase the opportunities for scientists in dual science career couples to secure proximate employment (Ackers, 2004a).

In addition to these resource-related considerations linked to the nature of science funding, another dimension of the quality of working environments referred to by scientists concerns the level of autonomy associated with their work and the freedom to work effectively. Migrant scientists talk of the attraction of transparent and fair (meritocratic) recruitment and progression systems with objective approaches to the evaluation and rewarding of excellence (Ackers, 2003; Van de Sande et al., 2005). Pelizon (2002: 3) refers to the 'cumbersome appointments system' in Italy, for example, which makes it 'difficult for Italians to navigate and virtually impenetrable for foreigners', arguing that it is the greater and 'fairer' opportunities abroad that attract scientists.

Even in situations of profound economic hardship, scientists attach great importance to these wider systemic factors. Referring to the Bulgarian context, Sretenova (2003: 8) points to the influence of the 'special personality' and value systems of scientists and the priority they ascribe to working conditions and infrastructures that enable them to do good science:

[F]aced with the personal choice . . . it is no surprise that the most brilliant and skilful scientists (be they young or established) prefer the mobility option and a nomadic style of life in order to be able to practice their profession in an effective and productive way instead of being frozen at home.

Developing this point about the importance of 'social' factors, she cites a Bulgarian scientist in the Netherlands who refers to the advantages of the 'freedom' associated with working in Western Europe: the informality, transparency and openness of debate associated with science that is absent in Bulgaria.

Of course, economic issues remain highly influential in migration decision-making processes and scientists frequently refer to the salience of income differentials and, more commonly – perhaps reflecting the specific nature of scientific employment – contractual insecurity, as factors shaping both outward moves and potential return (Ackers and Oliver, 2007). However, they rarely see this in narrow terms but within the context of wider costs of living (including travelling), social benefits (especially health care and child care) and access to pensions. As noted earlier, both the menu and significance of the factors identified above might change over time as

careers develop and lives evolve. They may also be gendered. The DTI study notes how skill levels, 'life-stage' and country of origin shaped the way individuals responded to the 'motivational factors' identified. Partnering, particularly in the context of dual science career situations, constitutes a serious challenge to migrant scientists, as does parenting and the need to support family members in other countries (Ackers, 1998, 2003; Kofman, 2002).

This section has emphasized the importance of understanding the context within which scientists are moving. Scientists working in different disciplines, sectors and national contexts face very different pressures and opportunities. These shape their migration decisions. Life-course and career trajectories also have an important influence on the priority attached to mobility or international experience and the ability to respond to it. In order to understand the impact of international scientific mobility on the regions concerned, we need to consider the 'quality' of scientific flows.

ASSESSING THE QUALITY OF FLOWS: WHICH SCIENTISTS MOVE?

Understanding the impact of HSM on sending and receiving countries requires more than the measurement of the direction and volume of flows. The processes of knowledge acquisition and expenditure are fluid and evolutionary and extend over time and space. From a research point of view, it is necessary to take into account the level (seniority or experience) of migrants and to capture, as far as is possible, their relationship to 'excellence' and potential. Salt (1997: 5) defines a highly skilled migrant as someone possessing a 'tertiary-level education or its equivalent in experience'. This is the criteria we used in previous studies of intra-EU flows, which have sampled a population of scientists from doctoral level upwards. This is not to imply that the loss of more junior talent is less serious. In the context of the 'old' (EU15) Member States, undergraduate mobility has become a normal and desirable phenomenon underwritten by European Commission (EC) funding. The presumption is that the majority of these undergraduates return home enriched by the experience without any major repercussions in terms of 'balanced growth'.

Arguably, the scope of any new research should curb the existing boundaries between undergraduate and other forms of academic mobility (King, 2002; Ackers, 2003; Baláž and Williams, 2004). Broadening the geographical canvas to encompass accession countries may support this approach. In situations where up to 70 per cent of undergraduates 'seriously consider' moving abroad (as in Bulgaria, for example), these countries might be at

risk of losing ‘the youngest, most able people with the greatest potential in the most important sectors or disciplines for the future economic development of their countries’ (Salt, 1997: 23). A recent report echoes these findings, noting the ‘brain and youth drain’ facing new Member States (Krieger, 2004). The results of their attitudinal survey suggest that some 10 per cent of younger people in Bulgaria and Romania show a ‘firm intention’ to leave.⁵ The ‘typical migrant’ in these situations is ‘young, well-educated or studying third-level education and living as a single, non-cohabiting person’ (ibid.: 3). Krieger argues that these trends may ‘erode a country’s long-term competitive position [with] negative repercussions on a country’s developmental process’ (ibid.: 1). Baláz and Williams (2004: 25) note that undergraduate mobility has been neglected in migration theory, yet this ‘provides the “seeds” for future international skilled labour migration’. This is echoed by King (2002: 99) who observes that ‘the migrational significance of students going to university has scarcely been studied’. Our own work supports this contention. A very high proportion of scientists moving at doctoral and post-doctoral level had experienced some form of undergraduate mobility and often used the networks developed then as the basis for future mobility. Sixty-two per cent of the Fellows interviewed as part of the impact assessment of the EC’s Marie Curie Fellowship Scheme had previously lived abroad at some point prior to their application (Hansen, 2003; Van de Sande et al., 2005).

Although evidence suggests a link between undergraduate and subsequent highly skilled mobility, the majority of undergraduates will not seek to progress in research, preferring instead other employment areas. For this reason, it is perhaps more ‘efficient’ to address some of these issues around undergraduate mobility retrospectively in research terms as part of a biographical or life-history approach. Moreover, while undergraduate flows may be numerically dominant, flows at doctoral and post-doctoral level may be of greater concern because of the significant investment the sending country has made to their education up to that point. Sretenova’s (2003: 4) ‘methodological frame’ for studying the effects of highly skilled migration proposes a focus on post-doctoral scientists (and above) who are ‘holders of at least a PhD degree’. According to this approach one could argue that although undergraduate or even doctoral mobility may represent a precursor to HSM, it is not constitutive of it. Considerable disagreement exists over when a science career commences or, put differently, what defines the ‘early stage’ of research careers. In some countries and disciplines, the doctorate is considered to form part of pre-career entry training (as a ‘student’), while in other cases the doctorate is considered to form part of the early career itself (Ackers, 2005c). Perceptions of the most appropriate level to study HSM may reflect these disciplinary and national differences and skills shortages.

Media and policy attention, in the UK at least, has tended to focus predominantly on the movement of the best-known, established researchers. In support of this emphasis, Mahroum (1998: 17) suggests that it is not singularly a question of volume but the *quality* of flows that shapes the impact of HSM, with movements of the 'brightest and best' having the greatest impact. At this level, even small international movements can have very serious negative effects on source countries and institutions: 'the departure of a few top-level specialists in certain sectors of basic research could lead to the collapse of national scientific schools' (Salt, 1997: 22). We have already noted the ability of science clusters to attract 'star scientists' and the multiplier effect of this in terms of subsequent recruitment. The mobility of such established scientists and the consequences of this in terms of the losses of human capital – their own expertise and their research group's – coupled with sources of external funding, represents a serious concern for less developed regions. The notion of 'quality' needs some unpacking also, however, as it conflates two related issues: first, the loss of very senior or experienced scientists; and second, the loss of the most able or with most potential at *whatever level* – a process referred to by Wood (2004) as 'skimming' and 'poaching'. So, while Cismas (2004) agrees that highly skilled emigration from Romania is taking place in a context of labour surpluses and that Romania simply cannot 'absorb' all of its graduates, she expresses fears that a significant number of the *top ones* are leaving. From a research point of view, this issue is difficult to capture, not least because different systems have very different approaches to the conceptualization and measurement of excellence. For example, how do we assess the relative quality of those scientists who remain and those who leave? While there is some logic to the inference that the 'best' are leaving, it is also important to exercise some caution here as it assumes that migration and employment processes are relatively meritocratic and efficient. Both career progression and migration are driven as much by networks and connections than quality per se, potentially subverting the meritocratic principle (Van de Sande et al., 2005).

The issue of 'quality' is important to the evaluation of impact because it tells us something about the contribution a scientist is able to make and the potential consequences of their mobility, and also because it reflects the level and geography of investment in human capital. Put simply, where is 'value-added'? How do we compare (both in terms of economic impact and ethical responsibilities) the situation of a person who moves to the UK for their undergraduate degree and doctoral research and then remains, to someone who has trained in Bulgaria and reached an established position and then leaves? Tomiuc (2003: 2) expresses concern at the outward migration of 'elites' from South Eastern Europe, which he suggests has reached

‘alarming proportions’ and constitutes a ‘huge blow to the economy, because the higher education of one person is something quite expensive and the investment was made by the [home] State’. Meyer (2001: 92) similarly argues that most data on ‘brain drain’ is retrospective and ‘ignores when and where . . . skills have been developed’. Research on HSM needs to capture the diversity of flows and also the geography of investment in human capital that these imply. Closely linked here is the issue of temporality and the significance of return.

MIGRATION OR MOBILITY: THE TEMPORAL QUALITY OF MOVES?

The language of brain drain implies unilateral and essentially long-term or even permanent flows of human capital. Clearly an important factor to take into consideration when assessing the potential impact of scientific migration is the issue of duration or permanency. This is significant for both the sending regions (and the extent to which their emigrants return home furnished with new skills, approaches and expertise) and for receiving regions concerned about safeguarding the investments they have made through retention. On a theoretical level, this raises questions around the very concept of migration. One of the ‘binaries’ identified in King’s (2002) mapping exercise is the traditional distinction in migration research between those researchers who focus on permanent forms of ‘migration’ and those whose work considers more temporary forms of ‘mobility’. The general consensus – at least among HSM theorists – is that this distinction now holds little validity and may constrain our understanding of this phenomenon (Iredale and Appleyard, 2001). Just as internal and international migration may be interwoven, the temporal nature of scientific moves may vary both between individuals and over the life-course and career trajectory. Our research suggests that scientists make at least one international move with subsequent moves often to different locations (Ackers, 2003; Van de Sande et al., 2005). King (2002: 98) characterizes these forms of movement as ‘multiple and spatially capricious’.

While any arbitrary distinction between forms of migration based on the length of stay (or the concept of ‘settlement’) at a theoretical level may be spurious given the fluid quality and unpredictability of these processes, the issue retains its relevance in terms of assessing impact at the regional and individual level. Recent work on HSM in the EU indicates a shift in favour of more temporary moves. Piracha and Vickerman (2002: 1), for example, suggest that ‘within Europe, most migration is not permanent, but part of a process of mobility in which both return and serial migration are natural

economic responses to a dynamic economy'. Williams et al. (2004: 29) similarly argue that the 'temporality of skilled labour migration is changing . . . longer-term migration has increasingly been replaced by more diverse shorter-term flows, so that it is more apposite to refer to circulation and mobility than to migration'. Writing in the context of accession, Okólski (2001: 329) describes 'settlement migration'⁶ as a 'tiny part of all movements' in Europe, a sentiment echoed by Haug and Diehl (2004a: 15) who conclude that 'the desire for temporary migration dominates over that for permanent'.

This work supports the emphasis on fluidity and 'circulation', and potentially allays the fears associated with 'brain drain'. Developments at the legal and policy level and, in particular, the extension of free movement rights post-enlargement, may reinforce this tendency. While the dominant view, at least in political and media circles, reflects concern that EU enlargement may result in a significant out-migration of highly skilled workers, it is likely that these provisions will have a more complex effect. Conceivably, the 'looser' post-transition regime enabling people to move to and fro, will support a higher degree of 'circulation' or 'shuttle migration', yet the net flows may remain unidirectional. Okólski (2000: 338) suggests that the post-enlargement legal regime may lubricate return on the grounds that 'absence from the home country does not prejudice future freedom of migration by the same person or the members of his family'.

In addition to the potential effects of accession on the exercise of mobility, quite dramatic changes in the accessibility and costs of travel and the rapid development of new communications systems might be expected to support greater 'circulation' than in the past. In our previous research, many scientists spoke about the influence of cheap flights on their location decisions and also the benefits of laptops in promoting more flexible approaches to work, enabling them to tolerate extended forms of 'commuting' or 'shuttle migrations'. Speaking in the context of Central and Eastern European countries (CEE) over a decade ago, Biggin and Kouzminov (1993) identified the relatively high costs of air travel as a holding factor, restricting both emigration and return. This situation is changing rapidly with the falling cost of air travel across Europe and improved technology that supports distance working. Salt and Ford (1993) even suggest that modern air travel means that it may no longer be necessary to have a permanent expatriate presence. Meyer (2001: 94) similarly refers to the impact of developments in 'communication, transportation, geopolitics and intercultural relations in fostering these new forms of movement'. The net impact of these developments on the temporal character and geography of migration flows is difficult to predict. For some, they may actually lubricate moves, encouraging people to leave who might otherwise have stayed. For

others, they may support the kind of exchange and knowledge transfer that obviates the need for migration as such. They might also impact on location decisions. Respondents in the pilot study emphasized the importance of location in the 'escalator' regions of South East England, for example, to EU migrant scientists who wish to either retain close contacts with Italy for personal or professional reasons or who were actively trying to manage dual career situations (Ackers, 2004a). Haug and Diehl's (2004a) analysis of the migration intentions of Bulgarians illustrates this relationship between distance and temporality, distinguishing favoured locations for those intending to migrate in the long term (when the US assumes first place) and more temporary moves (where Germany is the prime location).

Williams and colleagues (2004) identify a number of important directions for future research on HSM. Starting from the premise that 'the changing nature and duration of the fixity of labour mobility flows and circuits in institutionally specific spaces is one of the keys to understanding uneven regional development in Europe' (ibid.: 27), they chart the intersection of three different forms of mobility: human capital, financial capital and knowledge over time and space. On the one hand, their reference to 'flows' and 'circuits' builds on the circulationist argument emphasizing the fluid and ongoing nature of human mobility. But on the other, they suggest that human mobility is 'temporally and spatially "stickier" than most other forms of mobility' and that migrants become 'locked into' particular places or develop 'place attachments' that restrain movement (ibid.: 38). The concept of 'stickiness' and the reasons why people become 'locked into' spaces remains undeveloped, but the authors do give some indication of potential variables. Referring to the role of regulation on migration flows and uneven development they conclude 'the selective easing of immigration does not automatically lead to transfers of significant additions to human capital. Knowledge does not simply translate into action. Rather, the potential for action is dependent on position, in terms of class, gender and ethnicity' (ibid.: 43). This raises concerns around two dimensions of 'stickiness': first, whether the structural determinants identified in migration research are uniform or whether different groups of migrants might perceive and prioritize different structural determinants depending on their personal situation; and second, whether the 'potential for action' reflects differential opportunity and agency.

While the contextual factors outlined above can be expected to shape the resource framework within which migration decision-making takes place, it is important to remember that migrants are human beings with personalities and families. King (2002: 101) emphasizes the need for new methodological approaches to recognize the 'double embeddedness of migration'. At the macro scale, he suggests, migration research needs embedding in the

societal and social processes of sending and receiving countries. Then, at the individual scale, 'migration must be embedded in a migrant's life-course' (ibid.: 101). This second dimension of context has a significant impact both on migration processes in general (and the propensity to move) and, on the specific temporal nature of migration. The concept of fluidity needs to be complemented with an understanding of viscosity and the processes contributing to this 'stickiness'.

Some scientists are less 'footloose' than others, reflecting the demands of different stages in the life-course, personal situations and – potentially – gendered responses to these. It is quite common in migration research to link the notion of temporality with more complex and subjective notions of 'settlement' and integration. Salt (1997: 4) thus refers to the reluctance of migration researchers to 'accept that HSM is really migration at all, since there is *no intention to settle* in the destination country' (emphasis added). From a pragmatic point of view an intention to settle is important in the context of the distributional consequences of highly skilled migration, the association between such intentions and the level of engagement of the persons concerned with the host society more generally is questionable. While Okólski (2001: 7) links the perceived trend in favour of more temporary forms of mobility to notions of limited 'settlement', his analysis does not fit very well with what he also identifies as the emergence of 'split living arrangements'⁷ associated with 'incomplete migrations'. Okólski suggests that social integration in the host country is not an issue for highly skilled migrants 'whose basic function and main purpose of movement precludes that kind of integration or makes it a matter of relatively low priority . . . [and] are hardly involved in the public life of destination countries' (2000: 334). Forms of 'split living' may arise, as Okólski suggests, in situations in which the family remains 'settled' in the sending region with the worker effectively commuting across international space. Our research has identified numerically significant forms of 'split-living' arrangements reflecting increasing levels of post-migration, cross-nationality, partnering and parenting. In one study, some 47 per cent of respondents were in international partnerships (Ackers and Stalford, 2004). Other studies have also identified the specific challenges faced by the growing number of scientists managing dual science career situations. Here, partners may live in two different locations, neither of which may be their country of birth. Such transnational families often include children who may be born in the host state or elsewhere. In such circumstances the notion of 'settlement' is highly complex. It should certainly not be assumed that there is no intention to 'settle' nor that migrants in these more fluid and complex transnational situations place less priority on integration or involvement.

While arbitrary distinctions between temporary and more permanent moves may hold little value in terms of understanding migration behaviour or settlement, length of stay remains significant in important ways, particularly in terms of accruing citizenship entitlement for migrants and their families. Our research suggests that this is a significant consideration for scientists with partners and/or children who need to reassure themselves that their mobility will not jeopardize their own citizenship status, their partner's right to work and the wider family's social entitlement (Ackers, 2003; Ackers and Stalford, 2007).

The issues raised here in terms of life-course and gender shape both the initial decision to (e)migrate and subsequent moves or returns. In practice, early stage research mobility – of younger scientists moving during doctoral or early post-doctoral appointments – is less likely to be affected by concerns around family. To that extent, these emigrants are generally more footloose (Ackers, 2003). This contention is supported by other work that indicates a high level of feminization of early stage mobility followed by a marked decline (Haug and Diehl, 2004a; Lungescu, 2004).

In addition to more structural concerns around the funding of science, the nature of science labour markets, free movement and employment rights, life-course is an important dimension when studying the temporal character of HSM and its impact on sending and receiving countries. The tendency for mobility to become more 'sticky' over the life-course might thus restrict subsequent mobility (and the propensity to return) for those scientists who establish partnerships and families. Linked in important ways to these concerns around length of stay and permanency of moves – and of great significance to current political debate – are the issues of retention and return.

RETENTION, RETURN AND REINTEGRATION

From the perspective of receiving countries and regions, there is a concern to retain scientific expertise – to 'lock them in' to the system – particularly when the host country has made a major investment in terms of training and development. Iredale (1999) identifies retention and successful labour market integration as a key issue for host countries. The importance of retention becomes clear when we consider the critical reliance in some disciplines and institutions on migrant labour.⁸ In this context, the UK government's review of skills shortages in science (Roberts, 2002) predicted that the positive effects of science mobility – from the UK's perspective – may be mitigated by the propensity of foreign scientists to return. However, no evidence is presented to support this contention. Another UK study found that

'a relatively high proportion of the skilled migrant workers interviewed are planning to stay' (DTI, 2002: 64). Clearly, these issues of post-migration retention are highly significant dimensions of the knowledge transfer equation. However, the temporal dimension of this requires careful attention. For example, when can we say someone has left or returned and for how long will they remain? Moreover, as Regets (2003: 2) cautions, if they do leave can we assess that in terms of net loss when 'they still provide much in the way of research and teaching before they depart'? This draws our attention to the issue of 'skills expenditure' (the corollary of 'investment'). We have so far assumed that migrant scientists in the receiving countries are able to use their skills. Sretenova (2003: 4) adds to her list of 'useful conceptual tools' the concept of 'external brain waste' to denote situations in which scientists migrate but are not able to 'use their qualifications' effectively in the host state. In such cases, there may be evidence of 'brain drain' but limited commensurate 'gain' to the receiving region. Sensitivities about the ethical dimensions of HSM have meant that these concerns about retention in receiving countries have remained somewhat implicit and figure less strongly on the political agenda. The interest in return is primarily focused on its significance to the sending regions (Gill, 2004).

One 'binary' that King (2002) does not explicitly identify concerns the tendency of migration research to deal separately, both theoretically and empirically, with the issue of migration (which generally implies outward moves) and return. The issue of return needs to be considered in the light of movement in general. Arguably, from a scientific perspective, it is not so much the issue of out-migration, as such, but the overall balance of flows and whether the country in question is attractive to highly skilled migrants at all. Notwithstanding the importance of personal and family ties to return decisions, our research suggests that the factors shaping the return decisions of Italians may be similar to those restricting the attractiveness of Italy to other scientists. The problems with funding, the nature of recruitment and progression and the very lack of an international presence in Italy deter both Italians and other nationalities. With reference to the Italian context, Cismas (2004) stresses the importance of placing the return issue within the wider context of international flux, arguing that it is important both to encourage return and attract foreign scientists so as to avoid what she calls 'local thinking'. Arguably, an influx of foreign blood might have a bigger impact on cultural attitudes than returnees who are often viewed with some suspicion and jealousy in the 'home' countries. The issue of return, as a specific element of fluidity, must be considered in the wider context of in-migration and circulation and the focus should extend beyond a preoccupation with numbers to take account of the quality of flows and the nature of knowledge transfer processes.

Despite the symbolism attached to return, there is considerable evidence suggesting that return flows may not lead to an equivalent transfer of knowledge. To achieve such transfers, returning scientists need to be able to re-enter local labour markets and work in an environment conducive to the exercise and nurturing of their skills and knowledge. In more general terms, our work supports Balter's (1999: 1524) findings that many 'Europeans who do post-docs abroad face re-entry problems and struggle to reintegrate themselves into their native scientific communities'.

The corollary of international brain drain may not be flourishing national labour markets. Some authors are less pessimistic about the current 'asymmetry' of flows given the problems of over-supply and unemployment in some countries. The concepts of 'internal brain waste' or 'stagnation' have been used to describe situations in which scientists are forced to move intersectorally or combine scientific positions with other employment in order to make a living. Salt (1997: 22) describes this as a form of deskilling, which occurs 'when highly skilled workers migrate into forms of employment not requiring the application of the skills and experience applied in the former job'. The effects of scientific emigration need to be considered alongside the alternative prospects of 'internal brain drain' within countries, which may dwarf the losses through international migration.

Korys (2003: 36) identifies the saturation of the labour market with specialists in some disciplines in Poland as a factor generating an 'in-group drive to work abroad'. Furthermore, this drive to emigrate and realize higher financial returns may, ironically, increase incentives to undertake training in the home country. Lowell and Findlay (2001: 1) thus refers to the extent to which the 'possibility of emigration for higher wages can stimulate individuals to pursue education', encouraging economic growth in the sending region. On this basis, it may be possible to identify an optimal level of skilled migration, in a given context, that serves to augment these incentives without damaging the national science base. This does, of course, beg the question – raised earlier – of how the countries concerned underwrite the costs of, and provide the personnel to educate potential emigrants.

In situations of labour surplus, it may be politically and economically more acceptable for these scientists to work abroad. Indeed, it could even be a form of 'investment', allowing the receiving countries to underwrite the costs of their continued training until they are required back home. By way of illustration, Meyer (2003: 2) refers to China's 'deliberate policy' aimed at 'storing brainpower overseas for subsequent use'. Such situations can, however, change quite rapidly. Referring to the Italian context, Hellemans warns against complacency based on notions of over-supply predicting some serious challenges to the economy. She suggests that the

'exodus of scientists' must be viewed in the context of the demographic ageing of its population of active scientists, about 30 per cent of whom are due to retire by 2005 (2001: 4). The demographic situation in scientific employment in the accession countries is also quite alarming and may indicate significant changes in the labour markets in the next ten years.

In addition to the lack of positions in sending regions, scientists often express concerns about their ability to re-enter domestic labour markets, particularly when these are associated with forms of protectionism and 'position blocking'. Where networks are of particular importance to progression, the dislocation caused by migration opens up 'gaps and discontinuities in the home country's networks [which] . . . often made the outcome of their undertakings unpredictable, sometimes, even frequently, leading to a decision to re-emigrate' (Meyer, 2001: 101). Chompalov (2000) identifies the specific phenomenon of 'position-blocking' in the Bulgarian context, suggesting that representatives of the old elite prefer to cling to well-established positions, especially in view of the instability and tightening of the national labour market. Williams and colleagues' (2004: 41) concept of 'location-specific insider advantages' perhaps describes situations such as these in which social networks 'accumulated through living and working in the same place' lock people into national systems and restrict mobility. Fear of re-entry then may result in stasis in home labour markets, restricting the opportunities available for those who have left and would be interested in returning. These situations may have important demographic consequences and gendered outcomes. Langer (2004) refers to the existence of a 'gerontocracy' or 'mafia of oldies' in the CEEs, blocking the progression, and return, of young researchers.

The volume of return, although symbolically important, is clearly only one dimension of the equation. Understanding the consequence of migration – in terms of the flows of knowledge and the benefits and losses to the regions and individuals concerned – demands a greater focus on the nature of their work and the exercise of skills. Securing a 'position' and the remuneration that goes with it is an important factor to consider, particularly in terms of the personal costs of return. For many scientists, however, concerns about their ability to return to a position in which they are able to exercise their skills and work effectively dampens their propensity to return. Furthermore, from the regions' perspective, failure to offer conditions capable of harnessing the skills of returning scientists as the basis for scientific development raises questions about the potential of return migration. This brings us to the critical issue of the relational nature of skills (see Meyer, 2001; Williams, et al., 2004): while knowledge is clearly embedded in individuals, scientists are not simply passive vessels of knowledge that can be transported and utilized in a similar fashion in different situations.

Skill or knowledge can only be understood in the context of the environment within which it is being used: 'total human capital will be articulated in the context of a different set of localised and distanced social relationships' (Williams et al., 2004: 32).

Other authors have drawn attention to a range of factors shaping the relationship between human mobility and the transfer of knowledge. Harris (2004), for example, refers to the complexity of the knowledge transfer process and the importance of recognizing the limitations of attempts to directly transpose techniques and approaches developed in resource-rich to resource-constrained conditions. She argues that researchers in these situations may have more to learn from researchers working in similar contexts. Skills and approaches learnt in the host countries may, therefore, not produce equivalent results in a different research environment.

We have already noted the attraction of centres of excellence to potential migrants: the same can be said in relation to return. These not only serve as magnets to potential returnees but also shape the relationship between return and knowledge transfer. Effective knowledge transfer in this context depends on whether the location is a 'critical, institutionalised learning space' (Williams et al., 2004: 34). Such spaces are generally found in more dynamic regions and especially global cities, and do not always exist in the home countries or regions.

Harris (2004: 7) draws our attention to a further set of issues relating to the working context restricting scientists in 'low income countries [where] research is a luxury owing to economic constraints and many scientists hold several other jobs'. This situation is quite common in some Southern European countries and emerged as a major concern in Greece and, to a lesser extent, Italy where scientists either take on more than one full-time position due to the low levels of remuneration, or supplement unpaid work in science with paid work in other areas for long periods of time (Ackers, 2005b). In the Bulgarian context, Sretenova (2003) refers to the phenomenon of 'flying academics' juggling more than one lectureship often in different cities, with implications for their ability to conduct research effectively.

In many situations then, scientists may have difficulty expending their scientific skills and knowledge on return. This issue raises other broader questions about the quality or scope of skills. It is easy, and convenient in research terms, to equate the concept of skill directly with scientific qualifications. Recent work, however, underlines the importance of defining skills more loosely. Korys (2003: 51) notes the impact of highly skilled migration into – and return to – Poland, not only on the diffusion of technology but, more broadly, on approaches to the organization of work and working time, introducing 'new management techniques or the capitalist ethos of work'. Williams et al. (2004: 36) conclude that return is:

more likely to be innovative where there was critical mass in the level of return, geographical concentration of returnees, migration has been of medium-length duration, the migrants were well educated, economic differences between the origin and destination were relatively small, and return was organised in the context of national or regional economic policies.

Understanding the impact of scientific mobility thus demands detailed attention to the specificity of national context in order to capture how knowledge is generated, transferred and used. This is important to the analysis of impact in a regional sense but also in terms of individual opportunity. Those unable to take advantage of mobility may forgo the advantages of higher salaries and working conditions and find it difficult to progress or work effectively in local science labour markets. Our research suggests that the ability to respond to the opportunities – in terms of career but also quality of life – is neither universal nor random, but dependent on family status, life-course and gender dynamics (Ackers, 2003). Research in this field needs to address the question of whether those ‘frozen’ brains left behind or indeed those ‘stored’ abroad are gendered. In addition to these concerns around the significance of return, others have drawn attention to some potentially compensatory trends mitigating the effects of highly skilled migration.

SCIENTIFIC DIASPORAS AND THE TRANSFER OF KNOWLEDGE

Recent attention to the potential value of scientific ‘diasporas’ suggest a complex relationship between human flows and the transfer of knowledge and a potentially more direct compensatory effect. Meyer’s (2001: 91) research on ‘intellectual diaspora networks’ optimistically concludes that ‘highly skilled expatriate networks, through a connectionist approach linking diaspora members with their countries of origin, turn the brain drain into a brain gain’. Others support this, arguing that ‘international knowledge networks’ might constitute a ‘powerful means of profiting from skilled emigration’ (Lowell, 2003: 2) through the ‘exchange of knowledge and useful contacts’ (Regets, 2003: 1). While Mahroum (2003) acknowledges the potential of diasporas to contribute to the international transfer of knowledge, he is less positive, suggesting that the focus on diasporic communities might reflect a kind of ‘resignation’ on the part of sending countries, which have reached the ‘irreversible point’ and have ‘given up on trying to attract the diaspora back’ (ibid.: 3). Furthermore, he alludes to the potential of diasporas to augment out-migration: ‘the fast growth of scientific diaspora . . . can by itself act as a magnet . . . Local talent seeking

maximum career return find now an easier and greater access to international careers through their own diaspora' (ibid.). Such networks may 'facilitate the migration process' and diminish the risks and costs of migration (Meyer, 2001: 93). Korys (2003: 5, 36) would also appear to see the diaspora primarily as a means of promoting out-migration: 'building-up migration networks [facilitates] foreign migration' both through the exercise of networks but also in terms of the 'social memory of migrations [as] routes to success'.

Our previous research provides evidence of the 'channelling' function of diasporas with migrant scientists and especially established senior scientists (Mahroum's 'research stars') acting as bridge-heads for fellow migrants (Van de Sande et al., 2005). Meyer's (2001: 93–4) conclusion that networks are 'making migrants' and 'most positions are acquired via connections', has a strong resonance with our findings, and this may encourage situations in which employment opportunities are allocated on grounds other than individual excellence. Rather than selecting the 'brightest and the best' on the basis of individual merit and competition, HSM may be skewed by the power of networks. As Meyer (2003: 96) proposes, 'this is not a volatile population of separate units in a fluid environment but rather a set of connective entities that are always evolving through networks, along sticky branches'. Earlier we noted the potential of cheaper travel and improved communications technology that may help to maintain these 'umbilical ties' with regions of origin. In addition to the point about travel, Meyer and colleagues (2001) refer to the emergence of a series of trends supporting the rapid emergence of new science diasporas. They call the first of these the dual life setting of many highly skilled expatriates, and underline the importance of understanding the relationship between personal and family ties and scientific careers. Their second point refers to the impact of critical mass or higher densities of expatriates which, they suggest, is conducive to more frequent interactions and collective endeavours.

EXPATRIATE VERSUS SCIENTIFIC DIASPORAS

The current emphasis in the diaspora debate has been on the potential impact of expatriate networks. While this focus might be appropriate in some contexts, it is worth reflecting upon the nature of networks among the highly skilled and the relative importance of expatriate and scientific or professional connections. This raises interesting issues about concepts of community and the relative value and role of different forms of community to scientific migration. Certainly links with the home country will continue to have an important bearing on migration decisions. Focusing on the

African context, Gaillard and Gaillard (2003: 2) conclude that diaspora may constitute 'little more than a friendship network'.

Certainly, one might predict a relationship between HSM and the development of international scientific networks, particularly in the scientific sector where such networks are so important. Earlier we referred to the blurring of boundaries between forms of more permanent migration and ongoing internal or international mobility. The issue of ongoing international mobility via conferences and research collaboration is a particular feature of scientific research that is likely to shape the impact and experience of mobility and potentially temper any direct relationship between migration (or residence) and the transfer of knowledge. A recent study of the relationship between gender, mobility and progression in science careers (Ackers, 2007) provides some indications of the amount of time scientists spend on foreign travel in order to present papers at international conferences, to develop collaborative projects and to visit key research infrastructures and centres of excellence. It is not uncommon for scientists to report spending at least six weeks per year working abroad. Academic careers are perhaps somewhat unique in this respect in fostering such a close relationship between concepts of excellence (and progression) and international activity. Mobility, in the context of scientific careers, could thus be seen as operating on two interlinked continua: the first might 'measure' the physical employment-related moves made by scientists in the course of their careers; the second might capture the degree of ongoing employment-related travel. Meyer et al. (2001) talk of 'scientific nomadism', while Williams et al. (2004: 42) use the concept of 'diverse temporalities' to describe the nature of academic scientific mobility that incorporates short-term visits, fellowships and 'longer-term migration for individual career development'. These forms of mobility do not necessarily occur in a linear fashion but reflect an ongoing spatial manifestation of career and family-related mobility. Williams et al. (*ibid.*: 43) conclude that 'we simply need to know more about the spatial practices of workers and how these contribute to the spatiality (the concentration and diffusion) of knowledge and capital'.

Whereas the focus on expatriate links has led to a preoccupation with the impact on sending regions, attention to the contribution of scientific or subject networks encompasses the multidirectional nature of flows with important implications for all regions concerned. Can we conclude, for example, that the return of a leading migrant scientist to his or her home country implies a total loss of knowledge or input? Many scientists retain links with host institutions when they return home or move elsewhere, building a web of relationships across time and space, which shape not only their own careers but those of their students and colleagues.

The impact of networks on knowledge flows remains unclear and further research is required to develop our understanding of how these processes operate in different cultural and scientific contexts and how they impact on sending and receiving countries and individuals. The challenge lies in developing research tools capable of capturing the quality of these networks. As Baláz and Williams conclude (2004: 4), existing research gives ‘little insight into how human capital transfers are constituted’. Vizi’s (1993: 102) inference of a simple and direct correlation between migration and knowledge transfer – ‘when the best scientists leave their laboratories, they take with them not only their scientific knowledge, but also their reputations’ – clearly fails to grasp the wider contextual issues and the dynamics of knowledge generation and transfer. Meyer (2001: 95) challenges this kind of approach and its implicit conceptualization of skills as ‘individual-based properties bounded by human bodies’, arguing that skills are relational and that scientists are composite entities whose embedded knowledge can only be understood in the context of its connection with extensive networks at home and abroad.

CONCLUSIONS: A NEW RESEARCH AGENDA

This chapter, through analysis of existing literature and research has tried to identify some of the key ‘variables’ shaping scientific mobility and its impact. Building on our own research findings from the MOBEX pilot study and the work of others, it has defined the parameters of the current MOBEX2 study indicating the importance of encompassing the following considerations:

- the migration trajectories of scientific migrants including the frequency, permanence and location of moves, the issues of retention (and settlement) and the propensity to return;
- the dimensions and geography of scientific flows;
- the quality or characteristics of flows (who is moving and at what stages in their career trajectories), where investments are made and skills generated (and who underwrites the costs);
- the effect of life-course, partnering and parenting on mobility and the (gendered) effects of this on the demographic and social balance of scientific labour markets in sending and receiving regions;
- the extent to which international migration spawns other forms of knowledge generation and transfer that are not directly related to physical presence, such as diasporic networks and more specific forms of scientific exchange;

- the alternatives to migration and the consequences of these (what would happen if people did not move).

These considerations shape the analysis presented in the remaining chapters. Capturing the complex dynamics of these processes presents important methodological challenges. Baláz and Williams (2004: 23) suggest the need to adopt a ‘total human capital’ approach, which pays more attention to individual social biographies. They also emphasize the importance of context to understanding how ‘structural parameters’ relate to ‘individual agency’ and the ‘relational nature of skills’ (ibid.: 24). King and Ruiz-Gelices (2003: 24) similarly argue for a biographical approach to support an understanding of how ‘individuals enrich their biographies through social and geographical mobility’.

This review of the literature and research played a critical role in the design of the MOBEX2 research strategy. The pilot study made us very aware of the importance of both national and occupational context to an understanding of migration dynamics. For that reason we decided to focus on a limited number of countries and on a specific group of natural scientists. The face-to-face interviews with mobile scientists in the pilot study also supported the emphasis on biographical approaches advocated above. In practical terms this resulted in an online survey followed by in-depth biographical interviews ($n = 89$) with mobile scientists in all four locations. Both the survey and the interviews were designed to generate information that would enable us to reflect on the questions outlined above. The pilot study involved work with an Italian research partner and a division of labour along national lines. This meant that the UK-based team did the interviews with Italians in the UK but not with returnees in Italy. In retrospect we felt that this approach, whilst efficient, limited our overall understanding of the situation and the different perspectives of these two groups. Furthermore, it restricted the opportunity for a broader ethnographic element to the work. Visiting science labs in the UK for the purpose of the interviews was, in itself, a valuable experience for the researchers. This element was built into the new study, giving the UK team the opportunity to visit and spend time in research institutions in Poland and Bulgaria.⁹

We have referred, above, to the importance of understanding the migration trajectories and the temporal quality of scientific mobility. Gamlen (2005: 15) argues that little research exists ‘on actual mobility patterns to support the shuttle migration thesis’. The following chapter considers precisely this issue in the context of our work with Polish and Bulgarian scientists.

NOTES

1. This chapter is an updated version of an earlier article written by Louise Ackers in 2005 and published in the journal *International Migration*. It is used here with kind permission from Blackwell Publishing (Ackers, 2005a).
2. A summary of the approach is contained in Annex 1.
3. The pilot study was funded under the ESRC Science and Society Programme (Project RES-151-25-00).
4. Recent years have witnessed cases of 'forced' migration from Central European countries in response to political oppression or famine. Nevertheless, Okólski (2004: 330) suggests that 'with the exception of the outflow from Bosnia and Kosovo, much of the recent East–West ethnic movement has been taking place without severe tension or pressing need to leave the country of origin'.
5. A similar figure for Bulgaria is cited in Chompalov (2000). Attitudinal surveys are often relied upon as a predictive tool in the absence of 'hard' data on migration trends. The reliability of this approach is, however, questionable and figures often vary significantly, reflecting the wording of the question and the sampling method used. The figures used here illustrate the point rather than lend validity to them.
6. 'Settlement' migration refers to forms of migration where people move with the intention of settling there for a long period or permanently. A very common practice amongst scientists – and others – is to move with the intention of leaving/returning but then to establish a career or family and eventually 'settle' in the host country.
7. This idea resonates strongly with the concept of LAT – living apart together – couples recently identified by Williams (2004) and Roseneil (2006).
8. Further details are provided in Chapter 7.
9. Further details of the research strategy are contained in Annex 1.