Research Summary 8

Supporting Sustainable Scientific Mobility: Country Reports from Turkey, Germany, South Africa and the United Kingdom

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Work Package 2 in ResIST explores the imbalaces in highly qualified human resources that result from international scientific migration, and the range and success of policies that will help developing countries to attract, retain and use the highly qualified personnel more effectively.

This paper provides an introductory comparative section on research and development in Turkey, Germany, South Africa and the United Kingdom, whose content is summarized below, and four individual country reports were designed to provide basic information on the S&T systems and R&D indicators in these four countries as well as highlight policy and programmatic initiatives on scientific mobility. The reports will serve as background to ResIST empirical surveys and fieldwork that will study flows of scientific mobility in information and communication technologies between Turkey and Germany, and in health research between South Africa and the United Kingdom.

For the introductory comparative section of the report comparative S&T indicators were compiled on:

- R&D intensity (GERD as % of GDP)
- R&D expenditure per million of population
- Share of public sector in total R&D expenditure
- Researchers per 1000 of total labour force
- Share of researchers by sector
- Women researchers as % of total researchers
- PhD's per million of population

Citizens and governance in a knowledge-based society

- PhD's by broad scientific field
- ISI publications
- Patents granted

The individual country reports which follow this introduction were designed to have common core content but not to exclude national specifics. Their common core content covers:

- Training and supply of highly qualified personnel
- Labour markets
- Trends in highly skilled migration
- National policy context, especially in relation to skills needs/shortages/surpluses and related initiatives
- Diasporas – any information on highly skilled diasporas in the field
- Locating the population and sample for empirical research
- Other contextual material bearing on mobility

The conclusions drawn in each of the four individual country reports are:

Turkey

Supporting researchers is a priority of the Turkish Government. "Increasing the number and quality of scientists" is one of the three main objectives set in 2004 by the Supreme Council of Science and Technology, the highest level policy making and co-ordination body headed by the Prime Minister. International mobility has been encouraged by various institutions in Turkey since the 1920s. The main organisations providing scholarships for this purpose include the Ministries, Higher Education Council, TUBITAK, NGOs and international organisations. On the other hand 59 percent of scientist studying abroad do not return to the country. While the programmes implemented by TUBITAK aim to help prevent or reverse the brain drain, there are not any direct measures to encourage the return of skilled researchers. The Supreme Council of Science and Technology (BTYK) discussed, for the first time, at its meeting on 7 March 2007 the need for developing measures to reverse brain drain.

Previous studies on brain drain indicate that the following factors have been the driving forces for mobility of Turkish researchers:

- For young university graduates, the economic crisis in 2001 in Turkey has been the main reason for studying and/or starting their careers abroad.
- "The prestige, better quality education and advantages associated with study abroad" is another reason for studying abroad.
- One important reason for doctoral students and postdoctoral scholars is the "lack of facilities, resources and necessary equipment to carry out research in Turkey in their field of specialisation".
- Compulsory military service is an important reason for male students/researcher studying abroad.
- The reasons for student non-return include political instability, lower salaries and lack of employment opportunities in Turkey when studies are completed, and a preference to live abroad.
- The most important reason for returning is "reaching academic and work experience goals".

There is an emerging need to develop new employment generating policies, and to design and implement actions to reverse brain drain while at the same time to attract the Turkish Diaspora to Turkey and to establish international networks to transfer knowledge to Turkey.

Germany

The German R&D landscape is characterised by a great variety of research organisations. Since the 1960s a tremendous increase of the R&D budgets of enterprises, universities and other research institutes can be observed. Firms represent the largest organisational sector in research. Between 1970 and 2004, industrial R&D expenditures increased by the factor 2.9 (in real terms), in universities by the factor 2.1, and in the non-university institutes by 2.0.

In the public sector, R&D staff comprises about 77,000 people in non-university institutes (government) and 98,000 people in universities, so that all in all, 472,000 people are working in research and development,

271,000 of whom are researchers. As in many EU countries, the share of women in R&D personnel is characterised by a steady decline according to the hierarchical level.

The German economy is characterised by a strong orientation towards manufacturing. Within manufacturing, the primary sectors are chemistry, electrical engineering, mechanical engineering and vehicles. Overall, there is a very high number of first-year students in the field of engineering technologies, particularly engineering, chemical engineering. The share of foreign first-year students in 2005 is quite high in parts of engineering technologies and chemistry. The general picture for students in 2005 in Germany is that most of them can be found in natural sciences/ mathematics, followed by engineering technologies and medicine. The largest share of foreign students in 2005 is in natural sciences/ mathematics, followed by medicine and in last place engineering technologies.

With regard to Turkish students, business sciences, informatics, engineering/ technology and electrical engineering are the most important fields, but looking at the rank Turkish students have compared to other foreign students, the most important disciplines are informatics and electrical engineering, engineering/ technology as well as industrial engineering.

With regard to foreign scientists in Germany it becomes clear that the Russian Federation, India and China had the largest number of postgraduate students at German higher education institutions in 2004, whereas Turkey ranks in 9th position (236 postgraduates). One can find funded Turkish scientists/professors mainly in subjects from the field of mathematics and natural sciences (134), but also in the fields of languages/cultural sciences and sports (72), law/ economics & business administration/ social sciences (42), engineering (36), agriculture, forestry and nutrition sciences (19) and human medicine (11) (source: http://www.wissenschaft-weltoffen.de/).

South Africa

(a) general

Since 2001, R&D expenditure has grown in both nominal and real terms. This increase is partly due to improved survey coverage, particularly of the business and higher education sectors as well as increased funding from government sources. The growth of the South African economy since 2002 also appears to be stimulating an increase in R&D activities. The business sector accounted for 56.3% of R&D performance in South Africa in 2004/05, followed by the higher education sector (21.1%). The government sector (incl. science councils12) accounted for 20.9% of total R&D expenditure and the not-for-profit sector contributed 1.7% (Figure 1). The increase in the percentage of R&D performed by the business and higher education sectors since 2003 mostly arouse from a combination of better coverage and increased R&D activities within these sectors.

The deployment of researchers varies considerably by sector. The higher education sector has significantly more researchers (including doctoral students) compared to the business sector in terms of both headcounts and FTE's. If one compares the FTE's for each sector directly to the headcounts for that sector, one could derive an indication of approximately how much time the researchers spend on R&D activities. In all sectors, except for the higher education sector, significant proportions (71%-84%) of the researchers' time are devoted to R&D. However, in the higher education sector (where academics are mostly lecturers), the corresponding figure is only 37%. Based on this one could conclude that, on average, roughly 37% of academics' time is spent on R&D activities.

The smallest of the sectors (not-for-profit) has the highest share of female researchers (50%). The share of female researchers is lowest in the business sector (27%) and about 40% in the higher education, science councils, government and not-for-profit sectors.

(b) health specific

In 2004 the field of medical and health sciences accounted for almost 15% of total R&D expenditure in South Africa (Figure 6). This represents the second largest proportion of R&D expenditure per field in the country after engineering.

In 2000, there were altogether 3 244 academics (researchers and/or instructional staff) in the field of health and this figure has slightly increased to 3 649 in 2003. The increase is largely due to the employment of more permanent14 academic staff in health in 2002 and 2003. Although an increase in both the total number of health academics and in the number of permanently appointed health academics can be observed, these do not represent big shifts. Given the short time frame, large shifts would of course not necessarily be expected. Outside the university sector the two biggest research organisations in health are the Medical Research Council (MRC) and the National Health Laboratory Services (NHLS). The total number of researchers in these two organisations is approximately 700.

Between 1999 and 2004 the numbers of newly graduating health researchers increased by 19% at bachelor's level, by 56% at masters level, and 53% at doctoral level. If we compare the health sciences to other fields, the health sciences have larger numbers of students enrolling and graduating in both the first professional degree and the masters degree than any other field. Life and physical sciences, however, are greater in number for enrolments and graduates for the doctoral degree.

The share of foreign students enrolled for a masters and doctoral degree in health sciences remained more or less constant at 13%-14% per year during the period 2001 to 2004. With regard to graduation figures (masters and doctoral) larger fluctuations can be observed. For instance, in 2004, foreigners comprised about 21% of masters degree awardees in health, compared to 13% in 2003. Respectively about 77% and 59% of students who graduated with a masters or doctoral degree between 2000 and 2004 were from African countries (Table 7). Doctoral graduates, relative to masters graduates, have the larger share of students from European countries over this period (26% versus 9%).

The available statistics on the labour market in health reveal an uneven distribution of health workers between the private and public sectors, and between the urban and rural sectors. When reflecting upon the "anomalies" in the sectoral data, notwithstanding the causes, the explanation in most instances relates to migration patterns:

- *External migration of health workers i.e. out of South Africa*

A 2006 OECD study reveals that a total of 37% South African doctors are working in the following eight countries: Australia, Canada, Finland, France, Germany, Portugal, UK and the USA. This makes South Africa the largest Sub-Saharan African "supplier" of medical doctors to the developed world (World Health Report, 2006).

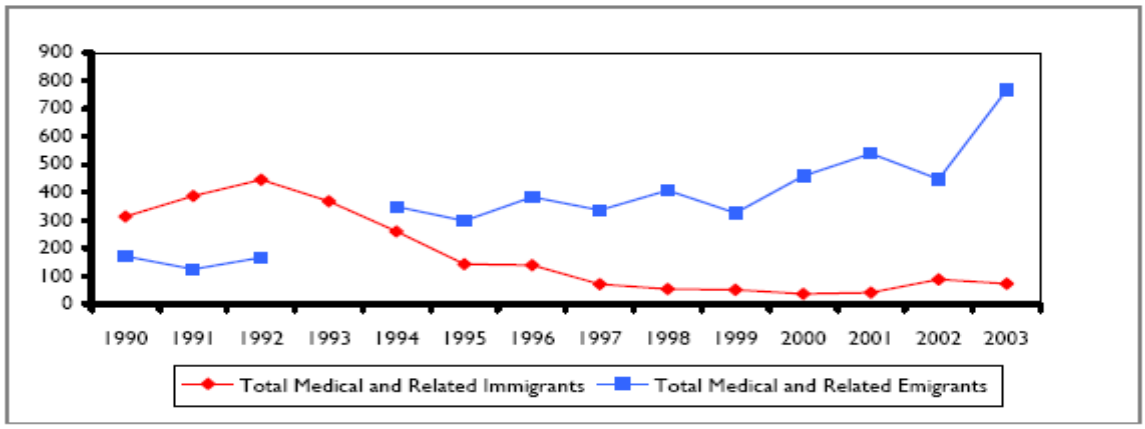
- *Internal migration of health workers i.e. within South Africa*

The internal brain drain caused by an influx of health professionals from rural to urban areas and from the public to private sector can be attributed to an array of aspects, also referred to as "push factors". Poor work climate, heavy workloads, limited career opportunities, unattractive remuneration, inadequate resources and management structures in the rural areas are just some of the contributing factors (Gilson & Erasmus, 2005).

One study reports that nearly 60% of health expenditure is spent in the private sector, while this sector services less than 20% of the total population. A further study suggests that the distribution of health professionals between the public and private sectors follows a similar split.
One review suggests an *oversupply* of physicians by 2011 but admits a number of uncertainties including emigration patterns and the impact of HIV/AIDS; it also projects a shortage of 18,758 nurses, with similar uncertainties, by the same date. According top the Human Resource Plan (2006) The five medical occupations with the greatest shortage, together with their respective targets, are:

- Emergency Medical Service Practitioners (need 1000 by 2009)
- Medical Practitioners (need 2400 by 2014)
- Professional nurses (need 3000 by 2011)
- Nursing assistants (need 10 000 by 2008)
- Pharmacy Assistants (need 900 by 2008)

Migration flows of health professionals in South Africa, 1990-2003 (official data)



For the period 1990 to 2003 the proportion of professionals leaving the country and moving to the United Kingdom declined from about one third to about one quarter. 18% of such emigrants are health professionals. In a 2004 study by the WHO more than half (58.3%) of the health professionals interviewed for the study in 2002, indicated that they considered leaving the country. Of these, 52% indicated that they considered the UK as a destination. The next biggest intended destination for these respondents was Australia, with 10%. A big inflow from other African countries in the early 1990s was effectively blocked by a moratorium on recruitment by the Health Professional Council; since then international recruitment has been from Cuba, Tunisia, Iran and Russia.

This section of the paper concludes by detailing the demographics of health professional migration before reviewing a number of South African strategies designed to address shortages. These include:

- A Memorandum of Understanding, signed in 2003, between the UK Department of Health and the South African National Department of Health
- A meeting in August 2004 between Health Minister Manto Tshabalala-Msimang and her British counterpart, John Hutton in order to "tighten the screws" on the recruitment of health professionals
- The development of the policy document "Recruitment and Employment of Foreign Health Professionals in the Republic of South Africa" from the Ministers of Health in the SADC region. It aims to regulate the "recruitment, employment, migration and support towards the residency status of foreign health professionals in South Africa."
- The Association of South African Nurses in the UK agreeing to "mobilise South African nurses in the UK to engage in issues relating to health service provision and development in South Africa".
- South Africa is a signatory to the Commonwealth Code of Practice for the International Recruitment of Health Workers. The guidelines provided takes into account demand of health professionals in a manner that is cohesive to both source and recipient countries. The principles listed by the Commonwealth code of practice include:
    - Transparency: the agreement should be clear on the type of skills, expertise and numbers of health care workers recruited.
    - Fairness: a range of factors come into play when considering fairness. Recruiters should not engage with health workers who have an outstanding obligation to their own country. Fairness also requires that recruiters provide accurate information on selection procedures, nature and requirements of the jobs they are expected to do. Employment regulations such as remuneration, professional development also come into play when considering fairness as a principle.
    - Mutuality of benefits: recruiters should consider ways in which they could provide support to source countries for example technical assistance. (Commonwealth Code of Practice)

United Kingdom

(a) general

Public expenditure on science declined in the UK in the 1980's and early 1990's but has experienced growth in the past decade. The (OST) Science Budget is £3.4 billion in 2007-08, more than double the level of 1997; and total spending on science through the Department of Trade and Industry (DTI) and Department for Education and Skills (DfES) will reach £5.4 billion (€7.9billion) by 2007-08.

Funding to support research in the UK comes through three major sources – the science budget (set by the Office of Science and Technology), higher education funding, and from other funders (Charities, other Government Departments, Business, and International). The Office for Science and Technology has overall responsibility to maintain the health of the UK research base.

There has been a decline in the total number of people engaged in R&D in the UK (not including in HEI's) between the late 1980's and 2004-05. An exception to this general trend occurred in business enterprise where there was considerable growth in the number of research personnel.

A total of 163,692 staff were employed in UK Higher Education Institutions' in 2004-05 comprising, lecturers (34%), researchers (21%), other grades (19%), senior lecturers and researchers (17%) and professors (9%). Just over a third of the staff categorized as 'researchers' come from abroad.

In the last decade the number of women academics in the UK has been growing sharply - increasing by 43 per cent between 1995–96 and 2002–03, from 39,625 to 56,480 (compared to four per cent growth for males in the same period). Women are concentrated in research and lectureships accounting for only 15 per cent of professors in 2002-03.

Academic research is funded through the dual support system – the Higher Education Funding Councils (HEFCs) distribute core grants, and project grants are usually competitively bid for, and awarded by the Research Councils. There are seven different research councils in the UK , spanning different disciplinary areas; some funding opportunities are available through joint funding initiatives.

(b) field specific

Core funding for research in the medical sciences through the HEFCs has been steadily increasing year on year in the UK, from about 19% of the total in 1995/96 to some 23% in 2003/04. The Medical Research Council's allocation of £546m for 2007/08 represented just under 20% of the 'science budget' – the allocation to the research councils. The MRC funds training and research in Universities and teaching hospitals and its own funded centres (three research institutes, 27 research units in the UK and two in Africa).

Health research in the UK is carried out in Universities, the health service, and charitable research centres (with research frequently bridging these sectors, for example, in university teaching hospitals). Research is carried out throughout the UK, but there are concentrations of research funding and associated staff, most notably in the Golden triangle of Oxford, Cambridge and London.

Medical sciences were the most feminised field in the UK in 1999, where 48 per cent of higher education researchers were women. Nursing, health and community studies had the highest concentrations of female staff in 2002-03 – at 73 per cent and 63 per cent respectively.

One study shows the UK and Germany host over half of all reported tertiary level foreign students in the EU. European Commission statistics on undergraduate mobility present a similar picture, once again identifying the UK and Germany as key receiving countries. The combined figures for undergraduate mobility within the UK, Germany and France exceed the proportion of foreign students in the US. Subjects allied to medicine had the largest number of students registered in 2005/06 (as a total of undergraduate and postgraduate, full and part time). There were 55,960 full time and part-time undergraduate and postgraduate students studying Medicine & Dentistry in 2004-05, of these eighty six per cent were domiciled in the UK prior to starting their studies, four per cent were domiciled in the EU and the remaining ten per cent had come from outside the EU .

Of the 149,520 undergraduate and postgraduate students in the biological sciences in 2004-05 ninety-one per-cent were ordinarily domiciled in the UK prior to starting their studies, four per cent had been previously living in the EU and five per cent had lived elsewhere internationally.

In the UK in the academic year 2003/2004 15,255 PhDs were awarded, the majority of which (11,680) were for full-time study.21 Biological and physical sciences together accounted for just under a third of all registrations (HESA, 2005). 59% of total doctorates awarded to full-time students in 2003/4 were to students who were domiciled in the UK prior to their PhD and 41% came from abroad. Thus a larger proportion of higher degrees in the health sciences are being undertaken by migrants

The UK Government's 'Roberts Review' was set up in 2002 in response to *'serious problems in the supply of people with requisite high quality skills …which could undermine the Government's attempts to improve the UK's productivity and competitiveness'*. The causes of skills shortages in the UK are highly complex but include a level of losses due to out-migration (mainly to the US), the progressive expansion of higher education coupled with the demographic ageing of the scientific workforce and declining rates of transition from compulsory schooling into undergraduate science courses and subsequently into doctoral research and research careers. The Fifth Annual Survey of Recruitment and Retention of Staff in Higher Education found that almost 30% of universities reported difficulties *recruiting* younger academic staff and almost 25% in *retaining* them. Whilst it concludes that the UK *'appears to be a net beneficiary of the increasing migration of science and engineering talent – enjoying a 'brain gain' rather than 'brain drain'…*the Roberts review goes on to caution about the degree of 'risk' in over-reliance on these sources of supply referring to the 'elasticity of flows' of science migrants which are highly sensitive to changes in demand and conditions in the home and receiving countries and the broader European/global context.

Likewise, there are ongoing concerns regarding shortages of healthcare workers in the UK. Pond and McPake suggest some contributory factors necessitating growth in the health workforces in developed countries, namely, ageing populations and growing incomes, an ageing and increasingly feminised workforce and a greater focus on work-life balance. Studies also suggest that only a minority of medical staff who leave the UK return. International recruitment, therefore, plays an increasingly important role in policies to address skills shortages in health.

In 2005 there were 232,380 doctors registered in the UK by the General Medical Council. Of these, 69 per cent had received their primary medical qualification in the UK, a further nine per cent in India, 3 per cent in South Africa25 and Ireland respectively and two per cent in Pakistan. By 2007 the number of doctors had increased to 239,845 but the proportion of doctors who were awarded their primary qualification in the UK had decreased to 62.5%, with 12 per cent trained in India and the second largest group having trained in South Africa. In order to attract health workers to the NHS a global advertising campaign was launched in 2001. Of the additional physicians, trained overseas, that were recruited in 2002 and 2003 twenty-four per cent were from sub-Saharan Africa. However, the UK government is keen not to extensively recruit from developing regions and have produced some guidelines to this effect.

The UK is in the process of overhauling access for migrants (*'A Points-Based System: Making Migration Work for Britain'(March 2006)*. Citizens from outside the UK can seek entry on five schemes (Tier 1-Highly Skilled Migrants, Tier 2 – Skilled workers, Tier Three – Low Skilled Migration, Tier Four – Students, Tier Five – Youth Mobility and temporary workers). Health researchers from third countries are most likely to enter the UK as highly skilled migrants or as students. The UK and Denmark are the only two EU member states *not* introducing the "scientific visa" package, (Directive 2005/71/EC 'a specific procedure for admitting third-country nationals for the purposes of scientific research') which aims to streamline the process of entry for international staff.

Example: Flows of South African academic staff in UK HEI's

There were 264 South African staff working in UK Higher Education Institutions in 2004/05. The majority of South African staff were either researchers (30%) or lecturers (37%). Of the seventy-eight South African research only staff ninety-four per cent were on fixed term contracts (in part explained by the way these positions are funded in the UK).

Concentration in the health sciences

Nineteen per cent of all South African staff were working in clinical medicine, nine per cent were in Nursing and paramedical studies, seven per cent worked in bio-sciences, and a further three per cent were in anatomy and physiology. This provides evidence that South African researchers moving to the UK are most often working in the broad field of physical health, the largest other group (11%) worked in the social sciences. There is also a bias towards younger South African migrants – looking at the bio-science and clinical medicine staff alone, two thirds were aged 35 or less. Turning attention to the whereabouts of these staff, they were distributed between twenty institutions in the UK. There are significant clusters of South African scientists in these fields in London institutions – thirty-five out of the total sixty-eight.
(Source: HESA staff record 2004_05)

Despite the fact that doctors are in short supply the UK government has recently introduced more stringent requirements on the international recruitment of junior doctors. From 3rd April, 2006 International Medical Graduates (IMGs) wishing to work or train in the UK need a work permit. The General Medical Council, responsible for the registration of doctors within the UK have commented that, 'We anticipate (IMGs') employment prospects will significantly worsen following the Department of Health announcement on 7 March 2006. This is in addition to the on-going difficulties IMGs have reported in seeking employment' (http://www.gmc-uk.org/doctors/work_permits/index.asp). Depending on where doctors have trained and their nationality they may also have to undertake a series of tests for the Professional and Linguistics Board.

A number of Department of Health Initiatives have taken place to recruit health care workers. These include a global initiative to attract doctors at consultant level advertised in Europe, North America and Australia, schemes for postgraduate doctors and dentists to complete training in the UK, and bilateral schemes/initiatives of varying degrees of formality with Spain, the Philippines and India covering the supply of nurses.

Concerns about poaching healthcare workers from developing countries, and depleting their healthcare resources, has meant that recent recruitment drives have been restricted to developed countries. Guidelines on international recruitment were issued in 1999 (Guidance on International Nursing Recruitment). They followed a review of nursing strategy in 1999 (Department of Health 1999). These guidelines were then replaced by a code of practice in 2001 (Department of Health 2001), which has, in turn, been superseded by a new Code of Practice published in 2004. The Code requires NHS employers *not* to actively recruit from a list of developing countries (which includes South Africa) unless there was government to government agreement.

Despite the existence of the Code, it does not cover the independent sector, which continues to recruit from countries on the proscribed list (DFID 2004). A Report for DFID (2004) points to significant increases the inflows of doctors and nurses. In 2002 nearly half of the 10,000 new full registrations on the GMC register (registration is compulsory for doctors) were from non-EU overseas countries. According to one study all private recruitment agencies must abide by the NHS code of practice, and the Department of Health publishes a list of agencies operating within the code of practice (therefore the implication is that there are others who do not abide by the Code of Practice). Similarly, the number of overseas nurses also continues to grow. According to the report, one in four new overseas nurse registrations were from the DoH proscribed list of developing countries. This does not however show that the code has been broken, because they can come through other channels. The most significant source countries in recent years have been The Philippines, South Africa, Australia and India. According to the Report, recruitment channels have become more systematic. This includes the introduction of an NHS recruitment website for nurses and the development of regional recruitment co-ordinated through the NHS Workforce Development Confederations.