

SCIENCE AND TECHNOLOGY POLICIES IN THE CONTEXT OF INTERNATIONAL SCIENTIFIC MIGRATION

Anne Marie Gaillard

International freelance consultant, Sweden

Jacques Gaillard

Institut de Recherche pour le Développement (IRD, formerly ORSTOM), Paris, France and Acting Director at the International Foundation for Science (IFS), Stockholm, Sweden

Keywords :Brain drain, reverse brain drain, brain gain, international migration, mobility, human resources, technology, scientific network, migration return, expatriation, repatriation, migration policies, North-South international relations, foreign students, international cooperation policies.

Contents

1. Introduction
 2. Historical Perspectives of International Scientific Migration
 - 2.1 Scientific Mobility: A Continuing Feature since Ancient Times
 - 2.2. Second Half of the Twentieth Century: Expansion of Mobility
 3. Losses and Gains – an Unclear Picture
 - 3.1 Brain Drain versus Brain Gain
 - 3.1.1 Gain for the North?
 - 3.1.2 Loss for the South?
 - 3.2 Determining the Loss or Gain: The Return
 - 3.3 The Situation Today: A Mixed Picture
 4. The Response of Scientific Policies
 - 4.1 An Incomplete Knowledge of Migratory Movements
 - 4.2 Attempts to find Global Remedies
 - 4.3 The National Policies for Retrieving Scientists and/or the Science
 - 4.3.1 Repatriation Programs for Elites
 - 4.3.2 The Setting-up of Scientific and Technological Networks
 5. Science Policies, Globalization, and Migrations
- Bibliography
Biographical Sketches

Summary

After setting international scientific migration in a historical perspective, this article analyzes the science policies which, in the North as well as in the South, determine the direction of migration. While Northern countries (mainly the USA) continue to attract highly qualified people through incentive policies, some countries of origin (particularly in the South) are developing several strategies to counteract the brain drain. Two main strategies can be observed: the recovery of people through incentive return programs and the recovery of competence by establishing networks of highly qualified

expatriates. After presenting and analyzing these policies, this article discusses their impacts in the current context of globalization.

1. Introduction

International scientific migrations today are the manifestation of a host of different realities at the geographical and typological levels. Learning and discovery have always been the principal driving force behind this mobility, the primary condition for the creation and spread of knowledge. Historically such movements took place within the bounds of the large zones of cultural hegemony (the Ancient Greek world, the Arab world at the turn of the first millennium, Mediaeval Europe, and so on). It was the establishment of the colonial empires which brought them on to the world scale, leading the elites from the countries of the South to come to train in the mother countries in order to gain recognition from the colonial administrations. This trend accelerated concomitantly with independence of the colonized countries, mainly for lack of national systems of higher education. In the post-war period, another form of mobility appeared in the countries of the North where the US was able to absorb many scientific and technical specialists coming from all over the world. It is then that the notion of brain drain was applied to the migration of the most highly qualified scientists. It has since continued strongly to imply this migratory phenomenon.

The current movement of the highest qualified intellectuals and scientists between countries is, typologically, in keeping with the migratory trends that have emerged in the second half of the twentieth century. This is not the case for the directions they are taking, which have diversified enormously over the past few decades. It is in this way that, on one hand, there are the North-North, South-North and East-West migrations of trained, highly qualified personnel and, on the other, movements are seen of an ever-increasing population of students, South-North and North-North. The already highly qualified ones leave their country of origin for different reasons: scarcity of jobs at a suitable level in their countries' employment markets, the search for better places to practice science, better pay or a quest for better professional recognition (reasons which alone represent a variety of migratory profiles). The students are seeking higher training which is still sometimes lacking in their country of origin, but which above all will add a positive element for their CV if they are to work in a globalized sphere.

While these migrations are no longer the subject of political planning in the countries of origin, this is not the case in the host countries. The efficiency of some industrialized countries' policies to attract people no longer needs to be demonstrated. Similarly, the brain drain, a concept that still depends on the way such migrations are perceived, has become an increasingly prominent theme, judging from scientific policies of a growing number of countries of origin. Some of them have thus adopted deterministic policies favoring the return of these elite expatriates or have sought to create the conditions for regrouping them around common national interests; the long-term aim being to retrieve the people or the knowledge they have gained. These policies have sometimes produced remarkable results, after several decades of application, and have contributed to a change in the overall picture of world flows. A North-South flow of highly qualified persons can now be discerned, a return which, although far from counterbalancing the

South-North movements, is a new element to watch in international scientific migrations.

2. Historical Perspectives of International Scientific Migration

2.1 Scientific Mobility: A Continuing Feature since Ancient Times

The mobility of scientists and other scholars is such a continuous feature down the ages that it can be taken as a universal socio-anthropological phenomenon. In ancient Greece scholars traveled. It is known with certainty, for example, that among the 60 most celebrated scholars considered 45 left their native land in quest for study, education or research.

However, these migrations would have been limited in both volume and geographical destination, if zones of linguistic hegemony had not existed. Thus, the circulation of men and ideas was dependent on situations of linguistic domination (in turn dependent on the prevalence of political and cultural power). This can be generalized to all great spheres where large centers of culture and science emerged which had attracted scholars and artists from other countries.

The domination of Sanskrit and Pali allowed universities like Taxila and Nalanda, founded in India six centuries BC, to flourish and spread their influence. Greek and the Hellenic culture were at the core of the supremacy first of Athens then of Alexandria. Arabic, which had become the official language in Middle-Eastern countries from the eighth century, gave the basis for Baghdad and then great universities such as Al Azar in Cairo to gain their renown. And Latin, dominant in a Mediaeval Europe under the sway of the Church, was to allow mutual understanding between men of letters and men of science from the eleventh century onwards.

Although a common language was the essential catalyst of internationalization of education in these remote times, it does not in any way explain the deeper reasons for venturing beyond the borders of the native country. Especially so, given the risks that threatened those who left their own territory away from the protection offered by citizenship or by a ruler's sovereignty. One explanation stands out: along with an individual quest for knowledge, gleamed the attraction of famous places, reputed scholars to challenge, and sponsors ready to provide finance.

It was not purely by chance that Alexandria, at its peak, was permanent host to between 100 and several hundred scientists and other scholars who hailed from all over the Hellenic world. According to the historians, scholars were attracted at once by the immense research facilities offered by the museum and by Ptolemaic gold. Deliberate policies adopted by patrons created the attraction. Indeed the methods employed would already have produced a kind of brain drain. When for example the first King Ptolemy constructed the grand library and the museum at Alexandria (in the third century BC), in the absence of local scholars who could run the new complex, he simply brought in the necessary capacity from Athens. Seeking none other than to establish his new capital's supremacy over the Greek world, he used the most basic form of plundering, enriching his own potential while weakening the competitor.

Another example of such deliberately planned policies emerges from the medieval universities whose power and importance were the envy of princes and other rulers who well understood the advantage that could derive from these institutions – breeding grounds for administrators, judges and advisers. This is why some mediaeval towns vied with each other to offer the best terms and privileges to entice universities to uproot from other towns and set up within their boundaries. Both rulers and cities also unscrupulously offered professors the best working conditions and incomes to tear them away from institutions installed in their neighbors’.

History therefore provides many examples of policies openly geared to attract scholars. But there have also been policies aiming to repel them. Examples can be found too of mediaeval universities which, because they were cosmopolitan and they enjoyed a status exempting them from common law, frequently found themselves in conflict with the hosting cities’ inhabitants. At Bologna in 1188, at Oxford in 1209 and again in Paris in 1228, many professors and students were forced to leave following disputes with the local people and authorities.

Quite certainly therefore:

- in any period migration of intellectual elites has depended on the interest those in power have had for knowledge;
- from the earliest times this interest was expressed as deterministic policies to attract both men and institutions;
- the notion of drain and gain was already the crux of these embryonic scientific policies.

Consequently, there is no risk in saying that the roving life that became one of the main requirements for scientific creation and the spread of knowledge was the vector at once of the individual’s quest for knowledge and of policies applied to attract scholars and steer the migrations in particular directions. Motivations behind such migration trace a disconcertingly constant thread which continues just as strongly today.

2.2. Second Half of the Twentieth Century: Expansion of Mobility

The coming of the concept of the brain drain as the 1960s began signaled a profound change in attitudes towards scientific migrations in general. Hitherto considered beneficial by received opinion (they had not previously attracted any special attention and were not the subject of any particular study) they were officially deemed harmful for the countries of origin. It was in 1963 that the term *brain drain* appeared, in a Royal Society of London document which sought to dramatize the departure of scientific personnel from the UK for the USA where a buyer’s market offered better working conditions and salaries.

It was the first time that a migration judged to be substantial concerned highly qualified professional people in the industrialized countries: doctors, physicists, engineers and others left with no guarantee of returning. This represented a big change in that, since the eighteenth century, Europe had always been the scientific center of attraction. The departure of a colonial nation’s qualified people for its territories overseas was not

regarded as a loss because even the furthest region was seen as an extension of the nation. Such a trend was completely new and the disquiet it aroused found expression in this physiological and mechanical term 'brain drain' symbolizing an insidious process of loss of intellectual capacity from Western Europe.

At that time also, the movement of the highest qualified from the developing countries towards the industrialized countries was not yet described in the same generalizing and rather pejorative manner. Quite the contrary. During the colonial and post-colonial period it was quite the convention, even the rule, for children of local elites to leave for studies in the mother country as training for work in the colonial administrations, later in those of the newly independent nations. Expatriation for studying was considered one of the main thrusts of deterministic development policies. That process would in the long term enable the countries involved to make up sufficiently large and well qualified bodies of educated people to drive their development.

These displacements, which mostly had study as objective therefore fitted in with the tide of technology transfer thanks to which the countries of the South hoped to cure their deficiencies in qualified personnel. That strategy remained, however, a 'necessary evil' before these countries could institutionalize their own higher education systems. However, the migratory trend accelerated and as the 1970s approached, the notion of exodus then came to the fore. The flows towards the industrialized countries rose uncontrollably (they were to increase five-fold in 30 years, going from 245 000 in 1960 to 1 178 000 in 1990) and concomitantly the great majority of students, with qualification in hand, settled in the host country.

This large-scale migration was the direct consequence of the development of primary and secondary education systems in the countries of the South, which brought with it a demand for higher education that they could not satisfy. The best of their educated young people left in ever increasing numbers to study in the North. However, not all these countries were worried by departures, because they could no more satisfy the demand for higher training than the demand for qualified jobs.

Some even found an advantage in this emigration trend as it avoided extra unemployment when joblessness was endemic. Moreover it gave a source of revenue in strong currencies and a possibility to constitute abroad pressure groups who would keep in touch with the country of origin to promote transfer of technology. In addition this migration of highly qualified personnel provided a reserve considered potentially useful in case of need. It is this last point of view which prompted policies favoring the return of their qualified expatriates.

Then came the 1990s which saw extensive changes in the migratory flows of people highly-trained in science and technology. Two phenomena then became predominant, both resulting from political facts or choices. The first affected the Eastern European countries where the collapse of scientific institutions, in the wake of the fall of communist systems, and led to the departure of thousands of scientists. The second involved the emerging countries of South-East Asia whose voluntarist policies for retrieving their scientific elites were the start of a return flow which, through years, has been strongly confirmed.

As far as scientific migrations from former communist-bloc countries are concerned, a sharp distinction must be made between scientists who, owing to the critical state of the national science and technology systems, left research and those who, preferring to stay in their field, left their country. Russia provides some good examples: out of a million people working in the scientific and technical sector before the crisis, 500 000 have left their job. Among these, only 20 000 to 30 000 have left the country (the figures vary according to source). Most of them went to work in laboratories in the West. Although this represents an internal shift rather than an exodus abroad, the migratory flow was nevertheless substantial in the early 1990s. This gave rise to many works expressing concerns published in the years following the collapse of communism. Then appeared the notion of circular or pendular migration, where expatriates would return to their country after stays of several years only to go away again at regular intervals to live and work abroad. Yet, this circulation has not up to now been demonstrated by any reliable studies. Little work exists on such migration, which in any case are too recent (a matter of 10 years or so) to be set into any perspective for analyzing the consequences.

However, what can be observed today are the return flows of intellectual elites into the emerging countries of South-East Asia. South Korea, Taiwan and Singapore are countries where the brain-drain has been transformed into a brain gain. The example of migration of South Korean students is informative. Until the beginning of the 1980s nearly 70% of that country's nationals who had left to obtain training in the US settled over there once they had finished their higher qualifications (only 10% went back after obtaining their qualification). The tide has now turned and nearly 70% now return to their country in the three years following their doctorate in the US, and almost 40% do this as soon as they obtain their degree. The same applies for Taiwan and Singapore.

This migratory reversal has as its origin the regular economic expansion which has taken place over the past 30 years. In conjunction with a long-term determinist policy it has led to a narrowing of the gap in standard of living between the developed countries and these countries of origin. It has also favored the emplacement and spreading of industry and scientific and technological systems giving young qualified people the chance to find work in their field in their own country, without fear of a considerable fall in their living standards. Consequently we can now talk of a migration of the highest-qualified people from North to South, because, even if it is only a trend for returning to countries of origin, it may well be a blow to the scientific and technological systems of certain industrialized countries (the United States for example) whose scientific potential rests partly (and sometimes largely) on individuals from countries of the South.

Along with this migratory counter-flow is re-emerging the fear of North-North migration of scientific elites, infallibly attracted by the US, a country which through its deliberate policy to attract would continue to plunder the rest of the world (Europe included) of its most brilliant brains. Thus, at the end of 1990s, almost all the European press whether mistakenly or not was perturbed about the defection by these highly qualified. In Britain there is much concern about the possible effects of departures of the most brilliant, with degrees just acquired, to the US; in Switzerland and France people look with a kind of horrified fascination on the havoc that Silicon Valley would wreak in the ranks of graduates from the best universities and Grandes Ecoles; in Sweden there is resentment that a quarter of the country's engineers who graduate from the top-level

Engineering Institutes go abroad. As for Canada, which considers itself the country most affected by brain drain, the departure of graduates for better paid jobs in the US has become an important political issue unifying the opposition.

The United States continues to be renowned as a target of criticism regarding this question because, since 1968, that country has been applying a procedure for the introduction of foreigners voted in 1965 (US Immigration and Nationality Act Amendment), which facilitates the immigration of qualified people. This procedure, rather notoriously, has led to an explosion of departures of students from the South and professionals from the North towards that country. Now the US., today in full economic expansion, has a shortfall of human capital and is seeking to increase permanently its pool of highly qualified immigrants. US policy now running therefore endeavors to be increasingly attractive. This is reflected both by higher education establishments where recruitment of brilliant foreign students is accompanied by the allocation of grants, and in legislation where the rules governing the introduction of people from abroad has been simplified for highly qualified people even further.

The US migration policy does not only fit the context of its economic growth. It is also, in the more-or-less long term, becoming indispensable for the very survival of the American science and technology system. In fact, the practice of immigration for the highly qualified has had direct consequences on the composition of the scientific community itself. A large number of laboratories thus could not operate today without personnel from abroad, who in some cases are now the majority. At the same time, young Americans are declining to enter scientific careers that are considered as less attractive than others. Added to this dual situation has been a fear that highly qualified foreigners will return home, which is now confirmed. Consequently, the American system is increasingly vulnerable and the migrations policy is becoming one of the most obvious means of sustaining it.

This is of course one of the reasons why the most voluminous scientific migrations (students and professionals) are still operating towards the USA, which illustrates the durable validity of the observation already made that scientific policies help determine the directions migratory flows take. And the similarities do not end there. Still today the flows follow paths determined by the zones of dominant linguistic influence. Therefore it comes as no surprise that the United States, followed by the United Kingdom, are the destination countries for the largest number of foreign students.

Another consistent aspect of migrations of elites concerns the individual motives of migrants who are at once seeking the best conditions for practicing science and an improved chance of making the most of their talents. However, one thing is new which, in spite of the plethora of debates on the matter, is finding renewed credibility now at the turn of the millennium: the desirable role these migrations could play in assisting the development of the countries of origin of the South. In fact, while the notion of gain for the host countries seems patently obvious (the American example proves it), the notion of loss for the countries of origin is being increasingly called into question in those countries themselves which see, by way of this migration, a means of access for the developing countries to science and technology.

-
-
-

TO ACCESS ALL THE 22 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

Adams W. ed. (1968). *The Brain Drain: Conference on the Brain Drain (Proceedings of the Conference on the Brain Drain, Lausanne, 1967)*. 273 pp. London: The Macmillan Company; New York: Collier-Macmillan Ltd. [Overview of the brain drain question and the theories prevailing in 1968.]

Barber E. G., and Morgan R. P. (1988). *Boon or Bane*, Institute of International Education Research Report, Series Number 15, New York: IIE. 38 pp. [Implications of scientific migrations for the American S&T system.]

Bhagwati J. N. (1976). *The Brain Drain and Taxation – Theory and Empirical Analysis*. 292 pp. Amsterdam: North-Holland Publishing Co. [The proposals of taxation on immigration in the rich countries to compensate the countries of origin.]

Chang S. L. (1992). Causes of brain drain and solutions: the Taiwan experience. *Studies in Comparative International Development*. **27**(1), 27–43. [The results of thirty years of Taiwan's policy for retrieving the highly skilled.]

Das M. S. (1971). The 'brain drain' controversy in a comparative perspective, *International Review of Comparative Sociology*, **1**(1), 55–65. Also published in 1971 in *Social Science*, **46**, 16–25. [Econometric analytical models in the controversial perspective of the 1960s and 70s.]

Dedijer S. (1968). *Early Migration: The Brain Drain*, (ed. W. Adams) pp. 9–28, London: The Macmillan Company; New York: Collier-Macmillan Ltd. [The factors of migratory pull and push in the movements of scholars throughout history.]

Gaillard A. M., and Gaillard J (1998). *International Migration of the Highly Qualified: a Bibliographic and Conceptual Itinerary*, 142 pp. New York: Center for Migration Studies. [Classified bibliography and review article on the scientific literature produced on the brain drain during the past four decades.]

Gaillard A. M., and Gaillard J. (1999). Les enjeux des migrations scientifiques, internationales: de la quête du savoir à la circulation des compétences. 234 pp. Paris: l'Harmattan. Questions contemporaines. [Case studies, analysis of scientific policies and theories on brain drain in a historical perspective at the turn of the second millenium.]

Gaillard J. and Gaillard A. M. (1997). The international mobility of brains: exodus or circulation? *Science, Technology and Society, The International Mobility of Brains. Special Issue*, **2**(2) 195–228. [State of the art on the brain drain, introductory article in a special issue on scientific migrations and science policies.]

Glaser W. A. and Habers G. C. (1978). *The Brain Drain: Emigration and Return*, UNITAR Research Report, 324 pp. Oxford: Pergamon Press. [The results of an enquiry involving 65000 students in 11 pays at the beginning of the 1970s.]

ILO (1988). Standard Occupational Classification ISCO 88.

Johnson H. G. (1968). *An Internationalist Model: The Brain Drain*. (ed. W. Adams) pp. 69–91, New York: Macmillan. [An analytical model of migrations of elites in a liberal economy perspective.]

Meyer J. B., Charum J., Bernal D., Gaillard J., Granés J., Leon J., Montenegro A., Morales A., Murcia C., Narvaez-Berthelemot N., Stella Parrado L., and Schlemmer B. (1997). Turning brain drain into brain

gain: the Colombian experience of the diaspora option, *Science, Technology and Society, The International Mobility of Brains, Special issue*. 2(2), 285–315. (ed. J. Gaillard). [Analysis of Colombian Network of Scientists and Engineers Abroad as a tool for getting round the brain drain.]

Mundende D. C. (1989). *The Brain Drain and Developing Countries: The Impact of International Migration on Developing Countries* (ed. R. Appleyard). pp. 183–195, Paris: OCDE. [The impact of emigrations of the highly qualified from developing countries on the economic development of the countries of origin and review of measures proposed in and by international organizations to remedy the exodus of the best brains.]

OECD/EC/Eurostat (1995). *The Measurement of Human Resources Devoted to S&T* (Camberra Manual), OECD/GD (95) 77.

Rashdall H., Powicke F. M., and Emden A. B. (1936) *The Universities of Europe in the Middle Ages*, 3 volumes, Oxford: OUP (historical work).

RIHE (Research Institute for Higher Education) (1989). Foreign students and internationalization of higher education, *OECD/Japan Seminar on Higher Education and the Flow of Foreign Students, Proceedings, Hiroshima University, 8-10th November 1988*. (ed., K. Ebuchi). 300 pp. Hiroshima: RIHE Publications. [Policy issues and institutional responses to the growing flow of international students.]

Song H. J. (1997) From brain drain to reverse brain drain: three decades of Korean experience. *Science, Technology and Society; The International Mobility of Brains, Special Issue*, 2(2), 317–345 (ed. J. Gaillard). [The results of the policy of retrieving the talented conducted by South Korea over three decades.]

UNESCO (1997). *Standard Classification of Education, ISCED 97*.

Biographical Sketches

Anne-Marie Gaillard is a social scientist, doctor in social anthropology and ethnology, specialist of international migration. She published several theoretical papers on the process of integration and return of migrants as well as a book on repatriation of refugee: 'Exils et retours, itinéraires chiliens' (Paris: L'Harmattan, 1997). She is the author of several bibliographies, one on Migration return 'Migration Return. A Bibliographical Overview' (New York: Center for Migration Studies, 1994) and another co-authored with Jacques Gaillard: 'International Migration of the Highly Qualified: a Bibliographical and Conceptual itinerary' (New York: Center for Migration Studies, 1998). During the last years she has been publishing with Jacques Gaillard several articles and a book on the issue of the mobility of the highly qualified human resources in science and technology: 'Les enjeux des migrations scientifiques internationales. De la quête du savoir à la circulation des compétences' (Paris, L'Harmattan, 1999).

Jacques Gaillard is presently Acting Director of the International Foundation for Science (IFS) in Stockholm, on secondment from the French Research Institute for Development (IRD, formerly ORSTOM). A trained agricultural engineer with a Doctorate in Science, Technology and Society (STS), he published over 30 papers, 6 books as author and 6 books as editor in the field of Science, Technology and Society. His recent books include: 'Scientific Communities in the Developing World', co-edited with V.V. Krishna and R. Waast (New Delhi: Sage, 1997), 'International Migration of the Highly Qualified: a Bibliographic and Conceptual Itinerary', co-authored with Anne Marie Gaillard (New York: Center for Migration Studies, 1998), 'La coopération scientifique et technique avec les Pays du Sud. Peut-on partager la science ?' (Paris: Karthala, 1999) and 'Les enjeux des migrations scientifiques internationales. De la quête du savoir à la circulation des compétences', co-authored with Anne Marie Gaillard (Paris: L'Harmattan, 1999).