Plumbing the brain drain

Nancy Gore Saravia[1] & Juan Francisco Miranda[2]

Abstract Opportunity is the driving force of migration. Unsatisfied demands for higher education and skills, which have been created by the knowledge-based global economy, have generated unprecedented opportunities in knowledge-intensive service industries. These multi-trillion dollar industries include information, communication, finance, business, education and health. The leading industrialized nations are also the focal points of knowledge-intensive service industries and as such constitute centres of research and development activity that proactively draw in talented individuals worldwide through selective immigration policies, employment opportunities and targeted recruitment. Higher education is another major conduit of talent from less-developed countries to the centres of the knowledge-based global economy. Together career and educational opportunities drive "brain drain and recirculation". The departure of a large proportion of the most competent and innovative individuals from developing nations slows the achievement of the critical mass needed to generate the enabling context in which knowledge creation occurs. To favourably modify the asymmetric movement and distribution of global talent, developing countries must implement bold and creative strategies that are backed by national policies to: provide world-class educational opportunities, construct knowledge-based research and development industries, and sustainably finance the required investment for these strategies. Brazil, China and India have moved in this direction, offering world-class education in areas crucial to national development, such as biotechnology and information technology, paralleled by investments in research and development. As a result, only a small proportion of the most highly educated individuals migrate from these countries, and research and development opportunities employ national talent and even attract immigrants.

Keywords Brain drain/trends; Emigration and immigration/trends; Foreign professional personnel – education; Research; Development; Investments; Socioeconomic factors; Public policy; Developed countries; Developing countries (*source: MeSH, NLM*).

Mots clés Exode des compétences/orientations; Emigration et immigration/orientations; Personnel professionnel étranger – enseignement; Recherche; Développement; Investissement; Facteur socio-économique; Politique gouvernementale; Pays développé; Pays en développement (*source: MeSH, INSERM*).

Palabras clave Éxodo intelectual/tendencias; Migración internacional/tendencias; Personal profesional extranjero – educación; Investigación; Desarrollo; Inversiones; Factores socioeconómicos; Política social; Países desarrollados; Países en desarrollo (*fuente: DeCS, BIREME*).

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Voir page 614 le résumé en français. En la página 614 figura un resumen en español.

Introduction

The movement of skilled and educated individuals from one nation to another is as much a response to the lack of opportunity in their home country as it is to the availability of opportunity and the deliberate and selective promotion of immigration in another. Creating opportunity, then, is a necessary and effective strategy for redirecting patterns of migration.

Among the few newly industrialized countries that have been successful in retaining their nationals and encouraging them to return (such as India, the Republic of Korea, Singapore, and Taiwan (China)), domestic investment in innovation and research and development programmes has been a common denominator (*1*). The capacity built through this investment in turn has created demand for advances in science and technology, increased productivity, led to the development of scientific and technological career pathways and increased employment. Thus, domestic investment in research and development has created opportunity. Testimony to this is the beginning of a "reverse brain drain" manifested by a sustained drop in the number of doctoral students from China, India and Taiwan (China), who planned to remain in the United States beginning in the late 1990s. Furthermore, Japan, the Republic of Korea and Taiwan (China) account for more than one quarter of all applications for industrial patents awarded in the United States each year and, remarkably, Taiwan (China) and Singapore surpassed the United States in the overall number of citations to their patents on chemica l design (*2*). These examples show that when real opportunity exists within the context of coherent internal policies and investment in science and technology, returning to the home country becomes an attractive option for emigrants. It is at this point that tax incentives for returnees and prestige awards can be effective in encouraging nationals to return and diaspora networks of nationals residing abroad can enhance the achievement of critical mass through

[1] Scientific Director, Centro Internacional de Entrenamiento e Investigaciones Médicas – CIDEIM, Apartado Aereo 5390, Cali, Colombia (email: saravian@cideim.org.co). Correspondence should be sent to this author.

[2] Executive Director, Centro Internacional de Entrenamiento e Investigaciones Médicas – CIDEIM, Cali, Colombia.

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interactions with returning scientists. Policies and measures to repatriate nationals can be designed to target established scientists who will bring back with them other crucial skills, such as knowledge brokering, organizational and entrepreneurial skills, as well as their connections to colleagues.

This article seeks to raise questions, identify key issues and provide examples of policies that can be used to manage migration and the asymmetric distribution of highly educated and skilled people. Recognizing the factors that drive "brain recirculation" may allow them to be utilized to achieve a more symmetric global distribution of innovative capacity and may thereby enhance economic development.

Mobility of human resources: a global concern

The brain drain is not limited to developing countries. Australia, Canada, the Russian Federation and countries in the European Union have all encountered the threat that migration poses to economic growth. Between 500 000 and 800 000 scientists from the Russian Federation have emigrated during the past 10 years. Wages are 30–70 times higher in industrialized countries than in the Russian Federation (*3*) and this creates a gradient of efflux. Nineteen physicians and fifteen nurses have left Canada for each one that has immigrated there between 1990 and 1997 (*4*). During the next 10 years Canadian universities will require 35 000 new faculty, yet the country graduates only 4000 PhD students per year, and most are employed outside of academia (*4*). Active recruitment of individuals from abroad and the use of selective immigration status are strategies used to address this demand. However, the deficits in human resources in industrialized countries like Canada and Australia are also exacerbated by the emigration of their nationals to the centres of knowledge-based industries in the United States and Europe, underscoring the multidirectionality and interconnectedness of the highways of migration. The multilateral direction of migration has led to the idea of "brain recirculation" as a more precise description of the phenomenon of the global migration of talented individuals. Regardless of the term used to describe the phenomenon, the asymmetry of the circulation creates incapacitating deficits of human resources in developing countries (*5*).

Education: a conduit to knowledge-based economies

In general people who migrate from developing countries are young (aged between 15 and 45 years) and have higher levels of education and income than individuals of the same age who remain in the home country. In addition to laws that confer preferential immigration status on individuals who have advanced degrees in science and engineering, employment opportunities also affect mobility both within countries (from public to private and academic to productive sectors) and between coutries. Health, educational and communications services are knowledge-intensive industries that generate enormous revenues in Europe, Japan and the United States (Fig. 1). These industries create a steep and dynamic gradient of career opportunities that attracts and concentrates talented individuals from around the world (Fig. 2).

Higher education is one of the principal conduits of permanent emigration (*1*). The majority of skilled workers of foreign origin acquire specialized and postgraduate professional qualifications in the host country. Two-thirds of foreign-born scientists and engineers working in the United States earned their doctorates there (*1*). Half of the foreign-born graduate students in France, the United Kingdom and the United States remain there after completing their studies (*6*). The proportion of foreign students in doctoral programmes in engineering and the physical and natural sciences in these three countries approached 50% in 1999 (Fig. 3), and the proportion of foreign-born faculty in universities in the United States increased to almost 30% between 1991 and 1999 (*7*) (Fig. 4). These statistics suggest that if developing countries provided world-class education and training, as well as opportunities for career advancement and employment, the migratory flow could be redefined.

Changes in immigration policy instituted in the United States within the framework of the Department of Homeland Security are already affecting both the flow of foreign students and scientists into the United States and their decisions about whether they wish to or will be allowed to remain permanently (*8*, *9*). The coincidence of diminished access to opportunity in

Fig. 1. **Global revenues generated by five knowledge-intensive industries, 1998.** Adapted from ref. *7*

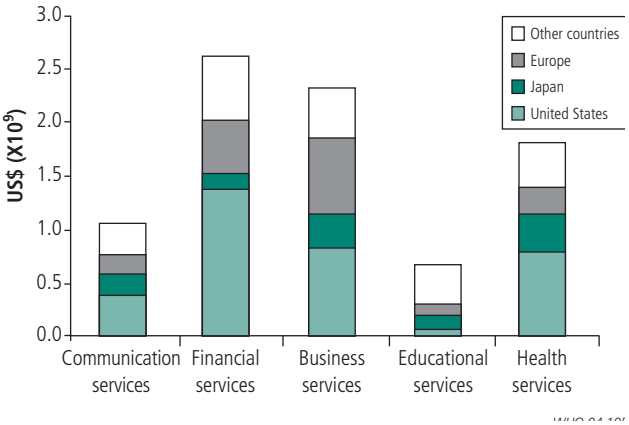

Fig. 2. **Analogous to the movement of substances across a biological membrane, the migration of human capital follows the gradient of career and educational opportunities, dynamically responding to changes in the surrounding milieu. Concomitantly, migration policies and access to higher education in fields relevant to knowledge-intensive industries exert active selection for highly educated and skilled individuals worldwide**

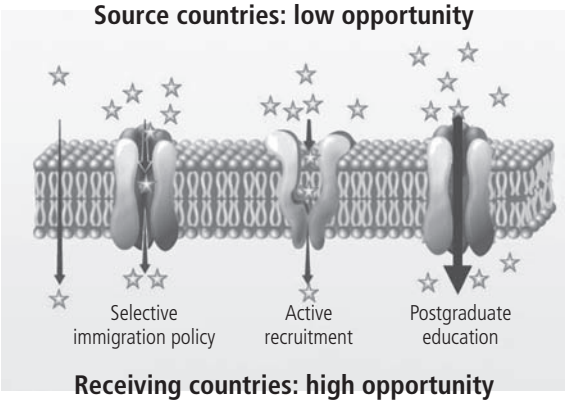

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Fig. 3. **Proportion of degrees in science and engineering awarded to foreign students in three countries, by field, 1999.** Adapted from ref. *7*

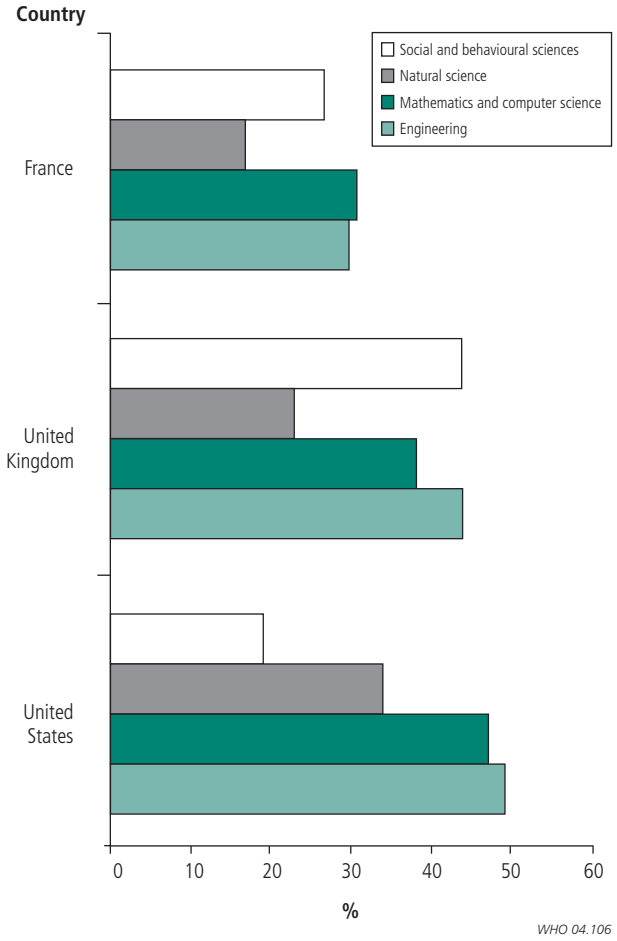
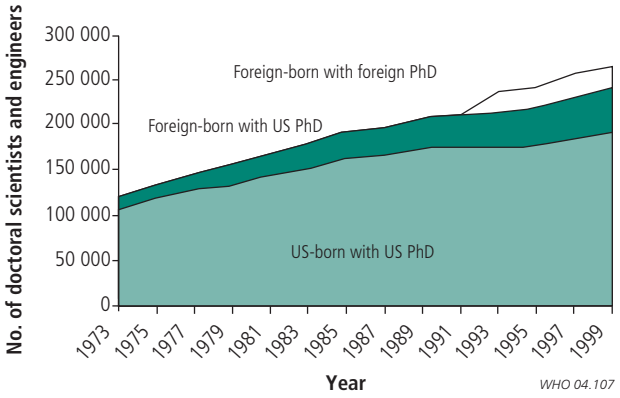


Fig. 4. **Employment of scientists and engineers with doctoral degrees in academia in the United States, 1973–99.** Adapted from ref. *7*



the United States and emerging opportunities at home, including the growing trend of outsourcing technological services (known as "job migration") to developing nations, has begun to alter the gradient of migration for some countries (*10*). For example business services are being moved to countries such as Mexico, and India has become a major provider of outsourced information technology services.

Magnitude and impact of the brain drain

The proportion of highly skilled and educated nationals that has migrated from individual developing countries is generally not known. Yet some data are available. For example, 30 000–50 000 Argentinean scientists and technicians work abroad, and there are fewer than 15 000 full-time investigators in all areas of science working in Argentina (*11*). Similarly, the 2000 emigrants from Colombia who are working in research and development abroad represent approximately half of the 4000 scientists involved in research and development in Colombia (*12*). Despite these striking examples, the availability of up-to-date data on international migrants is limited and imprecise (*13*). Definitions of immigrants vary widely and these variations confound attempts to construct or utilize statistical databases.

Countries that contribute human capital to the brain drain rarely record the characteristics of emigrants. In contrast, countries that receive the migrants, of which there are fewer (Australia, Canada, France, Germany and the United States account for >90% of migratory flow to countries in the Organisation for Economic Co-operation and Development), maintain statistics on foreign-born nationals and immigrants through census data and national databases on education and scientific and technological capacity. Although the proportion of emigrating nationals having secondary level or tertiary level education varies by region and country, immigrants to the United States have a higher level of education than the average individual in their home country. Furthermore, the proportion of the population migrating from either developing or industrialized countries, with few exceptions, is greatest among the most highly educated (*14*).

Although the migration of talented individuals can affect any country, and is intensified by social and economic crises, developing countries face the greatest challenge. Their student emigrants and temporary migrants are most likely to remain abroad. For example, among the doctoral graduates in science and engineering in the United States in 1995, 79% of those from India and 88% of those from China remained employed in the United States. In contrast, only 11% of students from the Republic of Korea and 15% of Japanese students who received their doctoral degree during the same year remained in the United States (*15*). Incentives for migrants to return to developing countries have been insufficient to override the limitations at home, both real and perceived, and the attraction of opportunities found abroad. Thus, in 2000 an estimated 1500 highly qualified Indians returned from the United States but more than 30 times that number leave India each year (*15*). According to the 2002 World Economic Forum report (*16*), Chile and Brazil generally retain their scientists and engineers while Argentina and Colombia do not.

The impact of the loss of highly skilled and well educated individuals differs for countries with different sized economies (*17*). Medium-sized economies in particular may be the most vulnerable since migration can subvert the possibility of achieving a critical mass of capacity to produce and innovate efficiently (*17*). Many of these countries have made significant investments in infrastructure and education but have not achieved the scientific development and technological and innovative capability either to retain or to recover the human capital that they have generated. This raises the question of whether it is justified to continue losing human capital or to make the additional investment in science and technology and bring about the innovations

needed to stop the loss and convert it into wealth generation. Although every country, irrespective of size, must be able to use knowledge to compete in international markets, smaller economies may lack the market or population size to make the acquisition of certain skills profitable; they may thus be less affected by emigration (*17*). On the other hand, large economies may have the diversity of human resources and educational infrastructure to overcome losses resulting from emigration. Nevertheless, the qualitative characteristics of the individuals (creativity, vision, high tolerance for risk) and the population lost through emigration can critically limit specific capabilities that are not readily compensated for either by other endogenously trained individuals or the influx of immigrants.

Contributions from citizens living abroad

Remittances from citizens living abroad constitute a significant proportion of foreign revenue for many developing countries (Table 1) and must be considered when assessing the impact of migration on developing economies (*18*). At the end of the 1990s, among the 20 developing countries receiving the greatest revenues from their expatriate citizens, the contribution to gross domestic product (GDP) ranged from < 1% in Brazil to 24% in Yemen (*19*). Remittances from expatriate Mexicans exceeded US$ 10 billion in 2002 (*19*), equalling revenues generated by tourism (*20*). In Bangladesh, US$ 2 billion is received from citizens who have emigrated overseas, and remittances are the second largest source of foreign revenue (*21*). In Colombia, remittances now exceed by almost a factor of 3 the foreign exchange earnings from coffee exports (Interpress Service News Wire, July 2002). Furthermore, the US$ 1.8 billion received in money transfers from abroad in 2001 was close to 14.63% of Colombia's total export revenues. On a regional scale, according to the Organization of American States and the Inter-American Development Bank, in 2003 Latin America received between US$ 32 billion and US$ 40 billion in remittances (*18*, *19*). Notwithstanding the magnitude and economic importance of remittances, economic development and growth, and ultimately social equity, depend on the endogenous capacity of each nation's human resources.

Investment in research and development

The transfer and management of remittance revenues are potentially exploitable factors in redirecting (or "plumbing") the brain drain. Formalizing the transfer of remittances might permit the generation of revenues that could be invested nationally in the social and economic development of the developing home country. The surge in remittances in the 1990s has stimulated both growth (20% annually worldwide between 1991 and 1996) and diversity in the marketplace for money transfers (*22*). Commercial banks and financial institutions profit by charging fees of 4–15% of the value remitted. In addition, further gain is levied through speculation in the exchange rates applied to the currencies in the sending and receiving countries (*22*), thus raising money transfer costs to as much as 10–25% (*20*).

Mexico has implemented leveraging mechanisms to redirect these resources from spending on consumer goods to investment by introducing cooperative banks as a means of saving and borrowing money for average Mexicans (*18*). Incentives, such as

Table 1. **The 20 developing countries that received the highest amount of remittances (millions of US$) from nationals working abroad, 1999**

Rank	Country	Amount of remittances (millions of US$)	% of GDP[a]	Funds for research and development as % GDP 1998[b]
1	India	11.097	2.6	NA[c]
2	Philippines	7.016	8.9	NA
3	Mexico	6.649	1.7	0.34
4	Turkey	4.529	2.3	NA
5	Egypt	3.196	4.0	NA
6	Morocco	1.918	5.5	NA
7	Bangladesh	1.803	4.1	NA
8	Pakistan[d]	1.707	2.7	NA
9	Dominican Republic	1.613	11.0	NA
10	Thailand	1.460	1.1	NA
11	Jordan	1.460	21.2	NA
12	El Salvador	1.379	12.3	0.08
13	Nigeria	1.292	3.5	NA
14	Yemen[e]	1.202	24.5	NA
15	Brazil	1.192	0.2	0.91
16	Indonesia	1.109	0.8	NA
17	Ecuador	1.084	5.8	0.08
18	Sri Lanka	1.056	6.9	NA
19	Tunisia	761	4	NA
20	Peru	712	1.2	0.06

Source: World Bank (*19*).

[a] GDP = gross domestic product.

[b] The source for these data is the Global Forum for Health Research (*23*).

[c] NA = not available.

[d] Data are for 1997.

[e] Data are for 1998.

remittance bonds and federal or state matching funds, have been introduced to increase the investment of remittances in Mexico, a country in which remittances account for a high level of income (more than US$ 12 billion in 2003) (*19*). Mexico is unique in its effort to channel these resources for national benefit (*18*, *20*).

If only a small percentage of the multimillion dollar sums sent home by emigrants could be invested in research and development, might not opportunities for highly skilled and educated nationals improve at home? And would this not in turn spur economic development? We suggest that innovative mechanisms to recover and invest a portion of the funds transferred home by emigrants working abroad could be used to promote the creation of knowledge-based industry in developing countries, while still maximizing the net amount received by the beneficiary in the home country. For example, mechanisms targeted at reducing transfer costs and providing favourable exchange rates could increase the proportion of the remittance received by the beneficiary while still leaving a margin for investment in opportunity creation. Given the small portion of GDP invested in research and development by most developing countries (*23*) (Table 1), an infusion of resources generated by recovering a percentage of transfer costs could significantly increase investment.

An important proportion of remittances sent from developed countries to developing countries comes from unskilled labourers in lower socioeconomic strata who are not highly educated. Their families in their home country depend on the remittance income, and this income has reduced poverty. Because these remittances may be used to alleviate personal poverty the decision to extract benefits to develop opportunities for others could be perceived as inequitable. However, the option proposed seeks to diminish the margin of intermediation of the formal and informal agents who conduct the transfer at a cost of 10–25% of the sum transferred. Considering that an undetermined but potentially large number of emigrants using these agents could be undocumented workers, the recognition of the economic reality of remittances and the formalization of their transfer would allow the risks (fiscal or legal) to the users, and hence the costs of intermediation, to be reduced. The benefit of this reduction in costs could then be delivered to the recipients' families and 1–2% of the remittance used to support the development of opportunities in research and development in the home country. Thus, only the intermediaries would experience a decrease in income.

Another alternative means of recovering the economic loss suffered by the countries of origin (as result of the emigration of highly educated and skilled individuals) is to find ways through which the direct beneficiaries of these resources can reimburse their countries of origin, perhaps by paying a fee for the training they received in their home country. These fees could be deposited into a national fund to support human resource development. A complementary mechanism that would return a portion of the benefit obtained by the institution or entity that recruited or employed the talent of other countries could also be devised. These institutions or entities should pay a value calculated on the basis of the marginal benefits generated by the highly skilled and educated emigrants from developing countries. Such resources could be collected through taxation in the country in which the emigrant lives and works and transferred to the home country to be deposited into accounts set up to promote research and development. This proposed scheme is a variation of the mechanisms that are already utilized in the field of environmental conservation whereby the countries and the industries within them that produce polluting emissions pay a sum to the countries that do not produce these emissions, and this payment is used protect their forests and other environmental resources (*21*).

Knowledge creation is contextually enabled

It has been estimated that overall one-third of professionals from developing countries who are dedicated to research and development reside and work in a small number of industrialized countries (*14*). Overall, these emigrants produce 4.5 more publications and 10 times more patents than their counterparts at home (*1*). Why is there such a vast difference in productive capacity? The context and conditions in which science and technology are able to prosper require political decisions, funding, infrastructure, technical support, and a scientific community; these are generally unavailable in developing countries (*1*). Knowledge creation is a collective endeavour in which scientific communities play an essential role. This concept of contextual empowerment and collective strength highlights not only the flaws in considering human capital in isolation but also the necessity of building scientific communities to achieve scientific and technological development. The value and effectiveness of individuals depends on their connectedness to the people, institutions and organizations that enable knowledge creation, and that together, constitute a propitious environment (*1*). Scientists, political leaders and decision-makers in developing countries, and international development agencies, need to appreciate the social and synergistic nature of knowledge creation so that policies and education systems are designed to promote and enable knowledge creation.

The example of health services

Health-care services are a rapidly growing sector of the world economy, generating US$ 3 trillion per year (*22*). Trade in health services has created diverse means of accessing these services across borders. For example, information technology can provide telemedical services; industrialized and developing countries export specialized health services; corporate hospital facilities and health-care companies are entering foreign markets; and health-care professionals emigrate from developing countries to industrialized countries, changing the distribution of human resources (*22*). Each of these modalities of international trade in health services affects the infrastructure, employment opportunities, competitiveness of wages and working conditions of health-care personnel, and they also have consequences for the equitable availability of quality health care. Whether the impact is positive or negative depends on policies, existing conditions in the health sector and whether revenues from trade in health services are invested to foster improvements in the domestic health sector.

The persistent flow of health-care workers out of a country causes shortages of specialist personnel. For example, more than 70% of physicians trained in Zimbabwe in the 1990s have left their country as have 60% of Ghanaian physicians trained in the 1980s (*24*). On the other hand, the international trade in health care conducted in developing countries brings about improvements in standards of care, infrastructure and employment conditions, as well as in compensation, all of which address the root causes of brain drain in the health sector (*24*). Policies are needed to ensure that these favourable outcomes are realized as is equitable access to the benefits of the international trade in health services.

Building research and development capacity in developing countries

The same factors that promote migration (poor compensation, inadequate working conditions, weak leadership and an adverse sociopolitical climate) are also associated with failed attempts to build research capacity (*25*). Some countries, such as Brazil, have worked to counter these factors by investing in education and in research and development; they have thereby promoted opportunity at home and, ostensibly, discouraged emigration. Brazil's education system currently graduates 6000 doctoral students each year (*26*). Today more than 90% of Brazilian doctoral graduates receive their degrees from Brazilian universities. In contrast, in 1985 more than 40% of doctoral degrees obtained by Brazilians were awarded by foreign universities, mainly in the United States, United Kingdom, France and Germany. Although the proportion of Brazilian researchers migrating has increased to 5.3% of those awarded doctoral degrees between 1993 and 1999 much of this loss is compensated for by the influx of foreign students and researchers, principally from other Latin American countries (*27*). The availability of both high quality education and opportunities in research and development are keys to retaining and attracting regional talent. For these reasons Brazil has become a focal point for regional talent.

Building opportunities for national development

The steps taken by China towards becoming a leader in biological research and biotechnology illustrate the empowerment that ensues when focus, political and social decisions, and investment in research and development converge. The advocacy and conviction of China's scientific leadership positioned China to become the only developing country participating in the Human Genome Project (*28*). The political decision was brought to fruition by the Ministry of Science and Technology in 1998 with the inauguration of the Chinese National Human Genome Center, with branches in Beijing and Shanghai. A year later the Chinese Academy of Sciences opened the Beijing Genomics Institute. Experience gained through the participation of these institutions in the Human Genome Project (including large-scale sequencing, the use of bioinformatics and the coordination of multicentre research protocols) provided the platform for developing biotechnology that can be applied to human diseases and agriculture. This capacity, coupled with China's numerous, unique, ethnically homogeneous subpopulations and foresight in establishing biological sample banks, position the country to make rapid advances in the field of medical genetics. The growth in biotechnological capability has also led to innovations in financing research and development companies: government support of universities allows them to spin-off start-up companies and also provides investment capital as low-interest, long-term loans. In 2002 China invested US$ 2.5 billion in basic scientific research; this came mostly from government sources (*29*). The opportunities generated by the Chinese ventures in biotechnology attract both international collaboration in joint ventures and gifted scientists from China and abroad.

The brain drain is a potential threat to China's research and development initiatives. The US National Science Foundation estimated that 33 000 Chinese students were enrolled in graduate programmes in the United States in 1999. About 90% of those graduating that year intended to stay in the United States (*30*). Yet a trend to return has begun (*2*). Chinese researchers in China and abroad have recently developed an innovative approach to offering world-class graduate education in China (*30*). With funding from the Chinese Academy of Sciences, the Shanghai Institute for Biological Sciences offers a year-long course in molecular and cell biology for 200 students. The course is conducted in Chinese by 25 Chinese faculty members: 10 of whom are based in China and 15 of whom are based in the United States. The sum of US$ 20 000 covers the expenses of the 15 guest lecturers who each participate for one week (*30*). Though still evolving, this approach to creating targeted educational opportunity together with political decision and investment in science and technology infrastructure provides a good example of a resourceful way of redirecting the brain drain. It is tempting to think that such on-site programmes involving national talent at home and abroad coupled with creative distance learning strategies could create access to world-class education in specific disciplines in the developing world.

The challenge of the brain drain

The challenge of redirecting "brain recirculation" is to find ways of creating opportunities at home. Potential nuclei for development could be established by focusing on research and development that is based on national priorities and niches of opportunity. The requirements necessary to achieve this include:

1. implementing educational strategies that support and nurture these nuclei through both targeted national programmes and training abroad;
2. investing in infrastructure for research and development and creating conditions that foster the growth of public-sector and private-sector demand for research results, technological development and innovation;
3. building an enlightened leadership and an enabling national scientific community that advocates internally and externally for the coherent development of scientific and technological capacity.

Scientists who have emigrated are recoverable assets that can play a part in developing opportunities at home. However, recovery requires the opening of diverse and creative conduits. One of these could be the strategic channelling of remittances to generate investment in research and development and used together with government matching funds and/or fiscal benefits as incentives. Another potential return conduit of emigrants' capacities would be to engage them in innovative graduate education opportunities at home and in technology transfer in areas of national priorities for research and development. Ultimately, involving individuals who are living abroad in creating opportunities at home favours both the retention and repatriation of national talent. Perhaps these and other strategies to achieve return flows of human resources and capital, together with the participation of the scientific community in national development through planning and policy, could indeed change the landscape of opportunity. ■

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Résumé

Endiguer la fuite des cerveaux

Les possibilités offertes ailleurs sont l'élément moteur de l'émigration. La nouvelle économie mondiale fondée sur les connaissances ouvre des perspectives sans précédent dans le secteur tertiaire à forte intensité de savoir en créant une demande de qualifications et de compétences supérieures que l'offre ne parvient pas à satisfaire. Les branches concernées pèsent des milliards de dollars, qu'il s'agisse de l'information, de la communication, des finances, des affaires, de l'éducation ou de la santé. Les principaux pays industrialisés sont des pôles d'industries de services à forte intensité de savoir et par conséquent des centres de recherche-développement qui, grâce à une politique d'immigration sélective, à des possibilités d'emploi intéressantes et à un recrutement ciblé, attirent des talents du monde entier. La quête d'une formation supérieure est l'autre raison qui amène les élites des pays moins développés vers les centres de l'économie mondiale du savoir. Ce sont donc à la fois les possibilités de formation et les perspectives de carrière qui sont à l'origine de la fuite et du « recyclage » des cerveaux. Ainsi privés d'une grande partie de leurs esprits les plus capables et les plus fertiles, les pays en développement tardent à constituer le capital humain nécessaire à la création du savoir. Pour inverser le mouvement et faire en sorte que les richesses intellectuelles soient mieux réparties dans le monde, les pays en développement doivent appliquer des stratégies audacieuses et créatives étayées par des politiques nationales qui visent à offrir des possibilités de formation dignes de ce qui se fait de mieux dans le monde, à mettre sur pied des industries de recherche-développement fondées sur le savoir et à financer ces stratégies. C'est la voie suivie par le Brésil, la Chine et l'Inde, qui assurent désormais une formation de tout premier ordre dans les domaines cruciaux pour leur développement, comme la biotechnologie et l'informatique, et qui, parallèlement, investissent dans la recherche-développement. De ce fait, seule une faible proportion des éléments les plus diplômés quittent le pays car les opportunités offertes dans le secteur de la recherche-développement séduisent les candidats locaux et attirent même des étrangers.

Resumen

Redirección de la fuga de cerebros

Las oportunidades son la fuerza impulsora de las migraciones. La demanda insatisfecha de enseñanza superior y de conocimientos especializados, producto de una economía mundial basada en los conocimientos, ha creado oportunidades sin precedentes en el sector de los servicios con alta densidad de conocimientos. Este sector, que mueve billones de dólares, comprende la información, la comunicación, las finanzas, los negocios, la educación y la salud. Las principales naciones industrializadas son también el centro neurálgico de las empresas de alta densidad de conocimientos, y como tales constituyen el escenario de actividades de investigación y desarrollo que atraen activamente a los individuos con más talento de todo el mundo mediante políticas de inmigración selectiva, oportunidades de empleo y contratos focalizados. La enseñanza superior es otra vía de transferencia de personas de talento de los países menos desarrollados a los centros de la economía mundial basada en los conocimientos. Combinadas, esas oportunidades profesionales y educativas impulsan la «fuga y recirculación de cerebros». La fuga de una gran parte de los individuos más competentes e innovadores de las naciones en desarrollo dificulta el logro de la masa crítica requerida a fin de generar el contexto propicio para la creación de conocimientos. Con miras a corregir la asimetría de los movimientos y distribución de los individuos de más talento a nivel mundial, los países en desarrollo deben poner en práctica, con el respaldo de políticas nacionales, estrategias audaces y creativas encaminadas a: ofrecer oportunidades educativas de nivel mundial; desarrollar industrias de investigación y desarrollo con alta densidad de conocimientos, y financiar de forma sostenible las inversiones necesarias para esas estrategias. El Brasil, China y la India han avanzado en esa dirección, ofreciendo educación de categoría mundial en áreas cruciales para el desarrollo nacional, como la biotecnología y las tecnologías de la información, paralelamente a la realización de inversiones en investigación y desarrollo. Como resultado, sólo una pequeña proporción de los individuos mejor preparados migran a otros países, y las iniciativas de investigación y desarrollo emplean a profesionales nacionales e incluso atraen a inmigrantes.

Arabic

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