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**Enhancing development through knowledge circulation:
a different view of the migration of highly skilled Mexicans**

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Introduction: Migration and development

While the advance of globalisation has highlighted the need for a new development paradigm focused on individuals and based on the concept of sustainable human development¹, knowledge, in the form of education and scientific or technological investigation, has increasingly become a key catalyst in the struggle against poverty and the desire to improve peoples' quality of life². International migration represents an integral aspect of the globalisation phenomenon (UNFPA and IMP, 2004), and it also forms part of the development process. Within this context, the relation between migration and development has acquired an enormous relevance in the current political debate in which the so-called "expatriate brains" have been identified as potential agents of development, insofar as legal international migration is an area which mainly concerns the most highly skilled individuals (Adams, 2003).

There has been an increase in the international movement of highly skilled workers since the early 1990s as a result of growing global demand for specialists, the advance of globalisation and the extraordinary developments in information and communication technology (ILO, 2004). Since then, the discussion has focused on trying to resolve the question as to whether the *exodus* of the most qualified individuals has a negative impact on development, or if such movement actually provides potential benefits for the population remaining behind in the countries of origin.

Traditionally, brain drain was considered to be a loss for the South, but over the last few years it has ceased to be perceived as entirely negative. The recent focus has been on the ability of migrants to advance development in their countries of origin through the flow of financial remittances, which are still the most visible outcome of international migration (Adams, 2003), as well as through social remittances consisting of regular transfers of knowledge, abilities, experiences, attitudes and other forms of human, social and financial capital (Ammassari and Black, 2001). As such, migrants have become agents of development for technological progress, economic growth, social development and environmental well-being (OECD, 1995).

If we consider the fact that little research is carried out in the South³ and that production systems there are fragile (Lema, 2004), together with the reality that most knowledge and information are generated within the Northern industrialized countries before flowing towards the lesser developed South, while the flows of highly skilled individuals are generally in the opposite direction, we can see how the knowledge, abilities, experiences and other resources

¹ Defined as human development (Sen, 1999) or human flourishing (Boltvinik, 2005), the concept of sustainable human development suggests a holistic vision that includes three dimensions of sustainable development: social equity, environmental preservation and economic responsibility (Bolay, 2004), and assumes that development liberates individual capacities and human needs, thus ending poverty and improving individuals' quality of life, offering a secure life with full rights and liberties in the long term.

² UNESCO (1998) defines 'knowledge society' (a more ample concept than the information society) as an economic and social system in which knowledge and information are fundamental sources of well-being and progress and which represents a development opportunity for developing countries.

³ Although developing countries account for 79% of the world's population, they account for only 27% of all scientific researchers, according to UNESCO's Institute of Statistics. According to information from this Institute, in industrialized countries there are on average ten times more researchers per million inhabitants than is the case in developing countries. In other words, three out of every thousand people in industrialized countries are researchers while only three out of every ten thousand are researchers in developing countries. In terms of investment in science, developing countries dedicate 0.9% of their GDP to research and development while industrialized countries dedicate 2.4% (UNESCO, 2003).

cooperation policies of other industrialized destination countries that host highly skilled Mexican immigrants.

The content of this article is structured as follows. We start by introducing the issue of migration-development before going on to define what we mean by highly skilled individuals, which we follow up with a brief overview of the traditional brain drain focus and an explanation of the change of paradigm towards that of brain gain. In both cases, we contrast the divergences of the most important literature with the studies and outlook of the phenomenon of highly skilled migrations in Mexico. We then present three examples of alternative brain gain mechanisms, which have been shown to make the most of the skills of the qualified human resources originating from the South. Next we examine the most important scientific public policies that have been applied to promoting research and reversing the negative effects of the brain drain in Mexico. We then attempt to measure the magnitude of highly skilled Mexican migrations. This section starts by defining the characteristics and dynamics of the Mexican population in Switzerland based on an empirical study, and which pays special attention to their impact on development. Finally, we conduct an overview of Swiss policies on scientific development cooperation as an example of development cooperation policies in other destination countries. The article ends with a review of the main conclusions and recommendations.

Who are highly skilled individuals?

The OECD Canberra Manual (1995) defines the term 'highly skilled' as human resources in science and technology (HRST hereafter), referring to those individuals who comply with one of the following characteristics: individuals who have successfully completed third level education, which implies at least 13 years of schooling (Carrington and Detragiache, 1998) within an area of science (knowledge) or technology (application of knowledge); and/or those persons who may not necessarily have had such an education, but who are employed within an area of science or technology and who hold positions that normally require tertiary education.

Accordingly, highly skilled resources consist of three types of individuals: individuals who have completed tertiary education and are employed in a professional area within the fields of science or technology; individuals with this educational background and who are not employed in a professional area within science or technology; individuals who do not have such an education but who are employed in a professional area within science or technology. On this basis, this distribution implies that individuals who do not belong to the HRST are individuals without tertiary education and who are not employed within a professional area of science or technology.

Parallel to our study of HRST migrations, we believe that it is equally important to study the movements of tertiary education students who, as semi-finished human capital (Khadria, 2001), have a tremendous value which should not be allowed to be ignored.

A traditional focus: brain drain

Global political discussion on the issue of HRST migrations originated during the 1960s with the first studies referring to brain drain, and this triggered an intense debate, especially in

The concept of an internal brain drain (Castaños-Lomnitz [coord.] 2004) appears in the literature and refers to those highly qualified individuals (Mexicans), who return to their country of origin after graduating from a foreign university or after a period working at a foreign research centre, but who abandon their academic career in pursuit of other professional activities. In Mexico, this phenomenon has become increasingly widespread because of the difficult conditions confronted by career academics, fundamentally due to the scarcity of positions, infrastructure and resources.

Temporary brain drain (Félix, 2003) refers to student assistants and academics involved in “technical” scientific work at foreign research centres and who provide raw data (information, symbols and concepts for subsequent application) to laboratory directors or projects through their research. These individuals are becoming symbolic analysts, and they are helping to create a new working class within the knowledge economy. According to Félix (2003) the temporary brain drain has a greater impact on the South than the permanent brain drain. In other cases, the terms brain waste (Salt, 1997), underemployment (Licea de Arenas, 2004) or over-education (Pecoraro, 2004) are used to describe those HRST expatriates from the South whose knowledge is not used in their countries of destination since they are employed in jobs below the level of their education, skills or experience, or even because they are excluded from the labour market. This scenario is becoming increasingly common, and it highlights the paradoxical situation whereby the countries of origin lose human resources of great value while the destination countries often fail to take advantage of such capital (Riaño, 2003).

Change of paradigm: brain gain, brain exchange and brain circulation

Moving beyond an understanding and explanation of the brain drain phenomenon, the past few years have seen a new interest in proposing and establishing national policies that permit the flow of knowledge, experiences and other elements within science, innovation and the creation of new knowledge. The notion of brain drain, which is the starting point for the study of HRST migrations, began to show its explanatory limits as it passed from general formulae to specific studies and the generation of public policies that were created to confront the phenomenon (Meyer and Charum, 1995).

In contrast to the traditional vision of brain drain, a new perspective referred to as brain gain came into use. This emphasized the positive impact that HRST migration can generate in terms of remittances, the return of highly skilled expatriates to their countries of origin, and the creation of networks promoting knowledge exchange or programmes fomenting cooperation or the circulation of knowledge, thereby advancing the formation of human capital in the countries of origin.

According to Meyer and Charum (1995), brain drain came to be considered as available emigrated capital, susceptible to mobilization for the benefit of the countries of origin. Thus, the perception of brain gain came into fashion, recognizing that “migrant brains” do not always represent definitive losses for developing countries (Johnson and Regets, 1998; Gaillard and Gaillard, 1999; Meyer, 2001; Khadria, 1999; Charum et al., 1997). Rather, from an internationalist perspective, HRST expatriates can be used to benefit both the countries of origin and the host countries⁷.

⁷ The internationalist argument in the brain flow debate during the 1960s and 70s admitted that the international circulation of people and skills had positive effects. Actually, the benefits of international circulation were never

Alternative mechanisms to brain drain

There is little evidence as yet to show that the HRST repatriation strategies adopted in the North as well as in the South to motivate or force expatriate élites to return to their countries of origin have had a significant positive impact in the majority of countries. Meanwhile, expatriate HRSTs have increasingly demonstrated their affective capital (IOM, 2005), which we can define as the interest and the will to make a contribution to their countries of origin.

If we take these two factors into consideration we can see that there is a growing need to study the new mechanisms, alternatives to the traditional perception of brain drain, which have been implemented to reinforce the skills of HRST expatriates from the South. We also need to understand the circumstances under which HRST expatriates have been able to contribute to the development of their countries of origin and to identify ways in which HRST expatriates have had a positive impact, if any, on development and poverty reduction in the countries of origin through a systematic use of knowledge, experiences and resources (for example, through their participation in the creation of micro enterprises, employment generation, scientific and technical cooperation, implementation of community development projects, creation of scientific and technological centres, attraction of investment for research and experimental development, etc.).

Recent research suggests that these strategic brain gain mechanisms demonstrate a great potential for mutually beneficial and effective North-South and South-South cooperation. This allows us to emphasise the idea that there is another perception of HRST migration from the South that goes beyond the brain drain.

Creation of scientific diaspora networks

The idea of a diaspora is based on the inspiration of a transnational population that has emigrated to another country but which continues to maintain its ties with the homeland (IOM, 2005). The notion of a scientific diaspora was conceived as a consequence of the inability of many developing countries to replicate the controversial but successful structural brain gain model of Southeast Asia, which involves the reintegration of HRST in their countries of origin. It came about as a new conception of the relationship between the HRST who had emigrated and their countries of origin. It was considered unnecessary to bring about the physical return of those who, following their integration in the new cultures for the production of knowledge and the construction of technological objects, were willing to co-operate with the scientific and technological communities in their countries of origin (Meyer et al. , 1997).

Scientific diasporas are based on networks in which HRST dynamically maintain and advance academic, scientific and entrepreneurial ties with the countries of origin, principally through new communication and information technologies, promoting a circulation of knowledge, abilities and resources. This alternative is considered as a means of benefiting from the presence of scientific nationals overseas (Gaillard and Gaillard, 1999), given the fact that the countries that send their talent away have the opportunity to actively recuperate the skills of those who have emigrated (Charum, 2001). These networks are based on the idea that every expatriate HRST can contribute to the homeland, irrespective of where in the world s/he may be located.

One of the most important collaborators and researchers of the Caldas Network argues that diaspora networks are engaged not only in scientific research but also in issues related to economic and cultural development (Charum, 1998). Moreover, their mere existence can provoke a new geopolitical context in which: original centres of knowledge production are created in the South, new efforts to attract scientific and professional élites are produced in industrialized countries of the North, migrations of élites are accelerated and new circulation and migration routes are created. Consideration of these elements is necessary to understand the functions, roles and potential use of these networks.

Barré et al. (2003) state that scientific diasporas are motors for development since their contributions and proposals can form part of public policies. As such, the role of scientific diasporas as agents of development in the reduction of poverty and stimulation of growth are becoming increasingly relevant in a debate that attempts to study the extent to which its potential ensures equal benefits for migrants, host countries and countries of origin (IOM, 2005).

Investment in research and experimental development (RED)

Some countries have developed important scientific and technological centres in the countries of origin using the resources of expatriate HRST. The best known example of this is India, which boasts a well developed higher educational system, producing a considerable number of highly skilled HRST who increasingly occupy top positions in the world's most important and prestigious technology firms and research centres, especially those located in the United States. More and more researchers from the Indian Institute of Technology - Madras (IIT) receive offers to take up professional or postgraduate positions in the United States immediately after they have finished their studies, and from there they continue to collaborate with the IIT or to create joint ventures with institutions in India.

The generic applicability of information and communication technologies (IT) is considered to be one of the main reasons behind the numerous migrations of HRST from India's IT sector (Khadria, 2001) (Xiang, 2001). In this sense, the globalisation of human capital no longer implies the simple physical movement of professionals but rather it also includes the global application of skills in various specialized areas.

The reference literature shows how Indian HRST expatriates, especially those residing in the United States, play an absolutely strategic role in terms of attracting investment for research and experimental development (RED) in India, the growth of industrial exports, the foundation of health and educational institutions and the creation of a development model that could be used as a blueprint for other developing countries suffering from brain drain (Tarifica Ph. Ltd., 1998; Khadria, 1999; Saxenian, 2000; Khadria, 2003). Some estimates suggest that HRST expatriates have facilitated a third of all the foreign investment in India since 1991 (Tarifica Ph. Ltd., 1998). Along these lines, Xiang (2001) suggests that migrations of Indian HRST should no longer be viewed in a negative light, but rather they should be seen as an opportunity to benefit from an Indian brain bank located overseas.

India is one of the few developing countries that has been able to attract an enormous amount of investments to RED centres (mainly in Bangalore), most of which have been founded and established by well known multinationals such as Lucent Technologies, Microsoft, Sun Microsystems, IBM, Oracle, etc. Furthermore, some Indian HRST expatriates who have

the acquisition of new knowledge that leads to action and policies that respond to social needs in an effective manner. However, in order to ensure that these programmes become true development instruments for the South, it is absolutely necessary that they be carried out within a framework of scientific cooperation. This should include adequate policies to ensure subsequent work opportunities in the countries of origin and to prevent these temporary scientific exchanges from becoming permanent stays in developed countries, thereby provoking a brain drain from the South (KFPE, 2004).

Public scientific policies to promote research and reverse the brain drain in Mexico

Various international conferences have recommended making use of the experience and knowledge of HRST expatriates in order to stimulate development. The purpose of such dialogues is to identify policies, in the North as well as in the South, which can maximize the net benefits of HRST migrations. The International Organization for Migration (IOM) recently launched a series of proposals directed at governments (those of industrialized countries as well as those of developing countries) to promote diasporas as agents of development (IOM, 2005)¹⁰.

In the case of Mexico, public policies have mainly focused on matters concerning remittances and looking after the interests of Mexican communities in North America. They have paid little attention to identifying the tools and mechanisms that permit the government to interact with HRST expatriates, not only in the United States and Canada, but in other destination countries as well, in order to estimate the positive impact of their knowledge, experiences and social resources on development¹¹. Similarly, it is only recently that the literature on migration concerning Mexican HRST has started to toy with the idea of taking advantage of expatriate élites (Didou, 2004; Licea de Arenas et al. , 2003; Castaños-Lomnitz, 2004).

Valenti (2002), for example, suggests taking two dimensions of the brain drain phenomenon into consideration: the factors associated with the loss of talent for a country and the low levels of institutional development that prevent the countries of origin from taking advantage of the scientific and technological links with HRST expatriates. On the other hand, Félix (2003) suggests studying ways of benefiting Mexico's higher research institutions as well as research there in general through an analysis of the flows of Mexican postgraduate students abroad.

What types of scientific public policies have been used by Mexico in recent years to promote research and reverse brain drain?

¹⁰ Discussed in the conference: *Migration and Development: Mainstreaming migration into developing policy agendas*, which took place in February 2005 in Geneva, within the International Dialogue on Migration of the IOM.

¹¹ The Institute of Mexicans Abroad (<http://www.sre.gob.mx/ime/>) is basically in charge of attending to the interests of Mexicans located in the United States and Canada and is in contact with some of the most important Latin American organizations in the United States. This interaction with Mexican communities could also be encouraged through connections with organizations and networks of Mexicans in other countries (above all with scientists and highly skilled professionals) in which the Mexican community has begun to have a considerable presence. Going further than these possible connections, Mexican institutions should encourage and participate in the creation of such networks, as the Colombian government did in the establishment of the Caldas Network. The initiative of the Mexican Embassy in Switzerland, Open Dialogue with the Community, could be a first step in this direction.

The Mexican Researcher Retention and Repatriation Programme, also known as the “Repatriation Programme”, was created in 1991 by the Mexican government through Conacyt, its aim being to retain HRST in Mexico and reverse the brain outflow. The institution facilitates the return of Mexican scientists from abroad and seeks to incorporate them into higher education academic institutions and scientific research centres in Mexico and the SNI in order to increase and strengthen scientific development and the advancement of human resources in science and technology. According to information from the SIICYT, this programme succeeded in repatriating and retaining 1,859 researchers between 1991 and 1999, a figure that corresponds to approximately half of the scholarship students and almost a third of the members of SNI in 1999. The majority of repatriates came from the following six countries: United States (40%), France (15%), Great Britain (13%), Spain (9%), Canada (5%) and Germany (5%), which are also the main countries to which Mexican scholarship students go to study.

According to Conacyt, approximately 1,400 Mexican researchers were repatriated in the period between 1991 and 1997 (an annual average of 200), and this required an investment of approximately 126.6 million pesos during these seven years (approximately US \$11.5 million). Despite the elevated cost, the Repatriation Programme has not been able to effectively implement its objectives because of the lack of opportunities in Mexico for scientists wishing to repatriate and form part of a research centre. Furthermore, the laboratories, equipment and other materials that are needed to guarantee the continuity of the research projects of repatriated scientists are usually insufficient.

In this respect, the Mexican academic sector will unquestionably find itself left behind because of insufficient government support and the lack of alternatives in Mexico. This situation could, however, be improved if there were stronger links between the private and academic sectors. In overall terms, the Repatriation Programme does not have the capacity to redress the international imbalances that attract the highly qualified élite towards the centres of major scientific and technological advancements in the industrialized world (Castaños-Lomnitz, Rodríguez-Sala and Herrera, 2004).

The strategies employed by the Mexican government have basically been the traditional approaches of retaining, repatriating and attracting HRST. No attempt has been made to support or implement innovative mechanisms, such as the creation of diaspora networks or similar initiatives whose purpose is to circulate knowledge and share research.

Magnitude of Mexican student and HRST migrations

If the international mobility of scientific élites is a natural extension of the cosmopolitan tradition of the world’s scientific community (Meyer, 2003), globalisation has certainly provoked a greater internationalisation of the labour market and higher education (Iredale, 2001), as well as a strengthening of the selective policies of host countries (World Bank, 2004). This has translated into an increase in HRST migrations over the last few decades (UNFPA and IMP, 2004; World Bank, 2004). Moreover, individual factors, such as personal and family relations, have played an increasingly important role in the flow of HRST from developing countries towards the resources and conditions of industrialized countries (Riaño, 2003).

experienced a brain drain to the United States are: El Salvador (approximately 35% of its population with a tertiary education were located in the United States in 2000), the Dominican Republic (25%), Guatemala (25%), Mexico (16.5%) and the Philippines (11.7%).

Migrations of HRST are ever more complex. They no longer follow fixed paths in terms of direction or density (Ouaked, 2002; Guellec and Cervantes, 2002), and volumes have increased significantly. In the case of Mexico, movements of emigrants have become more complex and heterogeneous, and cover many different types with large and growing volumes (López Vega, 2003). Moreover, the statistics are insufficient, and in the most common international databases (UNESCO and OECD) the information on Mexico is incomplete and irregular, which prevents a specific understanding of the magnitude of the phenomenon and its characteristics. People are aware of the significant movement of students and Mexican scientists abroad, but there are no available figures that permit an exact understanding of how many Mexican HRST live and work outside the country. In other words, we can say that the Mexican brain drain has not been quantified.

At a global level, we know that the principal country of destination for HRST emigrants continues to be the United States and that Mexico is the main country of origin in this case¹⁷. More precisely, we can estimate how many Mexicans educated to tertiary level reside in the United States thanks to the availability of information used to measure the volume of human resource migration towards the United States, and determine their level of education (Adams, 2003). However, this information is not available for the other popular destination countries receiving Mexican HRST.

From the available data, researchers have attempted to measure part of the Mexican brain drain through the application of different methodologies, thereby obtaining some relevant information that can undoubtedly help to obtain more information on the magnitude and characteristics of the Mexican brain drain, in addition to enabling discussion and the formulation of public policy proposals.

For example, in the case of the principal country of destination for Mexican HRST, according to the United States Population Census and the Annual Population Report of the United Nations, the aforementioned IMF study (Carrington and Detragiache, 1998) presents information on the level of education of the foreign national population in the United States and compares this information with the levels of education in the immigrants' countries of origin. In this way, the authors were able to estimate the magnitude of Mexican HRST migration in relation to the Mexican HRST who stayed at home.

Mexico is the country with the largest number of migrants located in the United States. These totalled 2,743,638 (migrants over 25 years old) in 1990, (Carrington and Detragiache, 1998) and 2,027,880 of these had secondary education (9 to 12 years of schooling), 368,540 had reached primary education (0 to 8 years of schooling), and 347,212 (almost 13%) had undertaken tertiary education (13 years or more of schooling) (Table 1).

Mexico continued to be the principal source of emigrants to the United States in 2000 with a total of 6,374,825 (migrants over 25 years old). It is also the principal country of origin for human resources with a tertiary education (Adams, 2003), with a total of 895,515 Mexicans fitting this category, 6.67% of whom had undertaken higher studies (postgraduate, Master's

¹⁷ According to the United States Population Census in 2000, of the total number of immigrants (31,107,000), 29.5% were Mexicans (9,177,000) (Adams, 2003).

which usually involves the movements of more educated individuals, who may even have a higher level of education than those who remain in the country (Adams, 2003).

Estimates also exist of the volumes of Mexican HRST residing in the European Union. For example, according to data from the Mexican Ministry of Foreign Affairs (SRE)¹⁹ and in line with information from embassies and consulates in the region, there are almost 29,000 Mexican resident in the European Union, 70% of whom (approximately 23,000) have had tertiary education. It is estimated that 46% of the total number (13,148 Mexicans) emigrated to study while nearly 40% (11,146 Mexicans) did so for personal/family reasons, as many form part of binational marriages or unions.

In order of importance, the countries with the greatest concentrations of Mexicans are Spain (approximately 11,000), Italy (5,000), Germany (4,000), Great Britain (2,500) and France (1,400). This data, however, contrasts significantly with official sources in the destination countries²⁰. For example, according to official statistics from France, the total number of Mexicans residing in that country with a residential permit was 4,516 as of 31st Dec. 2003²¹.

There are also studies that attempt to quantify the Mexican brain drain on the basis of data from Conacyt on the number of scholarship holders abroad, with these figures being compared to those for persons who subsequently take up scientific activities in Mexico and who join the SNI (Licea de Arenas et al., 2003; Castaños-Lomnitz, Rodríguez-Sala and Herrera, 2004; Castaños-Lomnitz [coord.], 2004). The use of this methodology, which seeks to measure the desertion of academic personnel (Castaños-Lomnitz, Rodríguez-Sala and Herrera, 2004), can be understood in terms of the lack of quantitative and qualitative information on the destination of ex-scholarship holders, as there is no efficient system to register and monitor the scholarship holders that permits the detection of those who do not return to the country after they have finished the studies funded by the scholarship. Conacyt does not have an updated register of this type.

Castaños-Lomnitz, Rodríguez-Sala and Herrera (2004) explore the Mexican brain drain by monitoring full-time academic personnel in institutes for higher education and scientific research who have carried out postgraduate studies abroad during more than one year without returning full time to the institution of origin and/or who did not become member of the SNI. The results of this research show that the desertion of full-time academics during the period 1980-1991 totalled 953 people, 49% of whom were located outside of Mexico (external outflow), while 45% changed institutions upon their return to the country (internal outflow). In this analysis, we can see that the majority of external as well as internal demand is within the technological disciplines: physical sciences, engineering and natural sciences.

Another study (Licea de Arenas, 2004) studies the highly skilled during the period from 1980 to 1998, and observes that 1,678 students receive their Ph. D. s from universities in the United States. Of these only slightly more than 20% (only 363) returned to the SNI to explicitly seek

¹⁹ The information was provided by the Mexican Embassy in Germany updated with 2005 data.

²⁰ It is important to note that the SRE figures are relative, given that registration with Mexican consulates or embassies is not required. As a result, SRE calculates a variation between 12% and 15%, thereby approximating figures in the registries of migratory authorities in destination countries. In addition, it is important to consider that, in general, the figures do not take into account persons with dual nationality – individuals who are nationals of Mexico as well as a destination country.

²¹ According to statistics from the French Ministry of the Interior:

http://www.interieur.gouv.fr/rubriques/c/c2_le_ministere/c21_actuelite/2003_03_11_rapport_immigration/Rapport_immigr_BAT.pdf

OECD, approximately 1.5 million students studied in another OECD member state in 2000, while more than 50% came from non-member OECD countries. There were 475,000 in the United States, 223,000 in Great Britain and 187,000 in Germany (OECD, 2002). Although the majority of students intend to return to their countries of origin upon completion of their studies, an important percentage remains on a permanent basis. For example, the OECD (2002) estimates that approximately 47% of those who are born abroad and who complete a doctorate in the United States remain there for an indefinite time.

**Table 2. Mexican students in foreign academic institutions by country of destination
2000-2002**

Country	2000		2001		2002	
	<i>Number</i>	<i>%</i>	<i>Number</i>	<i>%</i>	<i>Number</i>	<i>%</i>
Australia	73	0.5	131	0.9	334	1.8
Austria	63	0.4	68	0.5	46	0.3
Belgium	68	0.5	76	0.5	72	0.4
Canada	778	5.5	n/d		n/d	
Chile	14	0.1	80	0.6	94	0.5
Czech Republic	4	0.0	7	0.0	2	0.0
Denmark	15	0.1	13	0.1	23	0.1
Finland	13	0.1	16	0.1	21	0.1
France	n/d		961	6.8	1,136	6.2
Germany	417	2.9	502	3.5	588	3.2
Great Britain	1,182	8.3	1,405	9.9	1,466	8.0
Hungary	0	0.0	3	0.0	3	0.0
Iceland	0	0.0	1	0.0	2	0.0
India	3	0.0	1	0.0	4	0.0
Ireland	4	0.0	5	0.0	7	0.0
Italy	31	0.2	43	0.3	49	0.3
Japan	108	0.8	106	0.7	103	0.6
Korea (Republic of)	6	0.0	5	0.0	6	0.0
Malaysia	0	0.0	1	0.0	0	0.0

Ministry²⁵ a total of 795 Mexican students were studying in the country in 2003, making Mexico the second most important country for foreign students after Brazil (902 students).

We can conclude that there is indeed a significant brain drain of Mexicans toward the United States and that the movement of Mexican students to that country is reaching increasingly considerable numbers and shows a tendency to increase in the same way as other destination countries. However, what about other countries? What are the volumes of Mexican HRST and students in other destination countries? And moreover, what are the professional activities of these highly skilled Mexicans and what types of links do they maintain with Mexico?

Considering the fact that the principal methodologies that have been used up to now to measure the Mexican brain drain use only partial and incomplete data, and with the idea of applying a change of paradigm that focuses on the potentials of highly skilled Mexican expatriates, we believe that there is an urgent need for research that monitors HRST Mexicans in some of the other main destination countries.

With a view to making an initial contribution in this direction, we will now quantify the presence of Mexican HRST in Switzerland and examine their socio-professional position using the official Swiss statistics, an exercise that could be extended to other countries where the presence of Mexicans is even greater. It is important to mention the fact that Switzerland is the tenth principal country of destination for Mexican students. It is also a country with its own particular policy for development cooperation and public scientific policies, which could be used as bridges to maximize the potential of HRST migrations to favour the countries of origin through mechanisms and strategies intended to provide a more balanced knowledge production. Further on, we will define the particular characteristics of Swiss cooperation policy in order to identify areas of opportunity to strengthen collaboration between countries of origin of the HRST and the destination countries, but first we will look at the profile and dynamics of the Mexican population in Switzerland.

Profile and dynamics of the Mexican population in Switzerland

Until the mid 1990s, most Mexicans migrating to Switzerland did so primarily for personal/family reasons having gone there to form part of binational marriages, with most cases involving marriages between Mexican women and Swiss citizens. However, this tendency has changed over the last ten years due to an intensification of economic, educational and even tourist exchanges between the two countries prompted by the advance of globalisation, which has seen an increasing number of Mexicans emigrate to Switzerland for professional or educational reasons²⁶.

According to data from the Mexican Embassy in Switzerland, almost 1,000 Mexicans emigrated to Switzerland between 2000 and 2005, and approximately 80% of these did so for professional reasons. It is estimated that between 100 and 150 Mexicans arrive annually with temporary work contracts to work for Swiss companies. Accordingly, more and more young Mexican professional couples emigrating to Switzerland form part of the group termed 'skilled

²⁵ Data are from statistics from the French Ministry of the Interior: http://www.interieur.gouv.fr/rubriques/c/c2_le_ministere/c21_actualite/2003_03_11_rapport_immigration/Rapport_immigr_BAT.pdf

²⁶ The number of Mexican students in Switzerland is increasing, reaching almost 100 in 2003 (See Table 2).

Table 3: Number of Mexican residents in Switzerland 1995-2003

1995	1996	1997	1998	1999	2000	2001	2002	2003
923	1,054	1,152	1,145	1,230	1,342	1,556	1,698	1,801

Note: The data for each year correspond to December 31.

Source: Swiss Federal Statistical Office and Foreign Population Structure and Migration Statistics (PETRA).

According to official Swiss statistics, Mexicans were the sixth largest group of Latin American residents in Switzerland in 2003 accounting for 4.6% of the total and preceded in the ranking by Brazil, the Dominican Republic, Chile, Colombia and Peru (Table 4). Brazilians clearly occupy first place in the ranking of Latin American emigrants, accounting for 11,062 individuals or 28.7% of the total Latin American population in Switzerland in 2003. In 2003, individuals from the ten principal Latin American countries of origin represented 90% of the all Latin Americans, accounting for 34,779 persons out of a total figure of 38,554.

Table 4: Ten principal countries of origin of Latin American residents in Switzerland (2003)

<i>Country</i>	<i>Total</i>	<i>%</i>
Brazil	11,062	28.7%
Dominican Republic	5,450	14.2%
Chile	3,827	10.0%
Colombia	3,751	9.7%
Peru	3,115	8.0%
Mexico	1,801	4.6%
Argentina	1,758	4.5%
Ecuador	1,541	4.0%
Cuba	1,499	3.8%
Venezuela	975	2.5%
<i>Total 10 most important (90%)</i>	34,779	90.2%
<i>Total Latin American population</i>	38,554	100%

Note: In 2003 the foreign population in Switzerland totalled 1,623,586 people, of whom 2.37% were of Latin American origin (corresponding to a total of 38,554 people).

Source: Swiss Federal Statistical Office and Foreign Population Structure and Migration Statistics (PETRA).

According to data from the Swiss Population Census in 2000, more than 60% of the Mexicans over 25 years of age and resident in Switzerland were highly skilled. Accordingly, and as we can see in Table 5, of the 780 Mexicans from this age range resident in Switzerland in 2000, 483 (61.92%) had tertiary education, 192 (24.61%) had a secondary education and 105 (13.46%) had only a primary education.

Table 6. Number of professionally active Mexican residents in Switzerland by level of education (2000)

<i>Total</i>	<i>Primary Education</i>	<i>%</i>	<i>Secondary Education</i>	<i>%</i>	<i>Tertiary Education</i>	<i>%</i>
347	219	63. 1%	83	23. 9 %	42	12. 1 %

Note: 0.86% correspond to 3 professionally active Mexicans in Switzerland who did not indicate their level of education.

Source: Swiss Population Census, 2000

It is important to mention that 32% (111 Mexican HRST) of the 347 Mexicans who were professionally active in 2000 occupied high level positions (Table 7). In specific terms, 16 Mexican professionals (11 men and 5 women), representing 4.6% of all professionally active Mexicans, were in senior management positions. Ninety five Mexican professionals (50 men and 45 women) corresponding to 27.4% of the total number of professionally active Mexicans were employed as lecturers, academics and/or scientific researchers in high-level intellectual positions.

If, indeed, highly skilled emigrants are those who have the greatest potential to be agents of change (Ammassari and Black, 2001), the figures previously cited reveal the important potential for Mexican HRST residing in Switzerland to have a positive impact on the development of Mexico.

Table 7. Number of Mexicans in Switzerland in high level positions by professional category and gender (2000)

	<i>Total</i>	<i>Men</i>	<i>Women</i>
Total	111	61	50
Professionals in senior management positions or other high level positions	16	11	5
Lecturers, academics or scientific researchers in intellectual, high level positions	95	50	45

Source: Swiss Population Census, 2000

According to data from the Swiss Population Census, 27% of Mexican HRST who were professionally active in 2000 (94 Mexicans) were involved in professional activities within administration, banking, insurance and legal areas; 21% (75 Mexicans) were involved in professions related to health, education, culture and scientific areas while 10.37% (36 Mexicans) were involved in technical professions and computing (Table 8).

111 Mexican HRST have the possibility to act as agents of change. In terms of student migration we know that Switzerland is the 10th most important country of destination for Mexican students who are studying abroad and that the numbers of Mexican students in the country is increasing at an average annual rate of 14.8% (according to data from 2000 to 2002, see Table 2).

Little has been known to date about the participation of Mexican HRST expatriates and students in the production of scientific, technological, socio-economic and cultural knowledge and their involvement in activities which benefit Mexico. Similarly, the conditions that promote such resource mobilization and the effects of such involvement are not well understood, especially in countries outside of North America. In the advancement of such an understanding, we have conducted the first stage of empirical research on the Mexican community in Switzerland, and this has enabled us to obtain information that supports the idea that there is another way of perceiving HRST migrations from the South, which goes beyond simply perceiving them as an irreversible loss³⁶.

For this first stage of our research we have surveyed 102 Mexican expatriates. The data obtained so far is still provisional so we must exercise prudence and avoid making too many conclusions. Nevertheless, this study has uncovered some key elements which we can use as a basis for subsequent stages in our research and for predicting some future trends.

1. In terms of the professional activities undertaken by Mexicans in Switzerland, we have identified five groups into which we were able to place 75 people: university or postgraduate students (20 individuals), scientific researchers (8 women!), high management level professionals (27 individuals), professionals working within international organizations (10 individuals) and professionals working in the fields of art and culture (10 individuals).
2. The main reasons for Mexican immigration to Switzerland include: personal reasons (marriage to Swiss citizens), professional reasons (temporary work offers that occasionally become permanent) and educational reasons (temporary students who can become permanent residents).
3. Mexican students are concentrated in the French region of Switzerland³⁷. 65% are working on Master's or doctoral studies. The majority intend to return to Mexico when they complete their studies. 70% of the students planning to return to Mexico intend to

³⁶ This is the first stage, as yet inconclusive, of an empirical study that evaluates the migration of highly skilled Mexicans to Switzerland, within the broader project "From brain drain to brain dream: circulating knowledge of highly skilled migrants to promote development". The methodology that we have used in this first stage of research consists of a brief survey of the majority of Mexican expatriates located in Switzerland. To locate the greatest numbers of Mexicans possible, we have been supported by the valuable collaboration of various AMEX, the Mexican Embassy and some consulates. Some institutions of higher learning (above all universities and federal institutes of technology) have enabled us to reach Mexican students as well. In general we have observed a positive reaction on behalf of the Mexican community, as well as an overall general interest in the study. We have adopted a procedure for progressive communication (rolling or snowball) in which key people have provided new contacts, enabling us to gradually extend our network of identified Mexicans. The solidarity and support of certain individuals have been valuable in motivating other Mexicans to collaborate in this study. This corroborates the premise that HRST expatriates increasingly demonstrate their affective capital, in that immigrants are interested in participating in initiatives that recuperate skills to the benefit of their countries of origin.

³⁷ According to information from Conacyt, there are currently five Mexican scholarship alumni in Swiss institutions of higher education, at the Graduate Institute of International Studies in Geneva, the Swiss Federal Institute of Technology in Lausanne, and the University of Lausanne. The areas of knowledge include law, biology, economy, chemistry and architecture.

conditions, such as adequate public policies that permit the efficient investment of such capital.

In this manner and in order to identify some strategies aimed at facilitating the flow of scientific knowledge production to the South in which the expatriate students and researchers themselves participate, it is important to ask what types of public policies are required in the host countries to mobilise the resources of expatriate Mexican HRST, and specifically to define the role of the development cooperation policies of some of the countries receiving Mexican HRST.

Cooperation policies in destination countries: Switzerland's scientific cooperation for development

Given their transnational nature, emigrant communities have an added value both for destination countries and countries of origin. Cooperation policies that promote the mobilization of such a value should originate in both countries, under what is known as co-development, first initiated by the French government in 2000 (IOM, 2005), which gives equal recognition to the importance of brain drain and the growing potential of HRST expatriates in the promotion of development.

What does Switzerland's scientific development cooperation policy consist of within the framework of its policy for development cooperation? What specific elements of this policy favour the circulation of knowledge and take advantage of the skills of HRST from the South?

Scientific cooperation for development (Bolay, 2004) implies three main points of departure that need to be approached in terms of objectives and methods, with a view to understanding how it operates and comprehending the way it affects other policies defined at a national level and the strategies that are put into practice. The first is the quality of scientific production in North-South partnerships, or how to achieve excellence in scientific production which responds to certain specific criteria. The second is the conditions of scientific production, taking into account that cooperation implies, by its very nature, a partnership between individuals and institutions situated in different geopolitical and historical contexts. The third is the objectives of scientific production for development, whose implicit or explicit aim is to support a sustainable improvement to the living, environmental, economic and social conditions of the countries in the South, which benefit from such cooperation.

Some recent evaluations of cooperation projects show how difficult they can be to manage. The lack of financial resources experienced by scientific institutions in the South frequently results in the emigration of HRST, quite often the most brilliant of all, towards regions that offer them a better chance to develop professionally³⁸. The same financial restrictions mean that governments try to satisfy immediate needs, whereas the objectives of scientific research and higher education are more long term in nature and require a permanent effort. These pressures, to which we can add a bureaucratic system that is unaware of what is at stake,

³⁸ Poor countries, therefore, indirectly subsidize the development of a scientific élite. However, this must be clarified by the fact that many expatriate scientists conserve ties with their countries and institutions of origin; this is the case of Colombian researchers residing in industrialized countries through the Caldas Network (Rincón et al., 2001) (<http://www2.colciencias.gov.co:8888/redcaldas/info.html>). It is also the case of researchers from the Indian Institute of Technology-Madras (IIT), who continue to collaborate with the IIT or conduct joint ventures with entities in the country of origin while they work or study in the United States.

On the other hand, it is important to analyse scientific cooperation for development from a more strategic and political perspective. In Switzerland, which has one of the highest levels of GDP per capita in the world, it is estimated that private companies were responsible for 7.4 billion Swiss francs of the 10.7 billion designated for research and experimental development activities in 2000⁴², a financial participation which has seen a constant annual decline of 3% since 1994. Apart from this finance, 2.7% of GDP during the 1990s (CEPF, 2002) was also characterized by sector concentration (chemicals, metals and electromechanics of more than 50%) with private enterprise being a predominant component (Kleiber, 2001). The portion set aside for scientific partnerships with developing countries is difficult to estimate, on both the Swiss and the international level, and experience has shown that it remains very limited⁴³.

These financing restrictions have had an impact on the cooperation for development sector, resulting in the low credibility of North-South research due to its poor integration in major programmes and international scientific networks, which in turn results in poor visibility and recognition for initiatives taken in this area⁴⁴.

The Swiss Ministry of Education and Research (SER)⁴⁵ has reorganized the decentralized academic and research institution networks⁴⁶, and has opted for a more direct intervention by the federal government with regard to the definition of priorities, financing conditions and the awarding of credits. The recentralization of policy in this field, which is strategic for the future of Switzerland, aspires to place the country's scientific sector in a better position within the international context, not only in terms of basic research but also in terms of applied research. Within this constantly changing context⁴⁷ and bearing in mind the geopolitical position of Switzerland, the internationalization of science passes first through Europe, and then broadly through North America (its main socio-economic partners), and then moves on to benefit the large emerging Asian powers (China and India). Beyond this strategy, which is the conventional model for European countries as a whole, the Swiss government now defines, for the first time, a true policy of scientific cooperation with emerging and developing countries (Benninghof and Leresche, 2003).

The SER has outlined the elements of an external scientific policy characterized by prioritising certain regions and countries, through the introduction of new instruments and/or the strengthening of existent mechanisms. In this way, and on a level that extends beyond

⁴² According to information on the web page http://www.interpharma.ch/fr/291_608.asp. Office of Federal Statistics, Neuchâtel.

⁴³ For example, the Swiss Agency for Development and Cooperation (SDC, Swiss public agency for cooperation) reserves 5% of its budget (totalling nearly 60 million Swiss francs per year) to support scientific research in Switzerland, developing countries or through international networks.

⁴⁴ As a reaction to this marginalization of scientific cooperation for development, the SDC and the Swiss National Fund for Scientific Research got together to put into practice new programmes of research support (first through a programme focused on environmental issues, then through a North-South research partnership programme and since 2002 through a national competition associating seven Swiss institutions with foreign partners in developing countries (<http://www.nccr-north-south.unibe.ch/>), in which Mexican academic institutions of higher education and scientific research centres have participated).

⁴⁵ The State Secretariat for Education and Research (previously the Group for Science and Research) has been directed since 1997 by Charles Kleiber, a trained architect and public health specialist.

⁴⁶ This has been historically explained by a federalist Swiss structure and the traditional role of the Cantons in university financing.

⁴⁷ Not only in terms of a scientific and technological transformation that designs the globalisation of exchanges (Bolay, 2004), but also in terms of a transformation of Swiss foreign relations policy, which finds itself in a difficult period since the population's rejection of a national referendum on initial negotiations for Switzerland's integration into the European Union in 1992.

“Focal Points”; scholarships and cooperation between national funds. There are three criteria for scientific and technological cooperation: a focus on balanced collaboration focussed on common scientific excellence, exchanges concentrated in areas of common interest and exchange and scholarships as basic components of each project⁵⁰.

The scientific cooperation policy with developing countries mirrors the reforms that have taken place within this sector in Switzerland: a better definition of priorities and the establishment in terms of scientific areas, of strategic points, disciplines and the distribution of financial resources; improved efficiency in management of the sector through a strengthening of coordination between institutions and a concentration of decision-making power at a national level⁵¹; even closer links between national and international scientific priorities, and a technological evaluation of these and their economic consequences.

In view of recent events in Switzerland, as well as the spread of these same trends on a global level, we can make the following conclusions with regard to our three main starting points: the quality, conditions and the aims of scientific production. First of all, scientific quality within an international partnership implies mutual recognition of the competencies and complementarities of each player. If we examine the main countries for Swiss scientific cooperation, the concern is that this form of scientific cooperation for development may produce new knowledge barriers within the third world between a minority of emerging countries and the majority of developing countries.

Overcoming these new socio-cultural divisions means that all new cases of these very selective scientific partnerships must be accompanied by regional dissemination, where the countries receiving Swiss scientific cooperation become true focal points within the regions to which they belong, through South-South scientific cooperation which completes the mechanism that eliminates the effects of the North-South partnership⁵².

Secondly, the conditions for scientific production are basically characterized by disparities between partners of the North and their counterparts in the South, firstly in terms of finance, but also in terms of access to quality information (Rossel and Glassey, 2004), infrastructure and equipment. Nor must we forget the professional responsibilities and socio-cultural obligations associated with this function in some societies that have hierarchical structures which are different to those in western countries. These inequalities should be compensated for by adapted forms of positive segregation, which strive to adapt the conditions of productivity to local circumstances and the imperatives of international cooperation at an individual and institutional level.

⁵⁰ Currently the Swiss government grants four scholarships per year to Mexican students studying for a postgraduate degree in Switzerland through a bilateral accord with the Mexican government, which in turn grants four scholarships to Swiss students to study in Mexico. According to information from the Mexican Embassy in Switzerland, many of the Swiss scholarships are not used; for every two Swiss nationals who study in Mexico through the scholarship programme, only one Mexican conducts studies in Switzerland.

⁵¹ The choice of priority countries for scientific cooperation (also valid for development and humanitarian cooperation) is not conducted within the scientific community or parliament. Rather, it is the product of a process of internal decisions (of SER and SDC).

⁵² This is what we proposed elsewhere in terms of scientific cooperation between Switzerland and Chile, with the latter becoming a platform for extending scientific cooperation to other Latin American Spanish speaking countries (Bolay, 2005), of which Mexico could benefit.

In the case of Mexico, three political responses that have tended to dominate the debate should be borne in mind: the retention of HRST in their countries of origin; the return or circulation of HRST to their countries of origin – whether temporarily or permanently; and thirdly the mobilization of the diaspora⁵⁵, which can be used to confront the possible adverse consequences of a process that is on the increase. The proposal of retention seeks to improve the general educational level of the population as well as quality of life and access to opportunities.

Accordingly, those who draw up and direct Mexican scientific policies should implement effective strategies to retain the highly skilled by focusing on methods that eliminate the structural imbalances that encourage such migration. At the same time, public policy decision makers must also consider policies that go beyond the physical repatriation of highly skilled scientists and professionals, using other mechanisms of association that recover the skills and talent of HRST⁵⁶. As such, we believe it is absolutely necessary to promote links and activities between Mexican HRST expatriates and their country of origin.

Data collection on immigrant communities abroad is one of the principle areas on the agenda of migration and development⁵⁷. It is obvious that research needs to be done to monitor Mexican HRST in destination countries and to understand their professional activities and the links they maintain with Mexico (or the links that could be created) in order to take advantage of their resources in strengthening and advancing development objectives.

This preliminary study should be considered as a point of departure to encourage more research on the presence of Mexican HRST in other countries where their volumes are larger. The data examined provide an example to prompt the perception of the migration of the most highly skilled Mexicans as provision of emigrated capital that can be mobilised on behalf of Mexico. In specific terms, they help to perceive Mexican students in Switzerland as trailblazers of knowledge and technology for their country of origin. The Mexican scientific community and active professionals can be perceived as investors, providers of social help and artistic and cultural exchanges, and, like the students, as trailblazers of knowledge and technology that benefit Mexico, as well as providers of financial resources.

Nevertheless, many issues remain unresolved and we will attempt to settle these in the next stages of this study. We must improve our understanding of the circumstances and specific conditions that encourage the mobilisation of the knowledge and resources of HRST expatriates so that they effectively reach the country of origin. We must also study the participation of highly skilled Mexicans in science and technological systems in the countries of destination and in the production and distribution of international knowledge, as well as their relationship with programmes that promote economic progress in Mexico from wherever in the world they may be. The road for future research into these remaining areas of study remains open.

⁵⁵ Refers to the 3 Rs studied by Wickramasekara: retention, return and resourcing (Wickramasekara, 2003).

⁵⁶ An association could be established on the basis of thematic affinities, as in the case of the Caldas Network.

⁵⁷ The IOM recently recommended to immigrant-sending governments that they identify the type of their diasporas abroad and the level of education and professional activities of their members within the countries of destination, with the objective of designing policies that permit interaction between them and links to their political agendas (February 2005 in the Conference: *Migration and Development: Mainstreaming Migration into Developing Policy Agendas*, within the wider international dialogue on migration).

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