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

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Global Commission on International Migration

In his report on the 'Strengthening of the United Nations - an agenda for further change', UN Secretary-General Kofi Annan identified migration as a priority issue for the international community.

Wishing to provide the framework for the formulation of a coherent, comprehensive and global response to migration issues, and acting on the encouragement of the UN Secretary-General, Sweden and Switzerland, together with the governments of Brazil, Morocco, and the Philippines, decided to establish a Global Commission on International Migration (GCIM). Many additional countries subsequently supported this initiative and an open-ended Core Group of Governments established itself to support and follow the work of the Commission.

The Global Commission on International Migration was launched by the United Nations Secretary-General and a number of governments on December 9, 2003 in Geneva. It is comprised of 19 Commissioners.

The mandate of the Commission is to place the issue of international migration on the global policy agenda, to analyze gaps in current approaches to migration, to examine the inter-linkages between migration and other global issues, and to present appropriate recommendations to the Secretary-General and other stakeholders. The Commission's report was published on 5 October 2005 and can be accessed at www. gcim. org.

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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 development[1], 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 life[2]. 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 South[3] 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).

acquired by highly qualified migrants in their countries of destination have become important catalysts for development.

The aim of this paper is to reach a better understanding of the ways in which highly skilled migrants can become agents of development. This paper studies the Mexican community in Switzerland[4] and attempts to show the relevance of the relatively unnoticed and unappreciated role of migrant élites in the production and distribution of knowledge to the benefit of their countries of origin[5]. Similarly, the paper seeks to identify the conditions and public policies, in host countries as well as countries of origin, which encourage the effective flow of knowledge and other resources towards the countries of origin and which permit their efficient use and investment.

Up to now little has been known of the position of highly skilled migrants – Mexican expatriate students, scientists and professionals – within the industrialised countries of destination. This article offers a number of clues that can be useful in helping to establish a different perspective of the migration of highly skilled Mexicans, especially in terms of on how their skills and knowledge can be used to promote progress in Mexico as well as in the receiving countries.

This article has four specific objectives. The first objective is to reveal the importance of a paradigm change with regard to the theories that have been used to explain migrations of highly skilled Mexicans, reinforcing the idea that there is another way to perceive the exodus of élites from the South towards industrialized countries. With this purpose in mind, we offer a brief overview of the phenomenon of the Mexican brain drain theory and we examine this theory by contrasting Mexican literature with the most relevant international theoretical contributions of recent years. The second objective of this article is to uncover new information on the volume of migrations of highly skilled Mexicans and the methodologies that have been used to measure the brain drain from Mexico.

The third objective is to examine how, and to what extent, the unnoticed participation of expatriate Mexican élites has aided the production of scientific knowledge, and to measure the unexplored potential of these individuals in terms of advancing development. With this objective in mind, we analyse the profile and activities of the Mexican community in Switzerland, where our definition of highly skilled individuals covers students, scientists and professionals or intellectuals occupying high level professional positions. The fourth objective is to take a look at some of the mechanisms that can facilitate the flow of knowledge from industrialized countries to the South in a more direct and balanced way, through a brief analysis and study of Swiss scientific development cooperation as an example of development

[4] This is the first stage, as yet inconclusive, of an empirical study on the migration of highly skilled Mexicans in Switzerland, within the research project "From brain drain to brain dream: circulating knowledge of highly skilled migrants to promote development" whose objective is to study the potential contributions to origin countries of Mexican scientists and highly skilled professionals living in industrialized countries. Based on the idea that expatriates can be converted into agents of development instead of irreversible losses for their countries of origin, this project attempts to evaluate the potential value of highly skilled expatriates in the production and distribution of knowledge to the benefit of developing countries. The project also studies the role of scientific cooperation policies within destination countries, which encourage knowledge circulation and promote development of the South.

[5] Flow of knowledge, as a factor in development, assumes the interaction between technical, institutional and entrepreneurial components. Highly skilled human resources constitute a fundamental role in the linkage and integration of these factors, above all as promoters of relationships between groups and people who generate global scientific and technological knowledge, and at the same time as communicators of knowledge generated in their countries of origin (Ortega Salazar et al. , 2002).

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

terms of the loss to developing countries resulting from their diminishing élite population. The term brain drain was first used to describe the migration of scientists and engineers from Europe, particularly Great Britain, to the United States, which is still the primary destination for HRST migrants (Lowell, 2003).

The brain drain concept is based on the theory of human capital and involves the free circulation of HRST in search of the best opportunities in the most optimal conditions (Iredale, 2001). It is defined as significant levels of HRST emigrants locating to foreign countries on a permanent or temporary basis without there being a positive net effect on the country of origin, through, for instance, technology transfer, trade or investment (Lowell and Findlay, 2001). According to Lowell (2003), two conditions are necessary if the term brain drain is to be applied to a country of origin: firstly, there should be a significant loss of the country's highly skilled population and secondly, this loss must result in net adverse economic consequences. According to Adams (2003), brain drain occurs when a country loses more than 10 percent of its tertiary-level educated population to emigration.

In the last decade, and coinciding with an intensification of the globalisation debate, the brain drain issue was revived within research and political discussion, and this highlighted the negative effects for developing countries and its impact on economic progress. As such, the majority of the literature describes brain drain as flows of HRST in one direction: from the periphery to the centre (Salt, 1997; Carrington and Detragiache, 1998; Cervantes and Guellec, 2002), and emphasizes the losses to countries of origin because of the scarcity of highly skilled workers (Lowell, 2003) and an inverse transfer of technology (Salt, 1997). These discussions culminated in a collection of studies by the International Labour Organization (ILO)[6] which, although the authors agreed that international migration can provide important benefits to developing countries, concluded that in overall terms, brain drain definitively reduces economic growth in the South due to the loss in education, investment and the reduction in human capital (Lowell and Findlay, 2001; Lowell, Findlay and Stewart, 2004).

In the case of Mexico, there has been an increase in the number of students, scientists and highly skilled professionals emigrating to the North over the last few years. This increase is partly due to the traditional internationalisation of science (Didou, 2004), but it is also a result of Mexico's inability to generate sufficient employment, especially for its highly skilled workers (La Jornada, 30/06/05). Despite this situation, the issue has not been given the importance that it deserves and the only interest shown has been sporadic and unsystematic, which has resulted in a dearth of literature on the dynamics and effects of Mexican HRST migrations.

However, there are a number of theoretical articles and empirical studies that are worthy of mention. In these contributions, there is a predominance of the traditional paradigm that considers the movement of HRST as a drain and they adopt a nationalistic stance, denouncing the North's "raid" of Southern brains and the resulting "decapitalization" of developing countries to the benefit of the North. Following these lines, Licea de Arenas (2004) affirms that the intellectual capital of countries such as Mexico will not grow as long as industrialized countries continue to attract their HRST, a situation which increases the North's productivity at the South's expense.

[6] The studies were conducted under the supervision of the ILO within the project: *Skilled labour migration (the brain drain) from developing countries: Analysis of impact and policy issues* (Lowell and Findlay, 2001).

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 countries[7].

[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

Other terms have evolved with the use of 'brain gain' to define the highly skilled migrant outflow phenomenon in a more positive way. For example, the term brain exchange (Salt, 1997) describes the scientific and technological exchange of knowledge and experience between countries of origin and those of destination, and which benefit both. From a wider perspective, the term brain circulation (Johnson and Regets, 1998; Cervantes and Guellec, 2002) refers to the cycle that begins with the HRST moving to a foreign country – usually to study – working in the host country and finally returning to his/her country of origin with new experiences, knowledge and occasionally, savings (López Vega, 2003).

Ackers (2004) conceptualises HRST migrations not only in terms of permanent individual movements but also as part of an active and continuous process, and dissociates the transfer of technology from the physical location of the migrants, arguing that transfers (of knowledge, experiences and even technology) can take place through agreements, programmes or cooperation projects even when the HRSTs are temporarily or permanently located in the host country. Meanwhile, Khadria (1999) refers to the second generation effects of brain drain by considering that HRST migrants have the capacity to participate in activities that contribute to the development of their countries of origin (nation-building activities) and he studies the possibilities for promoting a return flow of resources to the countries of origin, which can substitute and replace what was initially lost.

On the other hand, optimal brain drain (Lowell and Findlay, 2001; Adams, 2003; Lowell, Findlay and Stewart, 2004) refers to the effect that occurs when a moderate level of HRST emigration from a country increases the overall educational level of its population. This argument is based on the idea that the possibility of working abroad and obtaining better salaries acts as an incentive for individuals to study more, thereby increasing the educational level of the country and stimulating economic growth.

In a study carried out for the ILO, Wickramasekara (2003) suggests sharing the gains of HRST migrants and he outlines policies that advance the circulation of knowledge to the benefit of the countries of origin as well as the destination countries. For countries of origin, he suggests policies whereby human resources remain or return, thereby attracting investments by expatriates or fomenting diaspora networks while in the case of destination countries, he recommends more flexible visa policies that help to promote the circulation of "brains", the promotion of knowledge networks and links to the countries of origin as well as offering support to the diaspora community for the purposes of endogenous development.

The literature contains many case studies of Asian countries referring to the exchange of knowledge and there are examples of the positive consequences which reveal the growing number of business and service opportunities generated through HRST expatriates (Song, 1992; Luo and Wang, 2001; Krishna and Khadria, 1997; Khadria, 2001). Moreover, some countries in Southeast Asia (such as the Republic of Korea and Taiwan) have implemented national policies – in the form of scientific and technological structures – which make the most of the skills acquired in other countries and which have contributed to the economic takeoff in the countries of origin (Meyer and Charum, 1995). These satisfactory productive return experiences, however, have not been repeated in Latin America (Charum and Meyer, 1998; Pellegrino, 2001).

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questioned. In addition, it was admitted that science benefited from scientific 'nomadism' (Meyer, Kaplan and Charum, 2001).

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 prominent researchers of this alternative argues that this contact approach is an effective method of transforming brain drain into brain gain, which can offer significant opportunities for cooperation in countries of origin as well as in receiving countries (Meyer, 2001). Another recent publication (Barré et al., 2003) concludes that such diaspora networks are an important tool for development, allowing the combination of government policies in the countries of origin and the receiving countries with voluntary organization initiatives.

According to Meyer (2001), the emergence and growing recognition of scientific diasporas as strategic instruments during the past few years are a result of the convergence of three factors: the significant increase in the number of HRST expatriates from the same countries of origin, leading to interactions and collective work; the evolution of new communication and information technologies, which has facilitated cross-border exchanges; and the ever increasing recognition that knowledge is a basic catalyst for development. These elements endow HRST with a social function and greater recognition than ever before (Meyer, Kaplan and Charum, 2001). The rapid emergence of such intellectual diaspora networks is also founded on a dichotomous situation in which many expatriates identify themselves as belonging not only to their country of birth but also to their country of destination (Charum, 2001), with the expatriates considering themselves as part of a transnational population (IOM, 2005).

The most representative examples of the impact of the scientific diaspora option include the South African network, SANSA (South African Network of Skills Abroad) because of its significant contributions to the development objectives of South Africa (Brown, Kaplan and Meyer, 1999; Brown, 2003), and the Caldas Network of Colombia[8], which has been the most important reference case in Latin America (Charum et al., 1997; Charum and Meyer, 1998; Granés et al., 1998).

The Caldas Network of Colombian Scientists and Engineers Abroad was set up in 1992 as an initiative by Colombian researchers and university students residing abroad, and it was one of the first projects in the world to reunite the scientific diaspora of a country, the aim being to link these highly skilled expatriates to scientific and technological activities in Colombia[9].

Studies of the Caldas Network have shown the viability of this new formation of expatriate élites (Charum and Meyer, 1998); and in some cases, the cooperation between the members has endured and reached significant results (Posada Florez, 2002). One of the first studies of the Caldas Network (Charum et al. , 1997) identifies five types of contribution to Colombia's development objectives made by the HRST abroad: the design and implementation of public policies, participation in the development of human resources in science and technology, mobilization and communication – referring to the organization of scientific gatherings and shared information acquired through academic conferences, professional offers or scholarships, proposals and applications of programme and projects, and scientists returning to and reintegrating in Colombia.

[8] http://www2. colciencias. gov. co:8888/redcaldas/info. html

[9] The Caldas Network as a communication instrument for the exchange of scientific and technological exchange between Colombian researchers located abroad and the national scientific community was supported by the Colombian Institute for the Development of Science and Technology "Francisco José de Caldas", based on the firm belief that the human resources of the diaspora could significantly contribute to the advancement of Colombia's development objectives. While the Caldas Network had nearly 1,000 members in more than 25 countries in its early years (Meyer and Brown, 2001), the network began to lose strength by the 1990s due to a lack of resources and a general crisis in Colombian science and technology.

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

become wealthy abroad have created foundations that support health and education projects or other types of infrastructure in their countries and regions of origin (Khadria, 2003).

A World Bank publication (World Bank, 2004) brings attention to the high level positions occupied by Indian HRST in prestigious corporations over the last twenty years, especially in the United States. This represents an important opportunity for India's decision makers to transform the loss of brains into gains for development (Saxenian, 2000). Nevertheless, political strategies should concentrate on reversing some of the negative consequences that such experiences have provoked. This includes the economic polarization of India insofar as only certain regions and sectors of the country (for example, Bangalore) have benefited from brain drain, leading to selective economic growth that has been unable to end the country's social marginalisation and poverty. China has also faced a similar phenomenon.

North-South Research Partnership Programmes

North-South partnership programmes encourage the participation of researchers from developing countries in research programmes and temporary exchanges which give HRST from the South access to the knowledge, infrastructure and equipment of the North. These temporary exchanges permit the transfer of knowledge, skills and other social and cultural resources in both directions (North-South and South-North), and can be considered as alternative methods for preventing brain drain and transforming it into brain gain.

Within the context of international cooperation on matters of development, the issue of North-South research programmes began to acquire importance during the 1990s (RAWOO, 2001) as a result of the increasing recognition that they could be used to encourage and strengthen research capacity in the South (Hurni, Lys and Maselli, 2001; RAWOO, 2001; Maselli, 2002). The end objective of such programmes is to ensure that the new experiences and knowledge are applied in the countries of origin of the HRST, thereby contributing to the advancement of sustainable development (Bolay, 2004; Hurni, Wiesmann and Schertenleib, 2004).

Some studies have attributed important brain gain results in Africa to such North-South partnership programmes, which have contributed to improvements in the quality of research in African universities (Mohamedbhai, 2004; IOM, 2004). The best known of these partnership programmes include MIDA (Migration for Development in Africa), which uses African diaspora experiences for development projects in countries of origin, and TOKTEN (Transfer of Knowledge Through Expatriate Nationals), which promotes consultancy firms that allow expatriates to work for short periods in their countries of origin.

Waast (2003) argues that scientific cooperation between African countries and industrialized countries is a key instrument for progress in Africa because of the fundamental role that scientific activities and research play in sustainable development. It is a well-known fact that African HRST in developed countries have an important role to play in the creation of scientific and technological exchanges, which increase productivity and competitiveness not only in countries of origin but also in host countries, and this adds up to a positive sum of mutual benefits instead of a loss to Africa (TWAS, 2004; IOM, 2004; UNESCO, 2004).

Such partnership research programmes can clearly act as bridges for the circulation of knowledge, skills and experiences to the mutual benefit of the North and the South, and they can represent an innovative and creative solution for development. These programmes permit

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 development[11]. 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.

Scientific research in Mexico has gone through different stages, and we highlight three of these here. The first is the development of human capital in science and technology in Mexico and abroad, conducted through the Conacyt scholarship programme. The second stage is that of the stimulation and recognition of scientific and technological research through the National Research System. The third is a stage that promotes the retention of Mexican researchers who are working in national institutions, and the return of those researchers located abroad through the Repatriation Programme.

The creation of the National Council on Science and Technology (Conacyt) in 1970 led to an increase in the development and training of human resources dedicated to the production of scientific knowledge and technological innovation in Mexico. This was especially due to the graduate scholarship programme, which is one of the principal promotional policies used for the stimulation of knowledge creation. It is also one of the main sources of support for Mexicans wishing to continue their education in Mexico or abroad. Conacyt estimates that about 75% of the scholarships offered by public and private institutions in Mexico are granted through its own scholarship programme (Ortega Salazar et al. , 2002).

According to data from Conacyt, 100,020 scholarships were awarded during the period between 1971 and 2000, with 74% of these being for studies in Mexico and 26% for studies abroad, and a total of 88,513 students and/or researchers[12] benefited from these. It is important to note that there is still an appreciable inequality in terms of the granting of scholarships. 70% of the scholarships awarded during this period went to men while only 30% were granted to women.

Most of the scholarships for Master's degrees are awarded for studies in Mexico while the majority of doctoral studies are conducted abroad. Half of the scholarships granted for study abroad were assigned to institutions of higher education in the United States. In order of importance, the remainder were for studies conducted in France, Great Britain and Spain. Conacyt believes that its scholarship programme for postgraduate study abroad forms part of the internationalisation of science and technology and allows the country's researchers to keep in contact with the global scientific community (Valenti, 2002).

The National System of Researchers (SNI) was set up in 1984 under the auspices of Conacyt. Its purpose is to recognize the work of persons involved in the production of scientific and technological knowledge in Mexico. Its objective is to reward research through scientific and technological competition, thereby increasing Mexico's international competitiveness and its power to solve national problems. The programme includes the appointment of a national researcher and offers economic incentives through scholarships. These distinctions and economic stimuli certify the quality, productivity, transferability and impact of selected research work.

In its twenty years of existence, the SNI has helped the Mexican scientific and technological research community to become more professional and it also introduced the peer review system among Mexican academics. According to information from the SIICYT[13], 8,558 researchers were registered with the SNI at the end of 2003; including the 1,631 candidates, this gives us a grand total of 10,189 researchers. 1,396 members joined the SNI the year it was established, which means that it has grown by 700% during its twenty years of existence.

[12] 13% received more than one scholarship.
[13] Integrated System of Information on Science and Technology Research, of Conacyt (www. siicyt. gob. mx).

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).

But what, we should ask, is the real magnitude of the brain drain? In general terms, Barré et al. (2003) estimate that about two thirds of tertiary level students from the countries of the South remain in the host countries of the North once they have completed their studies. According to data from the ILO, developing countries lose between 10% and 30% of their HRST to industrialized countries (Lowell and Findlay, 2001), and in some regions of the world the outflow is considerably higher. For example, it is estimated that nearly 75% of all individuals from Africa, 50% of those from Asia and 47% of those from Latin America who migrate to industrialized countries possess tertiary qualifications. Another estimate indicates that at least 400,000 scientists and engineers from developing countries are carrying out research and development activities in industrialized countries, compared to approximately 1.2 million involved in such activities in their countries of origin (Meyer and Brown, 1999). The implication here is that a third of the South's scientists and engineers have expatriated to the North[14].

It is difficult to estimate the magnitude of brain flow with reasonable certainty as there is no accurate international system of information for recording the volume and education of migrants, while at a national level many countries of origin do not collect such information on their emigrants. This has led to a lack of rigor and systematisation in the analyses that study the dimension of the phenomenon (Gaillard and Gaillard, 1998; Pellegrino, 2001; Iredale, 2001). Most of the available information is obtained from the databases of the host countries, for example, the United States Census or those of other OECD countries, and obviously these only measure legal movements of persons. As a result, the statistics on the migration process are fragmented, disperse and not very reliable (Adams, 2003).

Barré et al. (2003) have tried to fill this void, at least partially, by measuring the scientific diaspora of some countries or certain regions, arranging the available information and proposing tools to conduct reliable quantitative analyses. A recent contribution of great relevance is the database prepared by Adams (2003) for the World Bank which includes 24 HRST export countries. It uses estimations on education levels and the volumes of migrations from United States and OECD databases [15]. Adams' estimations (2003) are based on 2000 data and update those that Carrington and Detragiache (1998) prepared for the International Monetary Fund (IMF) using data from 1990.

At a national level, Carrington and Detragiache (1998) measure the magnitude of HRST migrations in 1990 and look at 61 developing countries of origin and OECD destination countries. They estimate that the main countries to have suffered a brain drain are Jamaica (about 77% of its nationals with a tertiary education were outside the country in 1990), El Salvador (26%), Ghana (26%), Iran (25%), Panama (20%), Korea (15%) and Mexico (more than 10%)[16]. Using 2000 data, Adams (2003) estimates that the principal countries that have

[14] Charum (2001) concludes that the productivity of expatriate scientists and engineers from the South located in industrialized countries, measured in terms of publications and patents, is greater than the productivity of such individuals if they had remained in their countries of origin.

[15] The annual publication, *Trends in international migration: SOPEMI of the OECD*, analyses recent trends in migratory movements within OECD member countries and selected additional countries. Regarding the need for more precise and current statistics that could serve as a base for better and more practical public policies, and with the goal of improving the ability to compare international migration statistics, the last edition of this publication (2004) suggests a relevant contribution in presenting the results of a new database on immigrant populations and summarizing the most important issues and difficulties related to the measurement of migration. Among other things, this latest report responds to the growing interest of member countries in labour migration, especially in terms of highly skilled workers (OECD, 2004).

[16] Mexico was considered a country of origin since it was not yet a member of the OECD.

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 case[17]. 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).

degree or Ph.D.). These figures are quite high, considering that almost half of Mexican adults living in the United States in 2000 had only completed primary education, and they show that the most important migratory flow in America at present is that of low-skilled workers originating from Latin American countries, especially from Mexico, and moving towards the United States (GCIM, 2005).

The figures in Table 1 show a significant increase in Mexican migration towards the United States between 1990 and 2000. The North American Free Trade Agreement is one of the main factors behind this surge. The installation of assembly plants on the borders of both countries have helped to stimulate labour migration from the Mexican interior and at the same time they have generated new pressures to cross the border in search of better opportunities (ILO, 2004). Other elements have also influenced migratory flows from the South toward the North; these include rural displacement, large levels of inequality (Clark, Hatton and Williamson, 2003), economic disparities and differences in opportunities (GCIM, 2005). Although it is true to say that the United States exerts a strong attraction with regard to Mexico, the geographical proximity of the two countries is equally relevant (Adams, 2003), given that the shared border facilitates the migration of Mexicans compared to migrants from other, more distant, developing countries.

Table 1. Number of Mexicans in the United States by level of education

Year	*Primary Education*	*%*	*Secondary Education*	*%*	*Tertiary Education*	*%*	*Total*
1990	368,540	13.43%	2,027,880	73.91%	347,218	12.65%	2,743,638
2000	3,081,310	48.33%	2,398,000	37.61%	895,515*	14.04%	6,374,825

Note: We refer to Mexican residents in the United States of at least 25 years of age. Primary education refers to 0-8 years of schooling, secondary education to 9-12 years of schooling and tertiary to a minimum of 13 years of schooling.
* 59,775 (6,67%) of whom had postgraduate degrees.
Source: Carrington and Detragiache (1998) and Adams (2003), according to data from the United States Population Census from 1990 and 2000 respectively to estimate the number of Mexicans, and according to the Barro and Lee database of 1993 and 2000 respectively to estimate the level of education.

From the figures in Table 1, we can conclude that there is a growing and significant flow of highly skilled Mexicans to the United States. At least 10% of the more than 3,400,000 Mexicans holding at least a university level education in 1990 were located in the United States on either a temporary or a permanent basis (Carrington and Detragiache, 1998). In 2000, the figure of 895,515 Mexicans with tertiary education represented a brain drain of 16. 5% (Adams, 2003), and this increases to 19. 33% if we consider information from INEGI which estimates that the Mexican population with tertiary education that year totalled 4,631,900 persons[18].

The figures in Table 1 do not include illegal immigrants to the United States, who probably have a lower level of education than legal migrants. They only consider legal migration,

[18] According to information on the activities of scientists and technologists from the Mexican National Institute of Statistics, Geography and Information (INEGI). Source: http://www.inegi.gob.mx

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 countries[20]. 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. 2003 [21].

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_actualite/2003_03_11_rapport_immigration/Rapport_immigr_BAT.pdf

recognition of their scientific activities. The author refers to those graduates who do not become part of the Mexican scientific community, and who total nearly 80%, as "cerebros fugados" or brain escapees.

The results of these research studies question the efficiency of the Conacyt scholarship programme in relation to its objective of increasing the formation of human resources dedicated to the production of scientific and technological knowledge (Castaños-Lomnitz, 2004; Licea de Arenas et al., 2003). However, although these studies show that the productivity of the scholarship programme is not high in terms of returns of HRST to the Mexican scientific community, it is also important to take into account the contribution of repatriates to society in general. Many scholarship alumni return to positions of high responsibility in Mexico and to other professional areas which are of national interest, or even to the academic world, albeit in private institutions.

Conacyt itself (Valenti, 2002) optimistically estimates that only 5% of ex-scholarship holders live and work outside Mexico[22], and thanks to the major opportunities and the low level of unemployment in Mexico (according to Conacyt), only 4% of the 26% Mexican ex-scholarship holders who received a job offer from abroad actually accepted. [23] This official data suggest that the Mexican brain drain is not large enough to cause concern and in fact the Conacyt considers it little more than a fanciful idea.

Conacyt argues that the minimal outflow is a selective loss which is not based on the scarcity of professional opportunities, but rather on the obstacles confronted by scientific and academic institutions in Mexico, and depends on whether HRST enjoy a satisfactory level of professional development that also allows them to make positive contributions to the institutions in which they work. Nevertheless, despite the fact that the decision to emigrate can result from distinct motives, it is evident that the main motor behind the current intensification in migratory pressures is the non-existence of satisfactory opportunities in the countries of origin (ILO, 2004).

Independent of the different opinions and contrary viewpoints on the magnitude of Mexican HRST migration, we believe that in definitive terms the volumes of formal student movements such as those financed through the Conacyt scholarship programme are not sufficient to explain the brain drain. It is obvious that the magnitude of Mexican HRST migrations is much higher than the 5% cited by Conacyt as representing ex-scholarship holders not working in the country, since we must also include all other HRST who, for personal or individual professional reasons, have decided to move abroad with their own resources, without ever having received a scholarship or having had any connection with the scientific Mexican élite.

In any case, as a precursor to the brain outflow phenomenon (ILO, 2004), the migration of students emphasizes interesting details of the dynamics and trends of semi-finished human capital (in the case of university students) as well as highly skilled capital (in the case of postgraduate students in specialist areas, Master's degree programmes and Ph. D. programmes). In this context, the figures speak for themselves. According to data from the

[22] These figures are only considered to be a "first estimation". Conacyt bases its data on empirical studies conducted in Latin America during the 1960s and on recent statistics of the National Science Foundation in the United States (Valenti, 2002).

[23] According to interviews conducted with 1,596 scholarship alumni between January and March 2000 (Valenti, 2002).

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	
	Number	***%***	***Number***	***%***	***Number***	***%***
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

Table 2 (continued)

Country	2000		2001		2002	
	Number	*%*	*Number*	*%*	*Number*	*%*
Netherlands	16	0.1	23	0.2	20	0.1
New Zealand	13	0.1	14	0.1	23	0.1
Norway	18	0.1	23	0.2	26	0.1
Philippines	0	0.0	6	0.0	0	0.0
Poland	4	0.0	6	0.0	7	0.0
Portugal	5	0.0	0	0.0	0	0.0
Spain	1,445	10.2	1,228	8.7	1,573	8.6
Sweden	42	0.3	99	0.7	107	0.6
Switzerland	74	0.5	85	0.6	96	0.5
United States	9,791	69.0	9,254	65.3	12,518	68.3
Total	**14,187**	**100.0**	**14,162**	**99.8**	**18,326**	**99.8**

Note: n/d refers to quantities that are not determined in the database.
Source: OECD

OECD statistics estimate the volumes and flows of Mexican students in foreign educational institutions of higher learning (Table 2). Countries with a high degree of economic, scientific and technological development are those that attract the majority of student emigrants. The ten principal destination countries for Mexican students are the United States, Spain, Great Britain, France, Canada, Germany, Australia, Sweden, Japan and Switzerland. Almost 70% of all Mexican students carrying out studies abroad (18,326) in 2002 were conducting their studies in the United States (12,518 students) with 8.58% in Spain (1,573 students), 8% in Great Britain (1,466 students), 6.2% in France (1,136 students) and 3.21% in Germany (588 students). As such, 94% of Mexican continued their academic studies in one of the five principal destination countries (17,281 students).

For its part the Atlas Project[24], which also uses the OECD database although it bases its findings on different figures, shows the three principal destinations for Mexican students (tertiary education) in 2001 to be the United States (9,662 students), Great Britain (1,503 students) and Spain (1,289 students). According to this source, Mexico occupies seventh position in the ranking of countries sending students to the United States (2. 3% of foreign students in the U.S. are Mexican nationals), and it is also the seventh most important country for Canada (3%), and the principal Latin American country of origin for foreign students studying in the U.S. and Canada.

The presence of Mexican students is also significant in Spain where 3% of foreign students studying in the country are Mexican, placing it in ninth position and making it the second most important Latin American country after Colombia (4%). The fourth principal country of destination for Mexican students is France. According to data from the French Interior

[24] The Atlas Project is a partnership between important public and private international organizations (mainly educational) of which the Mexican National Institute of Migration is a member. The project collects information and public data on the main countries of destination and origin in which foreign students are located (www. atlas. iienetwork. org).

Ministry[25] 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 reasons[26].

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).

transients' or 'temporary' workers, which is made up of HRST who have moved abroad for a determined period of time on temporary work contracts (Findlay, 1995).

In addition to this, four Mexican companies have established operations in Switzerland since 2001, having installed platforms there for market expansion and investment in order to access state of the art technology and/or to be close to the top technological research centres. This phenomenon has led to approximately thirty complete Mexican families establishing their place of residence (temporary or indefinite) in Switzerland. This has resulted in a considerable increase in the number of Mexican children and adolescents of school age living in Switzerland [27].

According to official Swiss statistics, approximately 60% of the Mexican community is made up of binational families. The great majority of the migratory movements of Mexicans who establish themselves in Switzerland are conducted through legal processes. However, there is a small number of illegal Mexicans (less than 10% according to estimates by the Mexican Embassy). These are usually students without identity papers or women working in domestic service. On the other hand, for more than ten years, a number of different Mexican associations (AMEX) have been established and these have helped bring together most of the Mexican community in Switzerland[28]. The AMEX carry on important social and philanthropic work and help support and promote social cooperation projects that benefit Mexico in addition to their role fomenting Mexican culture and traditions[29]. The AMEX serve as links between Mexican expatriates and their native land and for this reason they also have an important role to play in stimulating the affective capital of the Mexican community[30].

Based on official Swiss statistics, Table 3 traces the demographic evolution of the Mexican population in Switzerland from 1995 to 2003, and shows an appreciable upward trend. Whereas in 1995 the Mexican community was estimated to be made up of 923 people, the number of Mexicans increased by 45.39% in five years, reaching 1,342 in 2000. In 2003 the total number of Mexicans was estimated at 1,801 individuals, implying that the Mexican population in Switzerland had doubled in eight years, registering an average annual growth of 11.8 percent.

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[27] An indicator of the demographic evolution of the Mexican population in Switzerland over the past few decades is the number of births registered with the Mexican Embassy. According to information from the Embassy, an average of one Mexican birth was recorded per year between 1950 and 1970; while an average of 100 Mexicans have been born in Switzerland each year since 2001.

[28] Established and officially recognized AMEX operate in Basel, Bern, Geneva, Lugano, Vaud-Neuchâtel and Zurich, while others are in the process of being established in Lucerne, St. Gallen and Solothurn.

[29] It would be interesting to conduct a comparison between AMEX and the Mexican "clubes de oriundos" (culture clubs) in the United States (known as HTA from their initials in English: hometown associations). Serving as social networks and transmitters of Mexican culture and values, these clubs are created as informal networks of migrants originating from the same region and they are used to transfer important financial resources to Mexico. HTA have acquired an important relevance as social and political actors in defence of their interests and have designed new strategies for transborder cooperation, with a view to promoting economic development and reducing migratory pressures in the communities of origin (Orozco, 2003).

[30] The presence and dynamic nature of Swiss AMEX have resulted in three of them being listed on the website of the Institute of Mexicans Abroad (IME) (http://www. sre. gob. mx/ime/) from a total of thirteen Mexican associations around the world. These three Swiss AMEX include: The Association of Mexicans and Friends of Mexico in Geneva, (http://www. amegi. org), The Association of Mexicans and Friends of Mexico in Bern (http://www. amexberna. org) and the Association of Mexicans and Friends of Mexico in Ticino (http://web. ticino. com/demarta/amexhomepage/index1. htm). In fact, when IME was established in 2003, the Mexican community in Switzerland was one of only other two communities apart from those of the United States to be represented in its constitution.

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)

Country	*Total*	*%*
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%
Total 10 most important (90%)	34,779	90.2%
Total Latin American population	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 5. Number of Mexicans in Switzerland by level of education (2000)

Total	*Primary Education*	*%*	*Secondary Education*	*%*	*Tertiary Education*	*%*
780	105	13. 46%	192	24. 61%	483	61. 92%

Note: We refer to Mexican residents in Switzerland of at least 25 years of age. Primary education corresponds to 0-8 years of schooling, secondary education to 9-12 years of schooling and tertiary education to at least 13 years of schooling.
Source: Swiss Population Census, 2000

INEGI estimates that the total Mexican population over 25 years of age in 2000 numbered 45,833,170 individuals[31], of whom 4,631,900 (10.1%) had a tertiary education. The total amount of Mexicans with a tertiary education residing in Switzerland during the same year (483 persons) represented only 0.010% of all Mexicans with a tertiary education. Obviously, no major brain drain of Mexicans toward Switzerland has taken place[32].

According to information from the Swiss Population Census, it is estimated that 347 Mexican emigrants were occupied in professional activities in Switzerland in 2000, a figure that corresponds to only 25% of the total Mexican community (1,342 persons) (Table 6). Of these, 63.1% (219 persons) had at least a university-level education, while the remaining 36% was made up of 125 persons, 83 of whom had a secondary education with 42 having had only primary schooling[33]. Therefore, only 45.34% of those Mexicans with a university level education were professionally active. On the other hand, and according to the same source, the total number of professionally active Mexican HRST in Switzerland represented 0.3% of the total HRST expatriates in the country (nearly 78,660 persons) and slightly less than 10% of all Latin American HRST in 2000[34].

[31] According to data from INEGI, in 2000 the Mexican population totalled 97,483,412 people.
[32] It is interesting to compare the level of education between Swiss and Mexican residents in Switzerland. While 10. 1% of Mexicans (of those 25 years or older) have a tertiary education (according to data from INEGI in 2000), compared to 27% of Swiss (according to official Swiss data for 2004), Mexican residents in Switzerland have a much higher level of education overall, actually surpassing that of the Swiss. Of Mexican residents in Switzerland, 61. 92% have a tertiary education compared to 27% of Swiss.
[33] If we compare this information with the percentage of HRST foreigners in the Swiss labour market or inclusively with Swiss HRST, we notice that 52% of professionally active Swiss were HRST in 2000 compared to 39.2% of foreigners, figures considerably lower than the 63.1% of Mexican HRST. This advantage for Mexicans is even greater given that, as indicated previously, the definition of HRST not only includes individuals with tertiary education, but also those employed in a professional area within science and technology.
[34] A recent study on highly skilled immigrants in Switzerland (Pecoraro, 2004) estimates that the presence of foreign HRST in the Swiss labour market has increased considerably in the last thirty years. In 1970 only 15.4% of the foreign labour market were highly skilled while in 2000 the figure reached 39.2%, a percentage that increases to 61.8% if we take into account immigrants with fewer than 5 years of residency in Switzerland.

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

Total	*Primary Education*	*%*	*Secondary Education*	*%*	*Tertiary Education*	*%*
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)

	Total	*Men*	*Women*
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)**.**

Table 8. Number of Mexicans in Switzerland by professional activity and gender (2000)

	Total	*Men*	*Women*
Total	**1342**	**451**	**891**
Professionals in administration, banking, insurance and legal professions	94	31	63
Professionals in health, education & culture, and scientific professions */1	76	34	42
Professionals in sales, transportation and distribution	49	24	25
Professionals in hotel industry, restaurants and personal services	49	21	28
Technical and computing professionals	36	23	13
Professionals in industry, arts and specialities	26	19	7
Professionals in construction and mining	5	5	0
Professionals in agriculture, forestry and farming	3	3	0
Non-classified professions	9	6	3
Professions that can not be practised	15	5	10
Unemployed persons	564	101	463
Persons under 15 years of age	160	68	92
Unidentified */2	256	111	145

Notes: */1 Include lecturers, academics and scientific researchers.
*/2 Refers to those individuals who did not answer this question from the census questionnaire.
Source: Swiss Population Census, 2000

Of the 564 Mexicans who were not involved in professional activities in 2000, approximately 264, or 54. 6% of the 483 Mexican HRST in Switzerland, had completed tertiary education,. Regardless of the personal reasons or other circumstances, it is alarming to find that more than half of Mexican HRST are not used insofar as they find themselves left outside the Swiss labour market[35].

Potential of Mexican HRST in Switzerland

The previously cited tables referring to the profiles and characteristics of the Mexican population in Switzerland bring together data that outlines some general trends. The information reveals that the majority of Mexican migration to Switzerland corresponds to highly skilled individuals, since 61. 92% of Mexicans above the age of 25 residing in this country have a tertiary education, and the tables also show how this phenomenon is growing. Moreover, since highly skilled migrants constitute the greatest potential for achieving progress, Mexican expatriates in Switzerland represent an important value that should not be squandered.

Although an alarming 54. 6% of Mexican expatriates with a tertiary education living in Switzerland were outside the labour market in 2000, 32% of the 347 professionally active Mexicans held senior management positions or high-level intellectual posts, which means that

[35] A more profound analysis on the effects of Swiss labour policies (for example, restrictions on work permits), social policies (for example, deficiencies in the day care system or limited hours of children's schooling) and personal decisions should be conducted to understand why more than half of the highly skilled Mexicans in Switzerland are not in the Swiss labour market.

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 loss[36].

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 Switzerland[37]. 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.

work on scientific research and/or in academia, and these represent 40% of all students surveyed.

4. Mexicans play their part in the production of scientific knowledge in Switzerland. We have identified 8 Mexican women who are involved in scientific research and/or experimental development research. All have educational qualifications of the highest level (6 hold doctorates and 2 have Master's degrees). They are actively involved in Swiss institutes of higher education and research or international organizations within the following areas: health and poverty, environmental science, political and social sciences, computing, ethnology, administration technology, physics and chemistry.
5. Mexicans holding high level management positions include engineers, doctors, lawyers, psychologists as well as managers or directors working in financial institutions, insurance agencies, telecommunication firms, news agencies, the electronics industry, banking, the food industry and pharmaceuticals.
6. The majority of highly skilled transients work in Swiss industrial companies, in the food or pharmaceutical sector, or as high level managers in international organizations.
7. The majority of Mexicans who are professionally active in international organizations in Switzerland hold Master's degrees and some also have doctorates. Fifty percent send financial remittances to Mexico on a regular basis and will return to the public sector on their return to Mexico.
8. Mexican professionals working in the fields of art and culture in Switzerland have tertiary level education and 40% have also taken Master's degrees or doctorates. They promote Mexican art and culture in Switzerland and make a valuable contribution to the Swiss community.
9. As part of a transnational population, Mexicans who are professionally active in Switzerland are well integrated into their host country and at the same time they maintain a constant interest in events and situations in their country of origin.
10. Many Mexican expatriates make valuable contributions in terms of affective capital. From their base in Switzerland, they are increasingly interested in participating in initiatives that contribute to the benefit of Mexico. It is also interesting to note that the affective capital trend increases as the period of expatriation increases.
11. The majority of Mexican students and researchers who participate in the production of scientific knowledge in Switzerland maintain close links with research and academic institutions in Mexico and/or the Mexican public sector, with whom they exchange knowledge on a regular basis.
12. The majority of the Mexican community professionally active in Switzerland maintains ties with Mexico through business, investment, interpersonal, interprofessional and on occasions interindustrial contacts, with scientific and regional research associations, with cultural centres and Mexican artistic and cultural institutions, through financial remittances as well as financial support for social and cultural projects in Mexico.

A first glance at the figures in this preliminary study demonstrates the potential value of highly skilled expatriate élites. Nevertheless, it is evident that there is a need to link research on HRST mobility and its development potential with emerging political initiatives. Not only do the characteristics of HRST play an important role in such involvement, but the context within countries of destination and those of origin are also important (Ammassari and Black, 2001). Even if scientists, students and highly skilled professionals are enthusiastic, this is insufficient if their interest is not supported by public policies that serve as bridges so that the various types of resources can reach the country of origin through specific development cooperation projects. At the same time, the country of origin must also provide necessary

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 professionally[38]. 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.

complicate the integration of researchers from the South into international networks, thereby isolating them further and, frequently, preventing them from having access to the most important international publications (Cetto et al. , 2001).

Concern over the marginalisation of the scientific competencies of the South is confirmed by the recriminations voiced by the main actors themselves. This can be seen in a study published recently on the matter (RAWOO, 2001). In a synthesis of numerous local situations in Bolivia, Kenya, India and other developing countries, the main comments by scientists from the South focus on the asymmetry that characterizes all cooperation with their Northern partners. The differences are enormous. In general terms, Northern institutions receive the funds, decide how they are to be distributed and present a united front against the developing countries which are divided and insufficiently prepared for these types of negotiations. All this means that their counterparts in the South find themselves in a weak position with regard to research organization and planning, even in situations that have a direct bearing on them and in which they can boast recognized experience.

The most relevant recommendations must seek a better balance between the associated institutions from the beginning of the projects, which can be achieved through partnerships based on trust and teamwork, thereby offering Southern institutions the freedom to choose the partners in the North with whom they wish to co-operate. The contents of such collaborations are not in any way innocen*t*, given that they reflect the priorities of the two sides, which usually means that the Northern institutions concentrate on the theoretical and scientific issues, while researchers from the South concentrate on the application and operational side, directing research toward their most urgent social and institutional needs.

In the context of such circumstances, which are globally recognized as disturbing, Swiss scientific cooperation, as an example of that of other industrialized countries, outlines an international collaboration strategy that attempts to resolve such division of knowledge between the North and South. The scientific community is usually the first to develop approaches and methodologies that are better adapted to such situations. Along these lines, the Swiss Commission for Research in Partnership with Developing Countries (KFPE)[39] has analysed and published its findings on two occasions. The first occasion involved editing basic rules to serve as a reference for partnership collaborations[40] (KFPE, 2003). The second involved a recent publication which sought to analyse the processes and the mechanisms that strengthen or weaken the establishment of scientific partnerships for development (Maselli, Lys and Schmid, 2004).

Conclusions in relation to research into cooperation which suggests a better balance between partners are interesting. Nobody questions the need for quality science[41], and the projects evaluated demonstrate that exchange and mutual learning emanating from an international partnership can reinforce such competencies, both in the North and in the South, and improve the quality of research. Such an approach increases the visibility and attractiveness of the Southern based partners, opening new horizons for them in both scientific and financial terms.

[39] Swiss Commission for Research Partnerships with Developing Countries.

[40] Refers to the 11 principles that serve as the foundation for Swiss scientific cooperation projects (http://www.kfpe.ch/key_activities/publications/guidelines.html).

[41] We also recognize that nobody confronts this, either because of the basic demand in itself or because scientific excellence is too vague a notion to be dealt with in this context.

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 2000[42], 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 limited[43].

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 area[44].

The Swiss Ministry of Education and Research (SER)[45] has reorganized the decentralized academic and research institution networks[46], 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 context[47] 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.

Europe, the focus is on certain industrialized countries: the United States, Japan, Republic of Korea and Singapore. In terms of developing countries, and those in transition, the main priorities are China, Russia, Egypt, South Africa, the Ivory Coast and Tanzania; while Chile and Brazil are the chosen countries in Latin America.

Therefore, there is a selection of countries where Swiss scientific cooperation with the third world can be concentrated at the same level as general Swiss cooperation, but on the basis of scientific criteria rather than poverty. For some countries this can be explained by historic precedents (such as the Ivory Coast which has hosted the Swiss Centre for Scientific Research for the last 50 years and continues to do so despite the political turbulence of recent times[48]), but for the majority, the election is the result of scientific opportunities and technological and economic prospects (cases in point being the emblematic examples of China, India and Brazil).

The idea is to support the cooperation of Swiss universities by providing them with the tools to encourage bilateral collaborations in a spirit of partnership. In this way, the approach is one of true cooperation rather than development aid, and represents a collaboration between two partners where each contributes human and financial resources. This perspective shows how countries and partner institutions can be in charge and financially responsible at the same time, and have an equal share in the responsibilities of strategic decision making and the management of activities (although in practice this is rarely the case). On the other hand and taking budget periods into account, the objective is to substantially increase the public budget for this area from 2008.

From the SER's point of view, there are three levels of collaboration that guide international scientific and technological cooperation and aspire to stimulate it:

1) scientist-scientist: the most concentrated level, founded on the basis of personal acquaintances and joint opportunities;
2) university-university: this level reflects shared strategic options and can facilitate scientist to scientist cooperation and encompasses schools of higher education, their faculties and institutes;
3) government-government: this level translates the political will to draw up a strategy that seeks to reinforce international cooperation with certain chosen key countries and regions, working jointly with universities. It involves intergovernmental accords that permit the implantation of common projects on a large scale, especially with countries whose research funds are administered at state level[49].

In Switzerland, the SER is responsible for defining the instruments of cooperation and the principles of operation, direction and finance.

The main instruments for structuring, developing and strengthening scientific exchanges between Switzerland and other countries or social regions are: networks of scientific and technological consultants (made up especially of persons working for the state and for Swiss institutions); Swiss 'houses' for scientific and technological exchange; shared laboratories, bilateral agreements and related action programmes; scientific roundtables and their related

[48] http://www.csrs.ch/

[49] Although there is no scientific exchange programme between the governments of Mexico and Switzerland, there are some strong interinstitutional programmes between the two countries.

"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 project[50].

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 level[51]; 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 partnership[52].

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.

Finally, the objectives of cooperation of this type must be adapted to the needs of the Swiss scientific cooperation partner countries. However, achieving this is easier said than done, given the fact that on both sides the major avenues of science (biotechnology, for example) are becoming increasingly similar since they are based on decisions taken on a global level. This creates the need to contextualize scientific research for the benefit of countries of the third world, moving from a subtle balance in the acquisition of advanced scientific knowledge to the main concerns that the poorer regions of the world are directly and immediately confronted with (for example, hunger and nutrition, epidemics and mortality, economic marginalisation and precarious existence, contamination of natural resources and overpopulation, urbanization and rural impoverishment, etc.).

The originality of scientific cooperation for development aims at inspiring scientific creativity arising from shared competencies in an ambitious international partnership and aspires to resolve crucial issues of sustainable development in the countries of the South which are restricted by major limitations (in the environmental as well as in the economic, social and political fields).

Conclusions and recommendations

The new conditions used to define highly skilled migrants - when one considers on the one hand that they participate in international knowledge production and on the other their willingness and interest in working for their country of origin from the part of the world in which they find themselves - offer such individuals an important potential role as agents of development. The knowledge and resources of highly skilled emigrants can, in effect, contribute to the fight against poverty and help improve the quality of life of those individuals who remain in their countries of origin, although the circulation of this knowledge and these resources should be improved.

A large part of the long-term effectiveness of development strategies based on scientific and technological cooperation and promoted through the circulation of knowledge depends on the support received from national policies. The lack of political stability and of a long-term national vision can be prejudicial. On this point, the role of governance[53] becomes an essential element, especially in countries whose government institutions are weak or in countries, such as Mexico, where institutional continuity is still deficient. Along these lines, it is evident that there is a need for sustainable political commitment from governments in order to provide adequate, sufficient and continuous financial support for research as well as an active commitment to science as a socio-political tool, integrating it within political and economic decision-making at all levels.

In terms of its characteristics and objectives, the Swiss policy for scientific cooperation for development is an example of how public policies can serve as a platform to strengthen collaboration between countries of origin and countries that receive students, researchers and highly skilled immigrants[54].

[53] The concept of governance refers to the integration of different forms in which individuals and institutions, both public and private, carry out their common interests. Within migration, governance is exercised on a national, regional and global scale (GCIM, 2005).

[54] In fact, the lack of collaboration between migrants' countries of origin and destination has been identified by the IOM as a fundamental obstacle to development policies (Appave, 2005).

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 diaspora[55], 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 HRST[56]. 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 development[57]. 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 trail-blazers 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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