OECD Science, Technology and Industry Working Papers
2004/10

Highly Skilled Labour and International Mobility in South America

Rodolfo Barrere,

Lucas Luchilo,

Julio Raffo

https://dx.doi.org/10.1787/570061570356

OECD

Unclassified **DSTI/DOC(2004)10**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

23-Dec-2004

English text only

DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY

DSTI/DOC(2004)10
Unclassified

HIGHLY SKILLED LABOUR AND INTERNATIONAL MOBILITY IN SOUTH AMERICA

STI WORKING PAPER 2004/10
Statistical Analysis of Science, Technology and Industry

Rodolfo Barrere, Lucas Luchilo and Julio Raffo

English text only

JT00176419

STI Working Paper Series

The Working Paper series of the OECD Directorate for Science, Technology and Industry is designed to make available to a wider readership selected studies prepared by staff in the Directorate or by outside consultants working on OECD projects. The papers included in the series cover a broad range of issues, of both a technical and policy-analytical nature, in the areas of work of the DSTI. The Working Papers are generally available only in their original language – English or French – with a summary in the other.

Comments on the papers are invited, and should be sent to the Directorate for Science, Technology and Industry, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France.

The opinions expressed in these papers are the sole responsibility of the author(s) and do not necessarily reflect those of the OECD or of the governments of its member countries.

---

http://www.oecd.org/sti/working-papers

HIGHLY SKILLED LABOUR AND INTERNATIONAL MOBILITY IN SOUTH AMERICA

Rodolfo Barrere, Lucas Luchilo and Julio Raffo*

Abstract

This paper presents the main trends in respect of the supply of human resources in science and technology (HRST) in Latin America and the international mobility of its highly skilled labour. This will be done through the identification of potential data sources, followed by a presentation of indicators drawn from these sources. In addition, a short section is devoted to the main policy aspects surrounding these issues.

The section on policy issues will show that the main South American countries have in common a lack of strong or efficient policies for the migration of highly skilled human resources, although in recent years important changes have occurred in some of the countries of the region.

Available information sources on highly skilled labour and international mobility in South American countries are similar to those from OECD countries as far as the main types of collected data is concerned. Potential sources are labour force surveys, population censuses, household surveys, data from the higher education system and from migration departments. However, the quality, coverage and availability of information is inferior to that of OECD countries. Science and technology tend to be marginal or absent in the government agendas in the region, which impedes obtaining basic and statistically reliable data.

The available indicators show a massive expansion of the higher education sector, in numbers as well as in diversity of the offer of courses. The number of students enrolled in Latin America and the Caribbean increased from about 260 thousand students in 1950 to about 9 million in the year 2000. The number of graduates increased significantly as well, by around 50% between 1990 and 2001. However, this expansion was not accompanied by the creation of jobs requiring corresponding qualifications. For example, the United States employs 9 times as many researchers as Latin American and Caribbean countries. As a result, there has been a marked increase of unemployment of professionals, salaries have fallen and professionals and technicians are working in jobs for which they are overqualified.

Concerning the emigration of highly skilled South American labour, the best information is available by looking at data sources in receiving countries, especially the United States. Data from these sources show that the mobility of highly skilled labour from South American countries is of relatively small magnitude, especially when compared with flows from Asian countries, and much less politically visible than other migratory trends, such as the magnitude and political impact of Mexican emigration to the United States.

---

* Elaborated by a research group from Centro REDES/RICYT (Buenos Aires, Argentina), co-ordinated by Lucas Luchilo.

MAIN-D'ŒUVRE HAUTEMENT QUALIFIÉE ET MOBILITÉ INTERNATIONALE EN AMÉRIQUE DU SUD

Rodolfo Barrere, Lucas Luchilo et Julio Raffo*

Résumé

Ce document présente les principales tendances de l'offre de ressources humaines en science et technologie (RHST) en Amérique latine ainsi que la mobilité internationale de la main-d'œuvre hautement qualifiée de cette région. Nous commençons par répertorier les sources de données possibles, puis nous présentons des indicateurs tirés de ces sources. En outre, nous consacrons une courte section aux principales questions de fond qui s'inscrivent dans cette problématique.

La section relative aux questions de fond montre que les principaux pays d'Amérique du Sud ont ceci en commun de ne pas avoir instauré de politique vigoureuse ou efficace en matière de migrations de ressources humaines hautement qualifiées bien que, ces dernières années, d'importants changements soient intervenus dans quelques pays de la région.

Concernant la main-d'œuvre hautement qualifiée et la mobilité internationale de ces travailleurs, les sources d'information disponibles dans les pays d'Amérique du Sud sont analogues à celles des pays de l'OCDE du point de vue de la nature des données recueillies. Les sources possibles sont les enquêtes sur les forces de travail, les recensements, les enquêtes auprès des ménages, les données provenant des établissements de l'enseignement supérieur, et les services des migrations. Toutefois, la qualité, la couverture et la disponibilité des informations sont inférieures à celles que l'on observe dans les pays de l'OCDE. En général, la science et la technologie n'occupent qu'une place secondaire, quand elles en ont une, parmi les préoccupations des gouvernements des pays de la région, ce qui empêche d'obtenir des données primaires qui soient également fiables sur le plan statistique.

D'après les indicateurs dont nous disposons, le secteur de l'enseignement supérieur connaît une expansion considérable tant du point de vue des effectifs que de la diversité de l'offre de cursus. C'est ainsi que le nombre d'étudiants inscrits en Amérique latine et aux Caraïbes est passé de 260 000 environ en 1950 à quelque 9 millions en l'an 2000. Le nombre de diplômés a lui aussi progressé de manière significative, soit de 50 % environ entre 1990 et 2001. Pour autant, cette expansion ne s'est pas accompagnée de création d'emplois nécessitant les qualifications ainsi acquises. À titre d'exemple, les États-Unis emploient 9 fois plus de chercheurs que les pays d'Amérique latine et caraïbes. En conséquence, le chômage chez les membres des professions intellectuelles et scientifiques a nettement augmenté, les salaires ont baissé, et les professionnels et techniciens occupent des emplois pour lesquels ils sont surqualifiés.

En ce qui concerne l'émigration de la main-d'œuvre sud-américaine hautement qualifiée, les meilleures informations disponibles s'obtiennent en consultant les sources de données des pays d'accueil, principalement les États-Unis. Ces données montrent que ces travailleurs émigrent très peu, surtout si on les compare avec les flux de migrants en provenance des pays asiatiques. Sur le plan politique, la mobilité de cette catégorie de main-d'oeuvre est aussi beaucoup moins visible que les autres tendances dans le domaine des migrations, comme l'ampleur et l'impact politique de l'émigration mexicaine aux États-Unis, par exemple.

---

* Document élaboré par un groupe de chercheurs du Centre REDES/RICYT (Buenos Aires, Argentine) coordonné par Lucas Luchilo.

TABLE OF CONTENTS

1. Introduction

The national availability of highly skilled labour and the mobility of this highly skilled labour are two questions that attract the growing attention of government and public opinion in a great number of countries. Although the number of highly skilled emigrants is only a small fraction within the broad migration movements of the latest years, its economic importance is recognised as much greater than might be assumed from its relatively small number.

The public debate on the availability and the mobility of highly skilled labour in South America dramatise problems posed by the development patterns in the area. The discussion on the availability of highly skilled labour points to the lack of specialists in key areas as well as to the insufficiency of the labour market to absorb the professionals graduating in ever greater numbers from the institutions of higher education.

In the same way, the concern over the emigration of professionals reflects a feeling of loss for the community, especially in the case of countries such as Colombia and Argentina, which are undergoing a serious social and economic crisis.

As is the case in other areas, the information, studies and analysis available on the subject do not correspond to the magnitude of the problem. This is partly due to the limitations of the information systems and research programmes carried out in the region. It was only in the 1990s that there was a significant improvement in the information system on higher education, when it became easier to have access to data from surveys on jobs and standards of living, regularly performed by national statistics institutes of the region. It is more difficult to obtain information in the case of emigration, as much because of limitations in the data gathered by the public agencies in charge, as by the complexity of the migration processes.

In addition, questions on the availability and mobility of highly skilled labour in South America have not attracted special attention of the OECD countries. More precisely, these questions have not received as much attention as other subjects relative to South American development or international migration. In the agenda of the developed countries and the international organisations – in the case of South America, most notably the World Bank and the International Monetary Fund – the questions considered priority for the development of the region concern trade and financial dimensions, as well as the general macro-economic behaviour of the different countries, with scarce attention paid to the problems dealing with the training and supply of highly skilled labour.

At the same time, the mobility of highly skilled labour from South American countries is of relatively small magnitude and much less politically visible than other migratory trends, such as the magnitude and political impact of Mexican emigration to the United States. As regards highly skilled labour, the flow from Asian countries and in smaller measure from the countries of the OECD itself, leaves South American emigration far behind.

The purpose of the present work is to identify some of the principal tendencies in respect of supply and mobility of highly skilled labour in South America. The information used has originated in a study on highly skilled labour and mobility undertaken at the request of the OECD. The analysis will be centred on the countries of South America; yet information will be added on Mexico, Central America and the Caribbean countries.

Section 2 deals with some trends of highly skilled labour and mobility in the region. Section 3 identifies the principal policy issues, with a review of the state of affairs in the principal South American countries. Section 4 comprises a description and general evaluation of the available information sources, while Section 5 presents a selection of indicators on highly skilled labour, with special attention to human

resources in research and development. This section adds information about Mexico, Central America and the Caribbean, which have some important problems in common with South America. Section 6 develops some indicators on international mobility of the highly skilled, centred on the principal South American countries. The emphasis of this paper will be on the mobility of the highly skilled.

2. Highly skilled labour and mobility in South America: main trends

The development of highly skilled human resources and the brain drain were two faces of the same coin in the current of thought about the relations between education and development, predominant in Latin America in the sixties. It was at that moment that the links between education and economic development began to be analysed, which originated in the convergence of new thoughts in developed countries – especially the theories of human capital and the theories and techniques of social and economic planning – and the theoretical and political concerns deriving from the national development projects in the principal countries of Latin America in the second half of the 1950s.

We do not propose here to detail the evolution of political and academic reflection on these matters in the last forty years.[1] Rather, we are interested in highlighting the existence of the recurrent preoccupation along the years, which, however, seldom managed to translate into stable and well-planned public policies.

2.1 The growth of HRST

One of the reasons that may account for this discrepancy is the magnitude and rate of the changes in the training of highly skilled human resources. The expansion of higher education in South American countries has been one of the most remarkable phenomena in the last thirty years. The characteristics, magnitude and speed of this process have been the object of a series of studies and analyses that tend to emphasise the following features:

- The expansion of higher education took place in the whole area, with differences in scope and speed according to the country, but always in a pattern of accelerating growth. Towards 1950, there were about 260 thousand university students in Latin America; in 1970 the figure climbed to 1.6 million and in 1990 it was near 7 million. Towards the year 2000, some 9 million Latin Americans were students in different institutions of higher education in the region. The number of university graduates also grew considerably.

- Although the number of students in higher education as a proportion of the corresponding age group is far from the level of developed countries, in some countries in the area it has already passed 20%. In spite of this growth, the region lags behind the performance of the newly industrialised countries of Southeast Asia.

- The expansion of enrolment had as its corollary the expansion and diversification of the institutions of higher education and the growth of university teachers.

- Diversification resulted in a growing heterogeneity, not only in terms of types of institutions and offers of training, but also of quality.

- The outstanding demographic factor in this process was the increase in the number of female students and female university teachers.

1. For the evolution of ideas about mobility of highly skilled labour in Latin America, see Gaillard and Gaillard (1998).

- The dynamics of the expansion in higher education was mostly directed by the demand of families and young people belonging to the middle class, which grew after the Second World War and benefited from the expansion of secondary education in the period, rather than by the demands made by the productive system.

- A very important expansion of post-graduate studies began in the 1990s. Between 1990 and 2001, the total number of graduates with a masters degree multiplied 3.6 times, rising from about 13 thousand graduates to over 47 thousand. Brazil and Mexico account for around 80% of the graduates. The number of doctorates in Latin America and the Caribbean also experienced an important growth. Brazilian PhDs constitute some two-thirds of the total number of doctorates in the region.

The establishment of a mass system of higher education had important social consequences. From our angle of interest, the stock of university professionals grew at the same time as the difficulties for their absorption by the labour market increased. This was basically due to the lack of economic growth in the region. The public policies on higher education developed in the region during the last years have had as priority to try and establish mechanisms to improve the quality and relevance of the education provided by the higher education institutes. The evaluation of institutions and performance was chosen as the method to highlight and correct the problems of universities, while different sets of incentives to improve management, post-graduate training and university research were established. The capacity of the chosen instruments to deal with the priorities of the different national education administrations varied greatly between countries.

2.2 Mobility of the highly skilled

The subject of mobility of South American HRST has lately attracted renewed attention for internal reasons – notably in Argentina, Colombia and Ecuador – as well as because of the visibility the phenomenon has acquired in the developed countries.

Its magnitude and present or potential impact arouse the interest to analyse the question in more detail and with greater precision and concern for its effects on the countries of origin and the on the countries of destination of the migrants. It is not a new phenomenon. However, its scope and characteristics seem to have changed in the last few years as part of the globalisation process. These changes have led to the formulation of the idea that the world may be living a "new era of migration", marked by an increase in migration flows, a modification of the importance of the countries of destination, a change in the composition of population movements and the emergence of new forms of mobility. Whether it is a new migratory pattern or a consolidation and intensifying of previous trends,[2] what is certain is that the mobility of highly skilled human resources has acquired new interest and relevance.

The appearance and expansion of the so-called knowledge society and its technological infrastructure has fuelled concern over obtaining an adequate supply of highly skilled labour in the various countries. These countries – with the United States in the lead – have developed policies to attract specialists, above all in the information technology and communication fields, because of the anticipated or experienced shortages of specialised workers. The tendencies towards the internationalisation of higher education and the mobility within multinational production have added to this. As marked by Salt, "in many respects [migration of the highly skilled] is a child of economic globalisation and the activities of transnational corporations".[3]

2. Whitwell (2002).

3. Salt (2001).

Although studies on "brain drain" were being undertaken in several countries in South America already in the 1960s, different factors contributed to keep this problem from becoming the priority of public policy or research.

In the case of some countries – typically Argentina and Venezuela – the focus of interest on the subject of migration has been the movements of population from border countries and not skilled emigration. In the case of countries with strong emigration – such as Mexico and other Central America and Caribbean countries – the predominant preoccupation was the abundant migratory flow to the United States, consisting mostly of unskilled workers. In other countries, with low emigration, as for example Brazil, the principal issue was internal migration, deriving from the accelerated growth of big cities and rural poverty.

The studies on brain drain in the 1960s follow a nationalistic or developmental approach in general, according to which the loss of highly skilled labour was one more facet of a process of dependency regarding the capitalist countries of the North Atlantic.[4] From the second half of the 1970s, the worries about the brain drain began to disappear. One of the probable reasons for this loss of interest may have been researchers shifting to subjects related to the exile caused by the dictatorships in the area and the return of exiles during the democratic transition. In the 1980s, the emigration of highly skilled human resources seemed to have lost momentum. The economic crisis that spread during the entire decade interrupted some important regional flows – to Argentina and Venezuela – and the movements of highly skilled personnel did not experience any significant increase.

The 1990s brought great changes. From the point of view of international migrations, the most noteworthy process was the growth of emigration to the United States. The figures of the 2000 census reveal that there are more than 16 million legal residents in the United States that were born in Latin American countries, to which must be added between 3 and 6 million illegal residents, mostly coming from Mexico. That implies a 100% growth of Latin American emigration to the United States over the 1990s. Although the growth rates in the preceding decades are similar, the increasing weight of the population born abroad within the general population of the United States – which exceeds 11% – and the importance of emigration for the countries of origin lead to the general belief that migratory movements to the United States have surpassed a historical threshold.

The changes in the composition of emigration to the United States have been no less significant than the magnitude of this emigration. The educational qualifications of the immigrants are higher, even in the case of those occupying low-level jobs, as a consequence of the expansion of schooling in the countries of origin. Moreover, a nucleus of immigrants with high qualifications, consisting in majority of engineers and scientists of Asian origin, began to stand out.

The accelerated expansion of the information technology and communication sectors in the 1990s led to a systematic policy on the part of companies and of the United States government, oriented to make the access of specialists from diverse parts of the planet easier. Although Latin American countries did not make a very important contribution, the rise in emigration still has caused genuine worry about the impact on their own stock of human resources in science and technology.

Emigration to European Union countries also rose. Salt estimates a 38% increase in the stock of foreigners between 1988 and 2000.[5] However, the fact that a significant part of the emigrants, especially from the Southern Cone countries (Argentina, Brazil, Chile and Uruguay), have dual nationality makes it difficult to assess the magnitude of migrations from South America. Anyhow, there is no doubt that in the

4. Oteiza (1998).

5. Salt (2001).

last five years emigration from Ecuador, Colombia and Argentina to Europe, especially Spain, has intensified.

2.3 Some considerations on the definitions of highly skilled labour and international mobility

The problems associated with conducting analysis of highly skilled labour and international mobility originate only in part in the limitation of the information sources. The limitations in the sources probably have their origin in the complexity of the phenomena that must be recorded and subjected to statistical processing. The OECD has made an important effort to establish definitions and standardise methods, and is carrying out systematic work to improve the production of statistics and the elaboration of indicators.

The difficulties to measure international mobility will be analysed in greater detail in Section 4. In this case the problem with sources of information is greater, as is the complexity of the phenomena usually grouped in the mobility category. A United Nations recommendation distinguishes two categories of migrants: long-term and short-term. A long-term migrant is a person who moves to a country other than that of his/her usual residence for a period of at least one year. A short-term migrant moves for a period of at least three months but less than a year (except if the movement is for reasons of recreation, holiday, visiting friends or business, medical treatment or religious pilgrimage). Although these recommendations have not received ample recognition they are an adequate term of reference.

One of the phenomena noted in the matter of mobility of the highly skilled is the variety of situations that present themselves. The traditional pattern of change of residence for labour reasons, going from stable residence in one country to stable residence in another country, has been displaced by the multiplicity of movements of new types of migrations with a greater variety of destinations, for periods of varied duration and with a pattern of less stability in residence.

The growth of the circulation of highly skilled personnel in multinational companies, the expansion of consulting activities at an international level, the increase in university studies abroad, the emergence of systems of temporary visas for occupations and jobs a country considers strategic and the presence of refugees among the highly skilled are manifestations of a process which is difficult to measure and systematise.

3. Main policy issues concerning highly skilled labour and international mobility in South America

This section concentrates on the main policy issues concerning highly skilled labour and international mobility in South American countries. Although the detailed treatment of the more general questions on human resources policies in South America exceeds the scope of this paper, it is necessary to point out three important features.

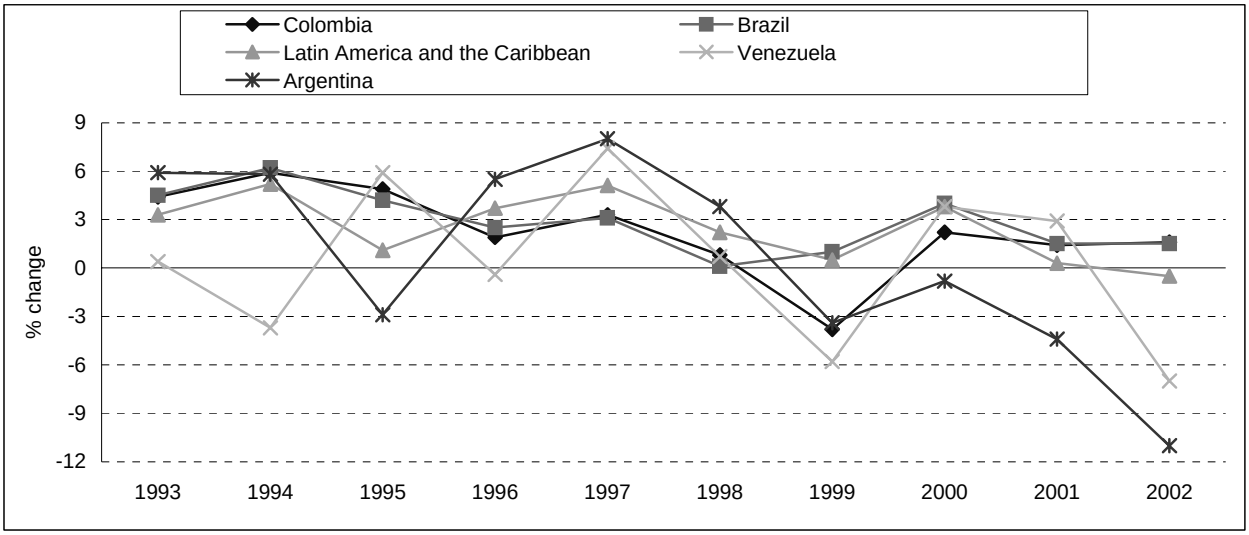
The first one is the disparity in national situations, in terms of the individual economic structures and higher education systems as well as in terms of their performance during the last few years.

The second one is the scarce capacity of the major part of the countries in the area to systematically and steadily apply policies regarding highly skilled labour. These policies are particularly complex, insofar as they emerge from the interaction of a large variety of factors, many of which escape direct intervention of the public administration. It is mostly the decisions of enterprises and educational institutions that shape the characteristics of the stock and needs of human resources in a country. The role of the states of the region to orient the decisions of enterprises and educational institutions is decisive and, at the same time, difficult to implement successfully. Whatever the ideological orientation of governments, they are expected to ensure the basic conditions to allow a good performance of their economic systems. Figure 1 shows the difficulties and failure of a good part of the countries to maintain reasonable degrees of

economic stability. The behaviour of GDP shows not only low growth but also sharp fluctuations, with abrupt and deep falls of the domestic product. If we add instability factors originating in serious political confrontations – Colombia is an extreme case but not the only one – it is hard to imagine that consistent and steady policies exist for each area.

Figure 1. Evolution of GDP in Latin America and the Caribbean and selected South American countries, 1993-2002

Annual average percentage change based on constant 1995 USD



Source: CEPAL (2003).

The third element that constitutes a critical question in the panorama of highly skilled labour in the region is the increase of unemployment in the case of professionals, with a corresponding fall of salaries and overqualification. This point will be developed more extensively in Section 5.

The evaluation of the impact and relevance of the emigration of HRST varies greatly between the different Latin American countries. The public policies and the concrete actions each country adopts are also diverse. The different histories and the present migratory conditions – as well as the definitions of international politics – contribute to shape different types of approaches and responses to the phenomenon. In the case of Mexico, the emigration of the highly skilled in science and technology is part of a complex process of regional integration with the United States and Canada. The perception of the loss of highly skilled labour that characterises the discourse of the leading groups of other Latin American countries contrasts with a more optimistic vision, centred on the benefits afforded by the circulation of their scientists and engineers in a common economic and cultural space.

The situation in the majority of Central American and Caribbean countries is strongly influenced by the economic effects of the emigration to the United States. The loss of young workers – whatever their qualification levels – appears to be offset by the magnitude of the money remittances sent by emigrants back to their families in their country of origin. A recent estimate shows that remittances to some of the Caribbean countries constitute one of the primary sources of foreign currency and exceed 10% of GDP.

The situation in South American countries is more complex. As we shall see, for some countries emigration is a problem that tends to become serious, for others it is not a problem of great interest to government or public opinion.

We shall now analyse the orientation of public policies concerning the mobility of highly skilled labour in the principal South American countries. The main feature in common is that the countries analysed do not have strong or efficient policies for the migration of highly skilled human resources. Neither has the emigration of the HRST become an issue that demands a systematic and clearly defined intervention by the public sector, although in the last few years an increasing interest and concern on this subject has been perceived. The history of migration in various countries contributes to bring this deficiency to light. Argentina and Brazil had an important amount of European immigrants by the time of their consolidation as national states, in the frame of a model of development guided by the exports of primary products to the economies of the north-Atlantic countries. Their migration policies were ones of active promotion of the entry of immigrants, facilitating their transport and residence, and with vigorous public action to encourage the immigrants' naturalisation, principally through the incorporation of their children in public schools. Since the crisis in the 1930s, the European migration flows have decreased, whereas those coming from neighbouring countries – mainly to Argentina – and internal migrations have grown. Colombia was, and still is, a country with a very low level of immigration, reckoning with an increasing emigration since the 1960s, with Venezuela and the United States as the main destinations. Chile shows a more balanced scenario.

According to Mármora, there is clear evidence that in recent years important changes have occurred in the countries of the region, mainly related to the social and governmental perception of migration issues, associated, principally, to the increase in emigration.[6] Among the countries in focus here, Colombia and Argentina have an increasing interest in the migration issue, generated by political crises, which have added to the dramatic growth of the emigrants' flow to the United States and Western Europe.

In Brazil there is no major preoccupation with international migration, though in recent years the interest on this subject has increased.[7] The low incidence of international migration and the persistence of important internal mobility processes between different regions inside the country contribute to limit the interest in the international dimensions of this problem. In the case of Chile, a bigger interest in migration issues can be perceived, in part due to the increasing presence of Peruvian immigrants, the Chilean community in Argentina, and the importance of qualified emigration.

The perceptions of the governmental capacities to act on the migration process vary significantly. In Argentina and Colombia, press articles – and the magnitude of migrations at the present time – reveal the perception of a process that escapes the control of the government.[8] In Brazil and Chile, apart from the opinions of the experts or the public interested in the subject, a clear vision of the occasional impact of the migration problem seems to prevail, and the local ability to regulate this is generally trusted.

The regional countries' priorities on legislation and policies related to migration mainly refer to the regularisation and the control of immigration from neighbouring countries, often in the frame of regional integration processes. The recent initiative of the countries that comprise the Mercosur to reach an agreement about the residence of nationals in the member states is of great interest. From the perspective of the mobility of HRST, although the agreements aim to make circulation easier, the points that are still unresolved are those related to the recognition of university diplomas – especially in liberal professions – and some important restrictions to the access of foreigners to public employment.

6. Mármora (1997), p.34.

7. See Comissão Nacional de População e Desenvolvimento (2001).

8. For Argentina see Albornoz et al. (2002). The problems of displacement of people and migration are summarised in CODHES (2003).

The migration administrations of Argentina, Brazil and Chile seem to be challenged by the new realities of migration. In the case of Argentina, the administration's inefficacy is expressed by the recurrence of amnesties for great numbers of illegal immigrants, as a way to solve the problems arising from illegality. In Brazil, the great length of the borders and the presence of near-conflictive regions – like the border with Colombia or the smuggling at the triple border with Paraguay and Argentina – seriously limit the possibilities of migration control. Chile's public administration is recognised by many as one of the most efficient in the region. Nonetheless, the sudden increase in the amount of Peruvian immigrants disclosed problems in the management of migration. By the middle of 2001, the country's authorities decided to create a commission to make a diagnosis of the migration situation and to give the government some tools for a new policy on this subject.

This weak capacity of the state to manage the international migration is also expressed by the lack of information on incoming migrants. The departments in charge of the administration for migration tend to restrict the access to information, because of the difficulties that processing and organising the information imply, or because of a policy of restrictions on data dissemination.

Although there is clear evidence of greater interest and concern about the issues of international migration and, especially in some countries, about the emigration of qualified human resources, there are no policy initiatives yet with the necessary thrust to deal with these issues. Traditional policies seem to be insufficient, and there are no new ones. According to Mármora, there has been a process of recognition and re-evaluation of the migration issues, but "Latin American governments would be in a kind of transition between national policies and the search for new alternatives".[9] To Mármora, this transition is much more evident in those areas related to emigration policies.

As said before, the fact that South American countries have been usual receivers of immigrants led to a lack of attention to the problems of emigration, and thus to a weakness of the policies on this subject, which have only recently begun to be modified.

It was only by the late 1960s that the first evidence of "brain drain" led to the adoption, in some countries of the region, of measures oriented towards the facilitation or promotion of the return of highly skilled nationals. After the fall of the *de facto* military regimes in the 1980s, some programmes for the return of exiled people were established, in many cases with the support of international organisations.

The increase of emigration in recent years even had an impact on usual receiving countries and has prompted a growing concern about policies oriented to regulate the flows, to limit the negative effects of the drain of human resources or to attract highly skilled labour from foreign countries. The adopted measures do not seem to have had great impact. There is usually an important gap between the migration problems that the countries have to deal with and their states' capacity to tackle them. For several countries, the big scale and complexity of the migration problems coexist with deep social and political crisis, one of whose dimensions is the erosion of legitimacy and efficacy of the national states. The cases of recent emigration flows from Colombia and Argentina are particularly acute manifestations of this issue. Even in cases of more efficient and stable states, the migratory situation seems to be out of control. In the Chilean case for example, the evaluation of the migratory situation carried out by the national government in 2001 concluded that "the institutions were not prepared for the massive arrival of foreigners".

In the definition and implementation of policies related to emigration, institutional factors have influence too. At the beginning of the 20th century, organisations oriented to rural settlement were usually in charge of migration policy. By the middle of the century, concurring with the exhaustion of the European migration flows and the increment in internal and neighbouring countries' migrations, migratory

9. Mármora (1997), p.37.

policies began to depend on the ministries of internal affairs. Often, the problems that claimed the attention of migratory administrations were those of border control, related to illegal immigration. More strictly, the migratory policy was limited to immigration, and only focussed on administrative aspects, without a reference policy on population or economic development.

The inclusion of problems that arise from emigration in public policies requires a new institutional framework for migration. Two lines of such a framework can be distinguished. On the one hand, given that the primary responsibility for the definition of policies about nationals in foreign countries lies with the ministries of foreign affairs, the first line of action for governments is to extend the consular functions of these ministries. This means that governments should try to extend their consulate and ministry functions and build stronger and more systematic links with the nationals living in foreign countries. An example of this action line is the creation in Chile of the Directorate of Chilean Communities Abroad, resorting under the Ministry of Foreign Affairs.

On the other hand, the goal of establishing more productive links with nationals abroad – especially the highly skilled – has led to the creation of specific programmes. The development of Red Caldas, in Colombia, is worth mentioning, because of its action line and importance. This network was created and falls under COLCIENCIAS, the organisation in charge of the state's policy on science. Red Caldas has carried out systematic work locating national scientists abroad. In Argentina, the Secretary for Technology, Science and Productive Innovation (SETCIP) implements the "Raíces" programme – a network of Argentinean professionals, scientists and technicians living abroad – which is an incipient effort to facilitate linkages between these professionals. In Chile, a more ambitious and systematic policy is on its way to implementation. The recent creation of DICOEX reveals the priority assigned by the government to this issue. DICOEX has created a Web site (http://dicoex.ciberutem.cl) and is developing linkage activities related to topics such as the voting of Chileans abroad and the promotion of commercial and productive interchanges. The DICOEX project includes the creation of a statistical database of the number of people abroad, their legal situation, economic activity, family group and time of residence abroad. This information will pave the way for stronger interchanges. In the Brazilian case, as it was shown, the issue of highly skilled mobility and migration has not acquired importance yet, confirmed by the lack of governmental initiatives on this subject. The National Commission for Population and Development has recently carried out studies aiming to incorporate the migratory issue in population policies. One of these studies indicates that "there is not a global / transversal policy from the Brazilian government to deal with emigration yet, and much less a democratically discussed policy on the immigrants living in our country".[10] In the same study, an important number of organisations and groups related to the migration issues were revealed, *in casu* non-governmental organisations for the study, encouragement and organisation of immigrants and emigrants.

The preceding considerations have centred on the perspective of national migration policies. We think it is necessary to add a complementary perspective, that of higher education and science and technology institutions. South American researchers are active participants in the internationalisation process of science and higher education. They participate in international projects and academic networks in many cases, they attend congresses abroad, receive international co-operation funds and promote in many other ways a link with academic communities in the world. In line with this orientation and because of perceived deficits in the training of human resources, the higher education and science and technology institutions promote international links, including scholarships for studies abroad. Studying abroad is made easier by the convergence between national efforts and international co-operation through scholarships and grants, whose number is fairly high in comparison with those available for research at home. At the same time, the scientific communities of South American countries – in various ways, depending on the country – manifest a well-founded concern for the loss of some of their best young researchers, who do not find

10. Sprandel (2001), p. 547.

sufficient stimulus to continue their careers in their country of origin. As we shall see in Section 6, the loss may be significant.

4. Information sources on highly skilled labour and international mobility

Available information sources on highly skilled labour and international mobility in most South American countries are similar to those from OECD countries as far as the main types of collected data is concerned. National statistical offices conduct different kinds of surveys, such as labour force surveys, population censuses, household surveys and other regular surveys. However, quality, coverage and availability of information are quite inferior to those found at the US Census Bureau, the US Immigration and Naturalisation Service, at Eurostat or at the Australian Department of Immigration and Multicultural and Indigenous Affairs. Labour ministries conduct periodical surveys on different questions related to the magnitude, composition and evolution of employment. Education, science and technology ministries also collect and organise information related to their area of competence. There have been different regional attempts to harmonise statistical methods and instruments, both regarding the range of action of national statistical offices and in the sectoral sphere. The efforts of "Red Iberoamericana de Indicadores en Ciencia y Tecnología" (Ibero-American Network on Science and Technology Indicators, RICYT) have been an important regional step towards collecting information and elaborating and disseminating science and technology indicators. As far as the higher education systems are concerned, information is likely to be more scattered, partly due to the quantity and variety of institutions involved. The World Bank possesses an important amount of information obtained at the preparation and pursuit of loans aimed to finance reforms of higher education systems in the area.[11]

The comparison between the relative importance of HRST within the labour force of OECD and South American countries deserves further consideration. Low participation of HRST in the labour force of South American countries hinders a more intensive use of household surveys, since for many kinds of HRST the samples are unreliable. In addition to the difference in numbers, there are also differences regarding production structures and required work profiles, a fact which should be taken into account in any comparison with OECD countries. This is particularly important for the HRST segment composed of workers in S&T activities who have not received higher education. It is not easy to trace these kinds of technicians, defined by job rather than by education, in the national statistics of South American countries. To compare technicians in South American countries with those from OECD countries is even more difficult than doing so for professionals. A recent report about work training in Latin America states that "in this area, a paradox is likely to be encountered: although an excessive work supply and relatively high levels of unemployment are shown, when new jobs are created in times of expansion, very few people fulfil the required qualifications", which shows an important shortage in technical training.[12]

Although, as has been stated, some sources are available, and in the last decade some important steps forward have been taken, information on HRST is still far from satisfactory. As Pires Ferreira puts it, "several factors can explain this lacuna, which range from the fact that S&T tends to be marginal in government agendas, continually urged by problems which demand immediate attention, to their complete absence in work programmes of most of the national statistical offices, which impedes obtaining primary standardised and statistically reliable data. Thus, technical, conceptual and methodological discontinuity is one of the main difficulties encountered by users of this kind of information".[13]

11. Holm-Nielsen, Blom and García (2003), p.3.

12. Gallart (2001), our translation. Similarly, results for Latin American countries participating in PISA are quite far from those for OECD countries.

13. Pires Ferreira (2003), our translation.

4.1 Censuses

Censuses are a major information source for data on the stock of highly skilled human resources in a country. They provide reliable information about education levels and employment conditions in national terms, which can be related to primary demographic variables.[14] As for their main limitations, they are of two kinds. The first one involves whether questions are asked to obtain information about educational attainment. Usually, people are asked to state the highest educational level they have attained. In addition, several censuses in the area ask university graduates about the degree they have obtained, which turns out to be very useful information if we want to know the internal composition of the professional group. The existence or non-existence of this question should be taken into account. The second limitation is that, even if this question is asked, codification of its answers is a complex and time consuming process, which means that information of this kind takes quite a long time to be produced by national statistical offices. In some cases, moreover, although the question has been asked, costs have prevented answers to be processed.

In the early 1970s, the Centro Latinoamericano de Demografía (CELADE – Latin American Center of Demography) started a regional project aimed to study migration phenomena, whose main sources of information were national population censuses. The IMILA project intends to create a database with census information – both from countries within and outside the area – about people living in a country different than their native one, that is, international migrants.

Although this project is specifically oriented to study international migration from Latin American countries, information about people born elsewhere is also included in order to obtain a number of tabulations permitting an exchange of information at the world level. The mass of information gathered in the database is important even if only the basic tabulations of the project are considered: foreign born population by sex, age, civil status, educational level, occupation, children born alive, surviving children and place of residence in the last five years.

It is necessary to explore the information potential of the 2000 Census Round, especially those data which might provide information about highly skilled human resources in a country and about their migration.[15] As for the stock of highly skilled human resources, Argentinean and Brazilian censuses present an important innovation: the question about the degree obtained. This will enable us to know the number of professionals in each area and their occupational features. Concerning international mobility, it will be possible to identify the different groups of foreign-born professionals and their number, as well as their arrival date and occupational characteristics.

4.2 Labour force surveys

Labour force surveys are a valuable information source to study questions related to employment of highly qualified personnel.[16] However, it is a well-known problem that sample sizes limit their potential. In South American countries, these limitations are more severe, since the proportion of professionals in active

14. On standardisation problems, see CEPAL / CELADE.

15. A project to extract data for Argentina, Brazil, Chile and Mexico from the latest Census round is currently under way.

16. Laafia and Stimson (2002) provide a detailed analysis about usefulness and limitations of the Community Labour Force Survey to gather information about HRST, employment in high technology and job-to-job mobility of highly qualified individuals.

population is smaller than in OECD countries. Besides, those professions which are closer to the HRST core are also less numerous than in OECD countries.[17]

In the same sense, surveys in South American countries do not prove useful to estimate the presence of HRST immigrants, since these immigrants represent only a small portion of the total number of immigrants, who are mostly lowly qualified.

4.3 Sources from the higher education system

Particular difficulties are encountered when compiling higher education indicators in Latin America. Most universities in the area do not have much experience in gathering, analysing and using statistical information, being, as they are, part of national states which have designed their policies mostly through informal mechanisms. As far as the university system is concerned, the high levels of autonomy in institutions and the parallel lack of interest of national education administrations to have and use information about the university system has led to a shortage of procedures, personnel and resources involved in statistical chores. This tendency shows a telling contrast with the United States and Europe.

In spite of biases and problems in gathering information from a number of institutions with different classification criteria and important deficits in their statistical culture, throughout the 1990s significant steps were taken towards production and dissemination of statistical information, and towards the elaboration of indicators.[18]

4.4 Sources from the S&T system

Information from direction and planning departments in national systems of science and technology usually comes from statistics bureaus with the longest tradition. Moreover, there is an important regional project – RICYT – whose aims are gathering information and elaborating indicators on the S&T systems in the region. However, we are still far from having RICYT standards adopted in national bureaus producing S&T statistics.

Latin American countries that take part in RICYT have not yet agreed upon the question of human resources measurement. Two main strategies are available: reliance upon surveys, on the one hand, and reliance on secondary sources, such as databases elaborated for different purposes, on the other. Some progress has been made regarding the definition of a "researcher", where efforts have been made to adopt OECD's definition.

Stating the difficulty of obtaining appropriate statistical information is commonplace in studies about international mobility of HRST. Some general sources, which provide information about international mobility of HRST (especially censuses), have already been mentioned. We will now state other actual or potential information sources that can help to complete an overview of the subject. As Lowell and Findlay point out, "it should be possible to construct estimates of highly skilled mobility for most sending countries drawing on *several* national data sources and imputing information as necessary".[19]

17. Gómez (2001).

18. For an excellent analysis of the trends discussed see De Vries (2000).

19. Lowell and Findlay (2001), p. 29.

4.5 Information produced by national migration departments

As already stated, several difficulties are encountered when using information produced by national migration departments. Some of them are due to inefficient administration, as is apparent in the high levels of illegal immigration in the countries we are studying. Others derive from the differences between administrative uses of information and statistical requirements. Last but not least, the lack of consistent migration policies can be observed in low attention and interest shown in providing specialists and the general public with information.

Some of the sources to which access is difficult are registers of entries and departures of the foreign-born. Up to now, these registers have been hardly used due to difficulties to organise its data. Besides, these registers do not include illegal migration, although in the case of highly skilled human resources this should not be a relevant fact.

Despite these hindrances, experience enables us to assume that they can turn into accessible sources in the near future. The SIMICA Project (Andes Community International Migration Information System), developed by the International Organisation of Migration and CELADE, has revealed information from registers of entries and departures in Colombia, Venezuela, Peru, Ecuador and Bolivia. The methodology elaborated by SIMICA does not include data about highly skilled human resources, but it is possible to trace them.

In general terms, the efficiency of migration administrations in South American countries tends to increase. This is likely to improve accessibility of information about migration. It would also be convenient to check access to information about residence and labour permits, visas and access to the labour market. It would be particularly interesting to obtain information about mobility within the area of professionals and technicians working in multinational enterprises.

4.6 Specific mobility and migration surveys

It is possible and desirable that specific national surveys about mobility and migration of highly skilled human resources be conducted. As this subject gains public relevance, governments tend to elaborate an increasing amount of information on volume and characteristics of this phenomenon, as well as on social perceptions about it. In many cases, destination countries are also interested in producing information.

In the case of Chile, the DICOEX project includes conducting a survey on Chileans living abroad. In Argentina and Colombia, the magnitude of emigration in recent years, as well as its political repercussion, will promote a higher development of research in this field.

Although specific surveys on international mobility and migration are rare, lack a national scope and usually focus on specific immigrant communities, they are undoubtedly useful.

4.7 CvLAC project (Latin American and Caribbean System of Curricula)

The Brazilian Lattes Platform contains an exhaustive and accessible register of active researchers in the country. On this basis, CNPq, BIREME, PAHO and the Stela Group have begun to develop an integrated platform for the whole of Latin America: CvLAC's System (Latin American and Caribbean System of Curricula in Health). From the starting point of health CVs, the system has expanded to encompass a wider area. Since 2000, CNPq has come to agreements on co-operation with a number of national S&T departments and specialised institutions, such as the Colombian Science and Technology National Observatory.

At the moment, the Lattes Platform is being implemented in Argentina, Chile and Colombia, but the system is likely to expand to other South American countries in the following years. Generalisation of this system will enable access to a valuable amount of information on characteristics of the Latin American community of researchers. Regarding international mobility, the platform will allow us to obtain information about international relations networks, foreign born researchers working in each country, attendance to workshops abroad, international research projects, papers published in foreign reviews, etc.

4.8 Skilled health professionals

The main regional information source about the existence of health professionals in each country is the compilation of basic health indicators made by the Pan American Health Organisation (PAHO). The PAHO collects and organises all the information provided by health ministries from different countries to compose a regional health data system. The system includes 109 indicators grouped into five collections: demographic indicators, socio-economic indicators, mortality indicators, morbidity indicators and resources, access and coverage indicators. In the resources, access and coverage indicators, the number of physicians, professional nurses and dentists per 10 000 inhabitants are included.

4.9 Sources from the United States

4.9.1 National Science Foundation databases

SESTAT is a comprehensive and integrated system of information about the employment, educational and demographic characteristics of scientists and engineers (S&E) in the United States. In concept, it covers those with a bachelor's degree or higher who either work in or are educated in science or engineering, although some data on non-S&E are also included. SESTAT was created by the National Science Foundation (NSF) to provide data for policy analysis and general research, and is maintained by the Division of Science Resource Studies within the NSF.

The approach chosen to measure US scientists and engineers (S&E) is very close to that of the "Canberra Manual", in that it looks at the S&E population in terms of both education and occupation. The coverage of US S&E is, however, more restrictive than that of HRST, *i.e.* it does not cover certain categories of teaching professionals, managers, other professionals and associate professionals in the ISCO sense. On the other hand, the term "scientists and engineers" in the US sense is much broader than that used in the Canberra Manual. Thus, harmonisation is still needed at international level.

The system is based on survey studies conducted in 1993, 1995, 1997, 1999 and 2001. Although the results of the 1999 and 2001 studies have not yet been thoroughly published, its first outcomes have been useful to elaborate the information provided in this paper.

4.9.2 Institute for International Education: Opendoors Report

Mobility in the higher education field is an important feature of the Argentinean born HRST. For this reason, information about South American university students studying in US universities and about teachers working in US universities is extremely useful.

The Institute for International Education issues yearly the Opendoors Report (Institute for International Education, 2002), which includes information about foreign undergraduate and graduate students as well as about foreign teachers at US universities.

4.9.3 Immigration and Naturalization Service

The Immigration and Naturalization Service of the United States provides very detailed information about immigrants admitted in the country, by country of birth and occupation group, as well as about naturalised foreigners and those possessing some kind of visa to remain in the United States.

4.9.4 Foreign physicians working in the United States

The American Medical Association (AMA) has a foreign physicians section. Information about foreign physicians working in the United States can be found at the International Medical Graduates Section Web page (http://www.ama-assn.org/ama/pub/category/17.html). It includes physicians' assistance activities as well as research and development activities.

The main trends in occupation and regional distribution are depicted on the Web page, as well as main countries of origin of foreign physicians. Unfortunately, the number of physicians from the countries in the study is not available. In any case, AMA is likely to possess information which could depict quite accurately the presence of South American physicians in the United States.

4.10 Sources from other OECD countries

As far as other OECD countries are concerned, we have gathered information about Canada, Australia and Western Europe, in particular Spain. Canada and Australia have got excellent information sources. In European countries, certain characteristics of the migration policy make access to information more complex.

4.10.1 Canada

Available information from the 2001 Census about immigration is still preliminary. Although tables containing basic demographic data (countries of origin, size, geographic distribution, age, etc.) have already been published, these data have not yet been related to education and occupation variables.

Every year, Canada issues, through *Citizen and Immigration Canada*, the *Immigration Overview*, which contains detailed information about the main immigration variables. None of the South American countries appears in the top ten countries of origin for highly skilled professionals. This is why data about immigration from those countries have not yet been published. Databases from which these tables come from should have information about each South American country though.

The Canadian Medical Association (CMA) also gathers highly aggregated information about foreign born physicians. The chart available at the CMA Web page (www.cma.ca) shows the proportional distribution of physicians by country of MD graduation. For 2002, only those physicians are distinguished that graduated in Canada, the United States and other countries. The Canadian Institute for Health Information produces the Southam Medical database, which provides information about migration of physicians in Canada. This database reveals and codifies immigrants' countries of origin and the universities where they have graduated.

4.10.2 Australia

Australia offers highly detailed information about immigrants through the Department of Immigration and Multicultural and Indigenous Affairs. Every year, this department publishes a collection of reports that provide the main characteristics and trends on the migration subject. The chapter on highly skilled migration specifies various categories of aggregation: independent migrants, employer's nominations, business skills migration, distinguished talent and skilled Australian sponsored.

In 2001, this department published *Population Flows: Immigration Aspects*, a synthesis of the main tendencies and indicators on qualified migration. Among other subjects, the report provides information about visas by migration category, by countries of origin and for several years. As in the case of Canada, the highly skilled immigrants from South American countries are very few, and this is the reason why these data are not published. The same happens with statistics about foreign students included in the same book.

4.10.3 Europe

For Western European countries, the various reports available do not provide accessible information sources to trace numbers or characteristics of highly skilled immigrants. Until now, we have not been able to find sources equivalent to those of the NSF for scientists and engineers, nor to those from the Institute for International Education for foreign students.

The main problem regarding access to statistical information sources from European countries is the definition of nationality adopted by most of them. Spanish statistical sources, which have been thoroughly checked, can illustrate this problem properly.[20] As other European countries, Spain has adopted *jus sanguinis* as nationality definition criterion, in opposition to *jus solis* criterion of immigration countries, such as South American ones. This means that Spanish descendents who are born, for instance, in Argentina, and immigrate to Spain are considered by law and the statistical system as returning Spanish rather than foreigners.[21] The Spanish municipal register, for example, distinguishes birthplace and nationality. In 2000, it registered 70 491 born in Argentina, only 26 142 of which were not Spanish citizens.

5. Indicators on highly skilled labour

In this section, HRST stock and flow indicators are presented, which have been elaborated from various sources. As example of stock indicators we present data on researchers, and for flow indicators series of graduates and postgraduates. Furthermore, these data are compared to indicators referring to other areas and to OECD countries. Finally, some indicators on employment of professionals are discussed.

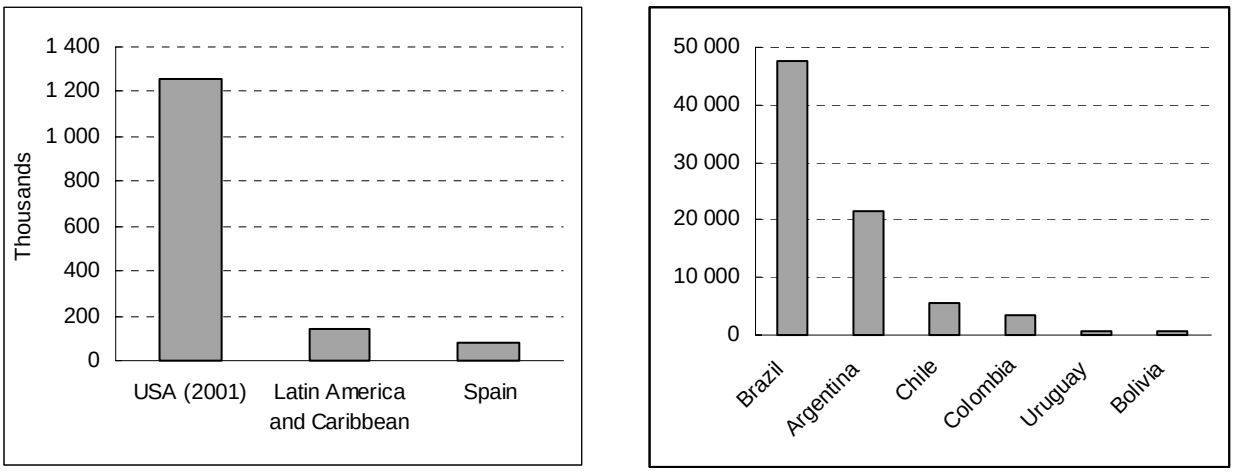
5.1 Researchers

The selected stock indicators are the number of researchers and the rate of researchers participating in the labour force. Clearly, there is a huge difference in research potential between the United States and Latin America (see Figure 2). In the United States, there were 1.3 million researchers in 2001, almost 9 times as many as in Latin America and the Caribbean (in 2000).

20. For information about sources to study immigration into Spain, see issue 69 of Fuentes Estadísticas (2000).

21. See Sarrible (2001).

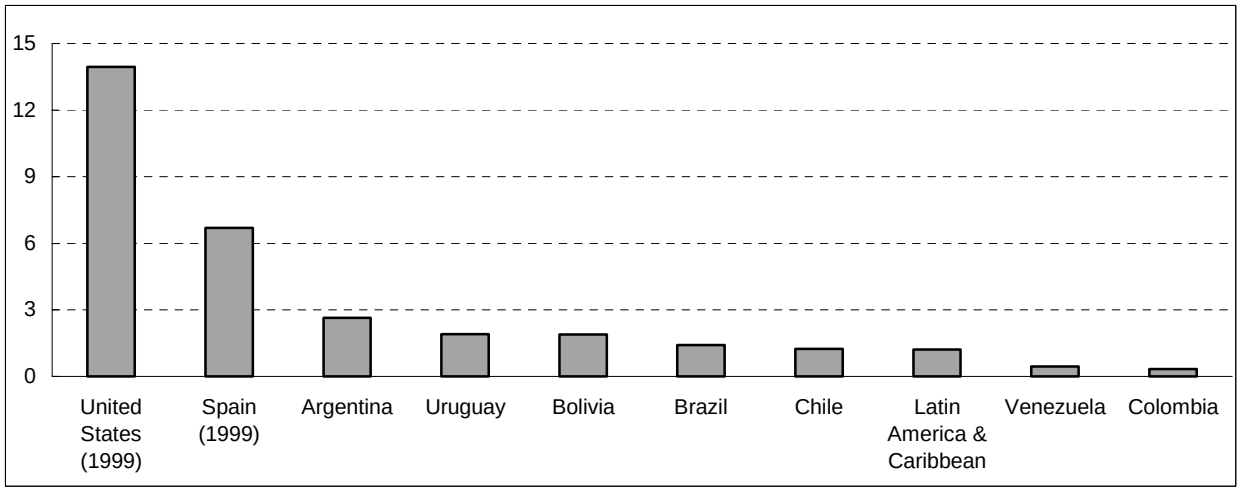
Figure 2. Number of researchers (FTE), 2000



Source: RICYT (2003).

Figure 3 shows a telling difference in the researchers' participation in the labour force between South American and OECD countries. Even those South American countries with a high proportion of researchers are unable to reach half the proportion of researchers in Spain.

Figure 3. Number of researchers (head count) per thousand labour force, 2000



Source: RICYT (2003).

5.2 Indicators from the higher education system

Selected indicators from the higher education system are university graduates,[22] masters and PhDs obtaining their degrees per year. The number of university graduates per year is the main indicator for the flow of human resources into human resources in science and technology. Some disciplines are more relevant, since they are more directly related to scientific and technological activities. The obtaining of a

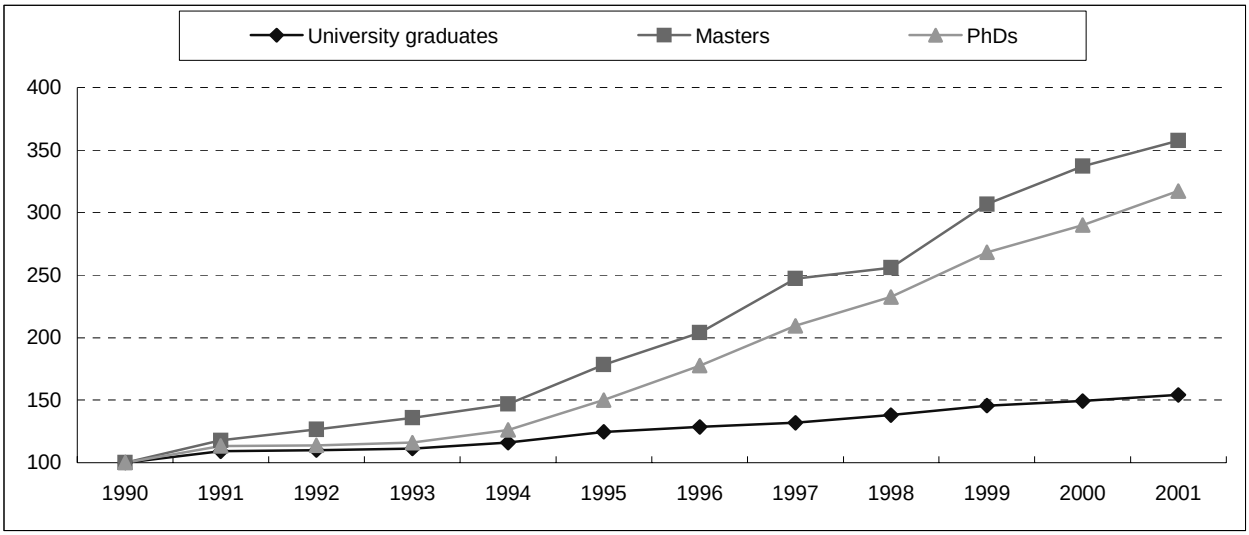
22. In the context of this paper, university graduates means students obtaining their first university degree.

masters brings about changes within the human resources pool, increasing the qualifications of a growing portion of graduates. PhDs are the highest degree of scholarly education and belong to the core of human resources in science and technology. Their training as PhDs enables them to develop complex research programmes and to play a role of intellectual leadership.

5.2.1 Main trends

The series of indicators provided clearly show a trend of changes in higher education in the last decade, especially in Latin American and Caribbean countries. The main apparent trends are massification and diversification. One of the most conclusive expressions of massification of higher education in Latin America and the Caribbean is the increase in the number of students. As was stated before, towards 1950 there were approximately 260 thousand students. In 1970, the number had increased to 1.6 million, whereas in 1990 it was already near 7 million. Towards 2000, about 9 million Latin Americans were attending some higher education institution in the area. The number of university graduates increased remarkably as well. The number of graduates between 1990 and 2001 grew around 50%. Finally, postgraduate education experienced a real explosion, as Figure 4 clearly shows.

Figure 4. Evolution of numbers of university graduates, masters and PhDs in Latin America and the Caribbean (1990=100)



Source: RICYT (2003).

Diversification encompasses educational offers, importance given to research and post-graduation programmes, targets of institutions, admission criteria, variety of available careers and quality of provided education. Although uniformity was never a preponderant feature in higher education systems, the present diversification shows great changes, which present national administrations of higher education with the challenge of establishing common regulations and basic parameters of quality for all institutions as a whole. In terms of our focus of interest, the concurrence of accelerated expansion and diversification processes in the offers of higher education poses the problem of heterogeneity in the background of graduates and postgraduates accounted for by our indicators. In other words, the remarkable increase in numbers is also an increase in the variety of degrees and in the quality of education.

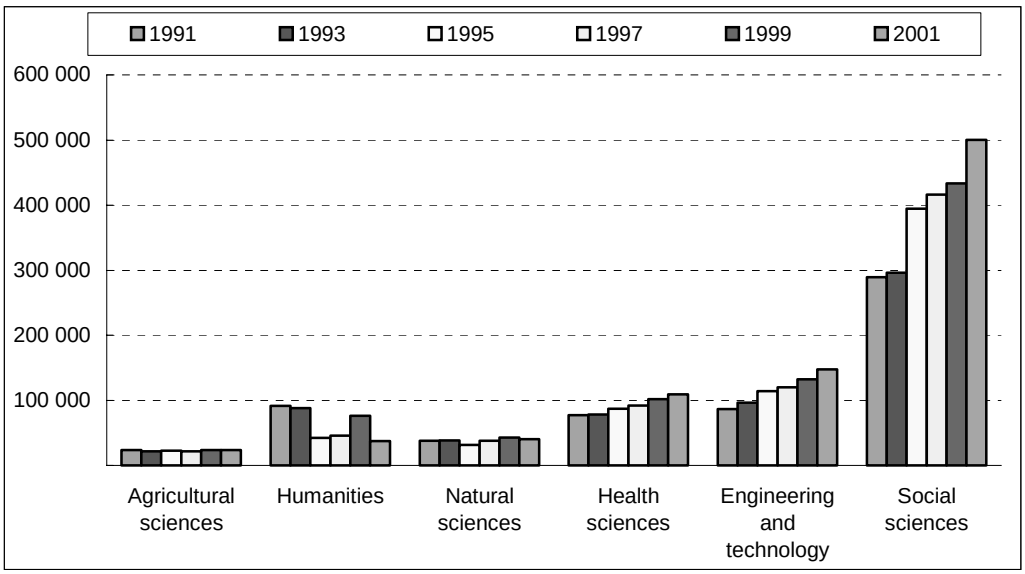
5.2.2 University graduates

As was already stated, between 1990 and 2001 the number of graduates in Latin America and the Caribbean grew slightly more than 50%, from around 560 thousand to some 860 thousand. The composition by discipline shows that the discipline with the highest increase was engineering and technology, followed by social sciences, which virtually doubled their number of graduates (see Figure 5). The increase of information technology graduates partly explains the sudden growth of the former, whereas the expansion of careers in business and communication mainly accounts for the increase of social sciences graduates.

The number of health sciences graduates does not show a similar variation – it only grew 50% – probably due to restrictions in the admittance to medical schools. Agricultural sciences graduates only grew 10%, whereas human sciences graduates cannot be precisely measured since some of their careers were shifted to the area of social sciences in Brazil in 1994.

Regarding national capacities in science and technology, it is particularly important to notice the stagnation of the number of graduates in natural and exact sciences. In 1990, graduates of those disciplines were some 6.3% of the total number of graduates. In 2001, this proportion had dropped to 4.7%. Whereas the total number of university graduates shifted from about 560 thousand in 1990 to about 860 thousand in 2001, those belonging to natural and exact sciences grew only from 35 thousand to 40 thousand. This trend differs from that observed, for instance, in Spain, where the participation of the graduates from the natural and exact sciences is over 10% every year throughout the series. However, significant differences can also be noticed within Latin American countries, where Argentina and Brazil are clearly above the mean.

Figure 5. University graduates, Latin America and the Caribbean



Source: RICYT (2003).

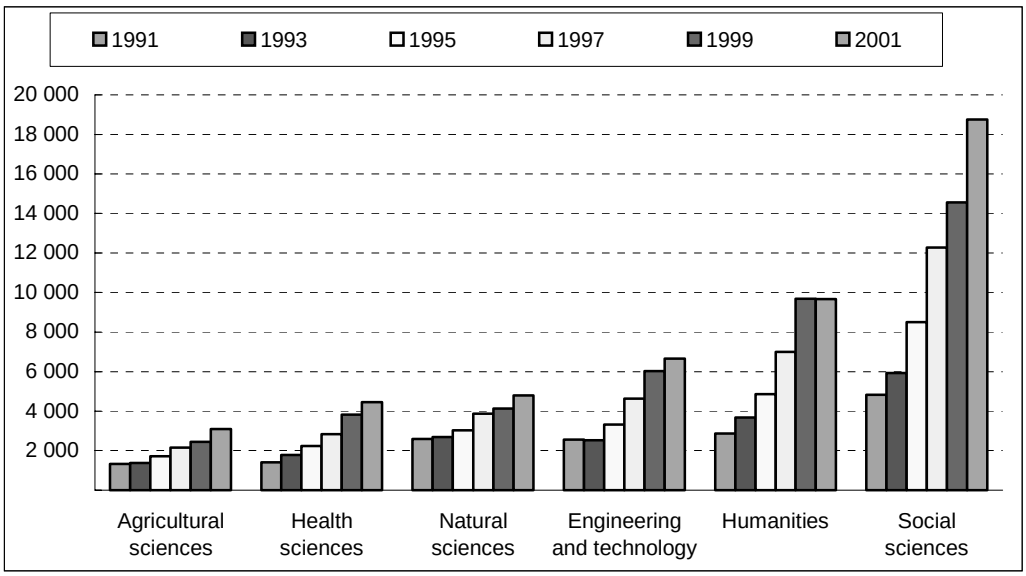
5.2.3 Masters degrees

As was said before, diversification is the second process made apparent by the indicators. In fact, massification and diversification can be regarded as two sides of the same process. One of the aspects of diversification is the growth of a heterogeneous postgraduate education system and thus of an increasing number of postgraduates.

The number of masters reveals explosive growth, which proportionally outruns the growth of university graduates. Between 1990 and 2001 the total number of new masters degrees awarded in Latin America and the Caribbean multiplied by 3.6, from slightly more than 13 thousand awarded degrees to more than 47 thousand (see Figure 6). Brazil and Mexico are responsible for some 80% of the total. The growth in the number of graduates in social sciences is what has fuelled the increase in masters degrees. In 1990, 28% of graduates were taking masters courses in social sciences, whereas in 2001 the percentage had grown to 39%. The relative participation of human sciences remained stable at 20%, whereas in the other areas it decreased. As we have seen for university graduates, natural and exact sciences masters grew at a substantially lower rate than the rest.

This growth presents some problems of interpretation arising from the ambiguous nature of masters degrees, which, under the same name, include scholarly educational programmes – many of them conceived as part of a PhD programme – and others oriented to professional training. As we have seen for graduates, a process of diversification, not adequately reflected by the indicators, has accompanied expansion. Nevertheless, it seems quite clear that the growth of social sciences masters holders reveals the expansion of professional masters degrees. A comparison with the United States, where the nature of masters degrees is more clearly scholarly, will underscore this point. US data show a lower rate of growth, which is below the mean in the case of masters holders in social sciences, and above the mean in the case of masters holders in natural and exact sciences.

Figure 6. Masters degrees, Latin America and the Caribbean

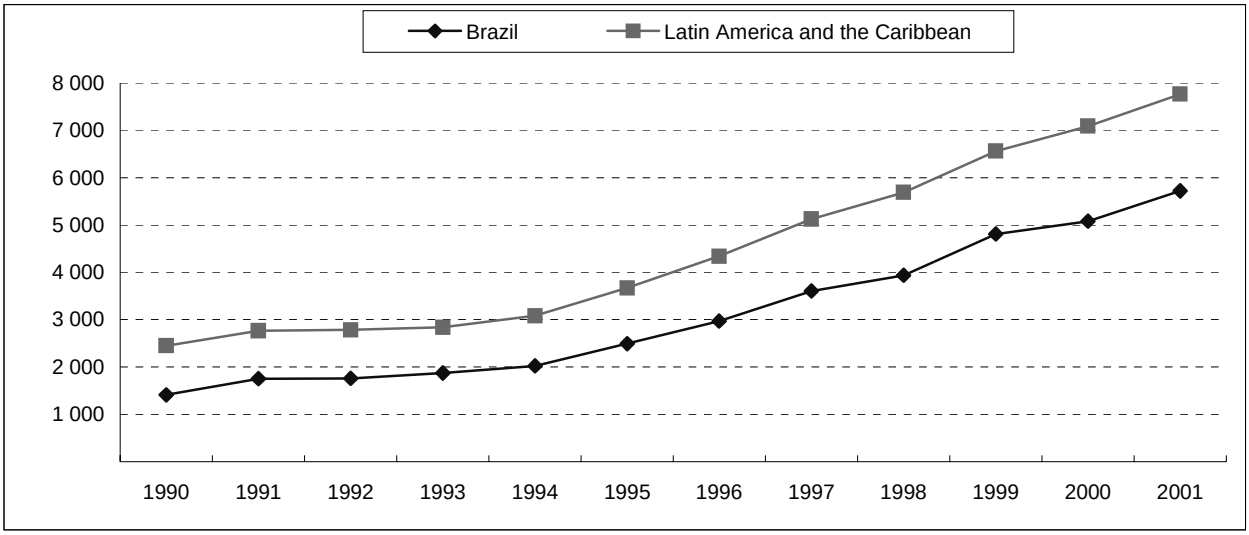


Source: RICYT (2003).

5.2.4 PhD degrees

The number of PhDs in Latin America and the Caribbean has also experienced a significant increase, much higher than that of graduates and slightly lower than that of masters holders. Variations can be explained on account of the increase of PhD programmes in Brazil, which account for two-thirds of the whole of PhD programmes in the area (see Figure 7).

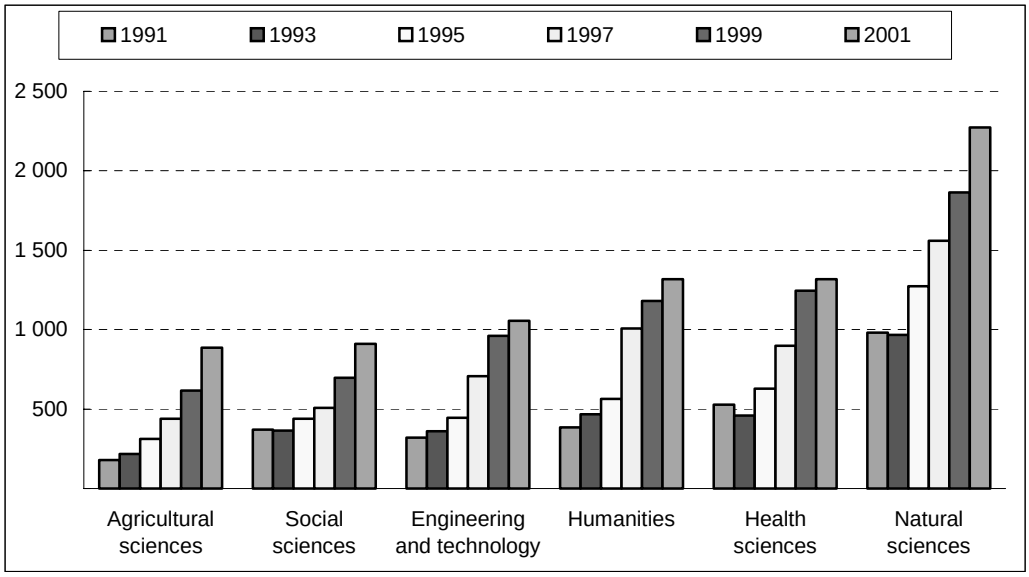
Figure 7. Awarded doctorates: Brazil and Latin America and the Caribbean



Source: RICYT (2003).

In Latin America and the Caribbean, contrasting with the situation described for graduates and masters holders, PhDs degrees in natural and exact sciences have suffered only a slight relative decrease, whereas those in engineering and technology have grown 20% above the mean (see Figure 8). The situation of PhD degrees in human sciences is also different from that of graduates and masters holders in the same area, and show slight relative growth between 1990 and 2001. Those in social and health sciences are close to the mean, whereas those in agricultural sciences show a slightly larger increase.

Figure 8. Awarded doctorates, Latin America and the Caribbean



Source: RICYT (2003).

The amount of Latin American and Caribbean graduates who obtain their PhD degrees in Europe and North America deserves further consideration. From the point of view of the development of human resources in science and technology, reckoning flows and their composition by country of origin and destiny and by branches of knowledge is of great importance to assess national capacities in science and technology.

5.2.5 Some comparisons with OECD countries

Comparisons of HRST between South American and OECD countries – and even among countries within each area – must be carefully made, inasmuch as higher education systems show significant differences in structure, traditions, and quality levels.[23] Although no comparative evaluations regarding the quality of university education in different South American and OECD countries are available, it seems quite clear that South American educational systems are much more heterogeneous and segmented than OECD's. Consequently, the proportion of university students within the corresponding age group may be misleading. Discrimination by branches of knowledge adds important information. Differences between Latin American countries and newly industrialised countries in South East Asia not only reflect on the evolution of higher education gross enrolment rates, but on the importance of sciences and engineering among students and graduates as well (see Tables 1 and 2).

Table 1. Gross enrolment rates in higher education, 1985 to 1997

	1985	1997
Latin America and the Caribbean	15.8	19.4
OECD countries	39.3	61.1
Asian newly industrialised economies (a)	14.8	30.5

Note (a): China; Hong Kong, China; Malaysia; Korea; Singapore and Thailand.
Source: Adapted from Carlson (2002).

Table 2. Higher education enrolment and graduates in natural sciences, engineering and agricultural sciences as a % of the higher education total, 1998

	Enrolment	Graduates
Latin America and the Caribbean	26.0	26.6
OECD countries	27.2	25.2
Asian newly industrialised economies (a)	36.0	38.2

Note (a): China; Hong Kong, China; Malaysia; Korea; Singapore and Thailand.
Source: Adapted from Carlson (2002).

Table 3 shows that the total number of graduates in Latin American and Caribbean countries, in the European Union, in the United States and in Japan show very important differences in terms of magnitude, much more so if they are compared with the total population of each area – 505 million in 2000 for Latin America and the Caribbean, 282 million for the United States, 378 million for the EU and 127 million for Japan. The most important gap can be found among science graduates, where the European Union has six times and the United States four times as many as Latin America.

23. Ekeland (1998), p. 27.

Table 3. Graduates (ISCED 5 and 6) by fields of study, 2000

	Total	Science	Engineering	Health and food	Social sciences, humanities and education
Latin America and the Caribbean	831 247	39 816	142 569	129 438	519 423
European union	2 143 500	255 172	300 475	351 814	1 123 519
United States	2 066 595	169 311	179 238	322 758	1 301 199
Japan	1 107 332	25 021	209 808	128 157	541 431

Note: United States and Japan: 1998.
Sources: RICYT (2003) for Latin America and the Caribbean, European Commission (2003).

5.3 Indicators of employment among university professionals

The growth of university graduates brings about an increase of the proportion of professionals in the total population and in the labour force. An optimistic view of the relationship between human resources training, development and employment posits that the continuing expansion of higher education levels positively conjoins with job creation in modern sectors of economy and with the growth of GDP. In the case of Latin America, the situation calls for several nuances. A recent study attempts to establish which positions increase or decrease their participation when income increases.[24] The authors state that one of the general trends that can be identified for Latin America and the Caribbean in the 1990s is "the increase of highly qualified professionals in countries of higher income, directly related in recent years to the growing presence of medium and large private enterprises and, to a lesser extent, to the incorporation of bureaucratic and professional personnel to the state apparatus". At the same time, this study shows that, in the case of Chile, those employees in non-modern sectors whose educational level has risen have not, however, seen their incomes increase.

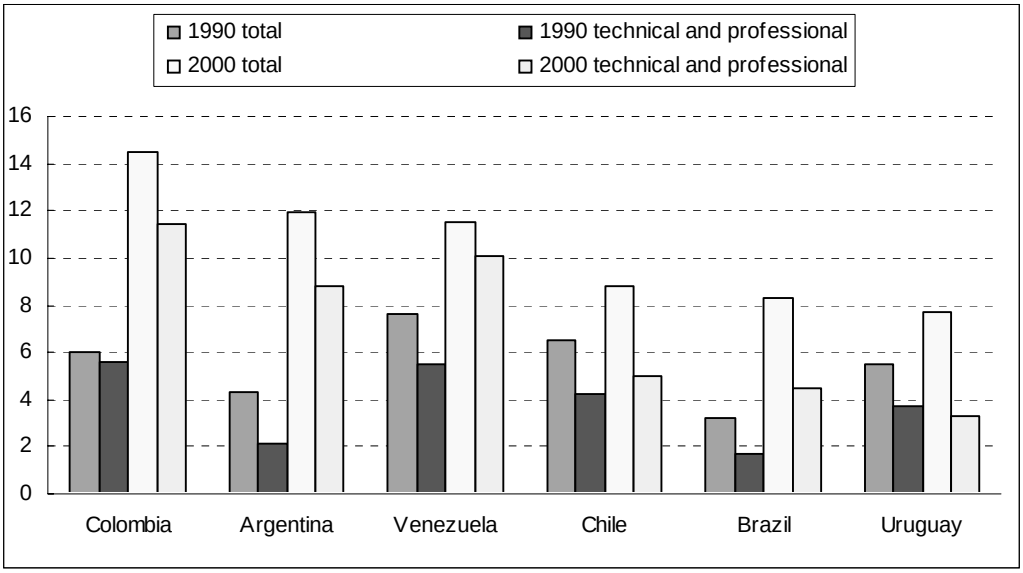
Similar evaluations have been made for other countries of the area. As Gómez states for the Argentinean case, the optimistic view of the relationship between education and employment "does not account for major processes such as underqualification of tasks, unemployment, and the displacement of less educated labour, replaced by university professionals".[25] Thus, it is apparent that the expansion of university professional education does not run in parallel with the creation of jobs requiring corresponding qualifications. A recent report underscores the fact that "the economies of the area are producing a number of jobs unable to absorb the rapid expansion of professionals and technicians".[26] The consequences of this trend have been, among others, the increase of unemployment in this sector, the drop of salaries and, on the other hand, the employment of professionals and technicians in jobs for which they are overqualified. In various countries, emigration has also increased. As we can see in Figure 9, unemployment has grown appallingly all throughout the 1990s in several South American countries. In several cases, the unemployment rate doubled or tripled. Unemployment is lower among technicians and professionals, but its growth rates in the 1990s were extremely high, and grew in equal or higher proportion than the general growth rates. In Argentina for instance, the unemployment rate of professionals and technicians increased four times.

24. Sáinz and La Fuente (2001), p. 96.

25. Gómez (2001), p. 106.

26. CEPAL (2003).

Figure 9. South American countries: unemployment rates, totals and technical and professional occupations, 1990 and 2000



Source: CEPAL (2003).

These trends do not imply an oversupply of highly qualified human resources in the area. On the contrary, professionals are likely to be underemployed while, at the same time, certain economic sectors are short of specialists, who are frequently extremely important to improve the economic efficiency of the area.

6. Indicators on international mobility of highly skilled labour

As it has repeatedly been stated, access to information and elaboration of indicators for international mobility of HRST is a complex task. The main reason for this complexity lies in the heterogeneous nature of the highly skilled and in the various modes of their mobility patterns. Salt mentions twelve different groups of temporary highly skilled migrants, with different motives and mobility patterns.[27] Permanent migrants and business travellers should be added to these diverse groups. Although some of the groups identified by Salt are not relevant for our focus of interest, his classification sheds light on the heterogeneity of the possible types.

The fact that the main information sources refer to the United States limits the range of conclusions that can be drawn about mobility trends of South American HRST. However, in spite of the lack of comparable information about other geographical areas, it is possible to ascertain that the United States is the main destiny of South American HRST migrants. According to Lowell, "the United States accounts for almost all tertiary educated emigrants in North and South America. The United States gets nearly 100 percent of North America's and 80 percent of South America's outflows. The major exceptions in the American system appear to be Brazil and Jamaica whose emigrants can often be found in other OECD

27. These groups include corporate transferees, technicians/visiting firemen, professionals (frequently working in health or educational sectors and often employed by non-governmental organisations), project specialists, consultant specialists, private career development and training, clergy and missionaries, entertainers, sports people and artists, business people and the independently wealthy, academics (including researchers and students), institutions of higher education, military personnel, and spouses and children of the above. Salt (1997), p. 8.

countries".[28] Lowell's estimates – based on Carrington and Detragiache (1998) – are likely to underestimate the magnitude of Argentinean and Uruguayan emigration to Europe.

In recent years, the most important migration trend for Latin America has been the increase of emigration to the United States and, to a lesser extent, to Western Europe. This contrasts with the migration pattern that was current until the 1960s, according to which migrations between countries within the same area, especially across the border, were predominant. This phenomenon became more intense in the 1990s. According to the US 2000 census, there are over 16 million people born in Latin American countries legally residing in the United States, whereas in 1990, there were almost 8.5 million.[29]

In general, it can be stated that Latin American emigrants to the United States are less educated than natives, and than Asian, African and European immigrants. Nevertheless, this statement should be carefully considered and specified to take into account particular differences between countries. If we study the percentages of immigrants with postgraduate degrees, we can observe that the proportion of postgraduates in the immigrant workforce from Argentina, Venezuela, Bolivia, Paraguay and Chile is higher than the mean of postgraduates in the total foreign population in the United States.[30]

We will now show a few relevant statistics on selected groups of HRST migrants, and some indicators to estimate the loss of HRST in South American countries.

6.1 Professionals and technicians in America

The population censuses included in the IMILA database enable us to estimate the number of professionals and technicians born in South American countries and registered in other countries. Censuses now available are those taken in the 1970s, the 1980s and the 1990s. As already stated, 2000 census information about these subjects has not been completely elaborated yet.

The general tendency towards growing emigration to the United States in contrast to emigration to other Latin American countries is clear in the case of professionals and technicians. As can be observed from Table 4, the increase of professionals and technicians born in Latin American and Caribbean countries and registered in Latin American countries between 1980 and 1990 was 12.1%. Instead, the percentage increase of the migration of Latin American professionals and technicians to the United States between the 1980 and 1990 censuses was 59.0%. This tendency consolidated all through the 1990s.

28. Lowell (2001), p. 10.

29. Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data.

30. Pellegrino (2001), p. 330.

Table 4. Professionals and technicians born in Latin American and the Caribbean countries, registered by censuses in other Latin American countries and in the United States

In Latin American countries					In the United States				
			Growth%					Growth %	
Country of birth	**1980**	**1990**	**80-90**		**1970**	**1980**	**1990**	**1970-80**	**1980-90**
Argentina	8786	7 431	-15.4		4 882	7 766	9 614	59.1	23.8
Bolivia	5 398	7 926	46.8		999	1 809	2 187	81.1	20.9
Brazil	2 163	2 495	15.3		2 138	3 474	..	62.5	..
Chile	10 872	1 1969	10.1		1 984	4 405	5 067	122.0	15.0
Colombia	16 572	17 523	5.7		5 240	8 724	15 518	66.5	77.9
Costa Rica	550	494	-10.2		1 110	1 773	..	59.7	..
Cuba	1 860	1 849	-0.6		26 195	42 066	46 792	60.6	11.2
Ecuador	1 465	1 639	11.9		1 901	3 436	6 066	80.7	76.5
El Salvador	1 252	802	-35.9		686	2 202	6 678	221.0	203.3
Guatemala	383	828	116.2		1 008	2 058	4 381	104.2	112.9
Haiti	149	223	49.7		2 654	5 832	12 455	119.7	113.6
Jamaica	..	..	..		..	15 899	28 020	..	76.2
Mexico	1 230	782	-36.4		12 689	34 937	60 965	175.3	74.5
Nicaragua	1 769	906	-48.8		813	1 696	4 449	108.6	162.3
Panama	698	596	-14.6		1 859	5 335	6 671	187.0	25.0
Paraguay	5 878	7 238	23.1		..	444	361	..	-18.7
Peru	5 889	8 412	42.8		276	4 853	9 051	1658.3	86.5
Dominican Republic	707	925	30.8		1 520	3 373	8 584	121.9	154.5
Trinidad and Tobago	..	279	..		..	5 372	9 550	..	77.8
Uruguay	7 202	9 314	29.3		488	919	1 133	88.3	23.3
Venezuela	368	687	86.7		631	1 773	3 471	181.0	95.8
Honduras	447	..	..		..	1 481	2 656	..	79.3
Guyana	..	..	..		..	4 117	8 327	..	102.3
Total	**73 638***	**82 318****	**12.1*****		**67 073#**	**163 744**	**251 996##**	**103.4#**	**59.0##**

Notes: * Excluding Jamaica, Trinidad and Tobago and Guyana
** Excluding Jamaica and Honduras
*** Excluding Jamaica, Trinidad and Tobago, Honduras and Guyana
# Excluding Jamaica, Paraguay, Trinidad and Tobago, Honduras and Guyana
Excluding Brazil and Costa Rica

Source: IMILA – CELADE.

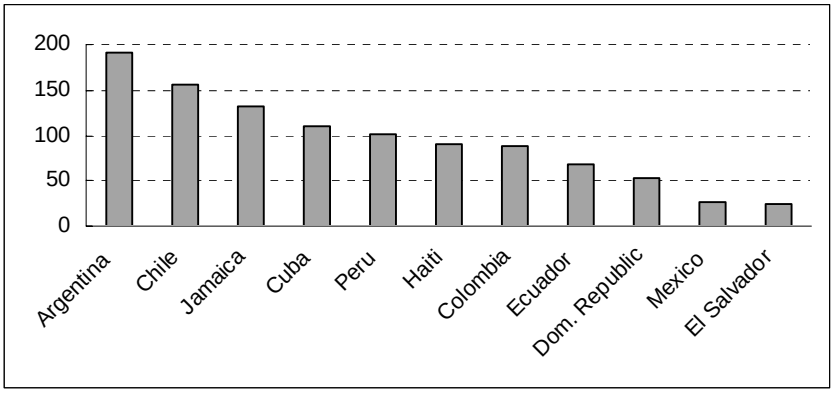
The trend becomes clearer when we consider the main Latin American groups of professionals and technicians emigrating to the United States and other countries in the area. Table 5 and Figure 10 show different profiles of emigration to these countries. It can be observed that several countries of origin show a considerable proportion of emigrants with professional or technical training. Twenty percent of Argentinean workers in the United States, for instance, are professionals and technicians. Percentages are also high for Jamaica, Cuba, Trinidad and Tobago, Panama and Chile. In some of these cases – such as Jamaica and Trinidad and Tobago – the number of emigrated professionals and technicians is significant when compared to the national stock. Some countries with a lower percentage of professionals and technicians in the immigrant workforce, but whose migratory groups are large in relation to their total population, such as the Dominican Republic or El Salvador, have also suffered important losses.

Table 5. Latin American migration trends to the United States and selected Latin American countries including more than 5 000 professionals and technicians, 1990

Country of birth (origin)	Country of residence (destination)	Immigrants, total	Immigrant workforce, total	Professionals and technicians	Professionals and technicians per 1 000 working immigrants
Mexico	United States	4 298 014	2 333 781	60 965	26.1
Cuba	United States	736 971	428 257	46 792	109.3
Jamaica	United States	334 140	212 993	28 020	131.6
Colombia	United States	286 124	176 696	15 518	87.8
Colombia	Venezuela	528 893	324 287	15 001	46.3
Haiti	United States	225 393	137 427	12 455	90.6
Argentina	United States	92 563	50 228	9 614	191.4
Trinidad and Tobago	United States	115 710	74 018	9 550	129.0
Peru	United States	144 199	90 337	9 051	100.2
Dominican Republic	United States	347 858	165 478	8 584	51.9
Guyana	United States	120 698	71 718	8 327	116.1
El Salvador	United States	465 433	276 345	6 678	24.2
Panama	United States	85 737	48 313	6 671	138.1
Ecuador	United States	143 314	88 540	6 066	68.5
Uruguay	Argentina	133 653	84 478	5 890	69.7
Paraguay	Argentina	251 130	150 034	5 751	38.3
Chile	Argentina	218 217	144 019	5 562	38.6
Chile	United States	50 322	32 300	5 067	156.9

Source: IMILA – CELADE.

Figure 10. Professionals and technicians per 1 000 working immigrants in the United States, 1990



Source: IMILA – CELADE.

6.2 Temporary workers in the United States

We will now turn our attention to different indicators about HRST temporary mobility. These are not temporary migrants in the sense of the UN definition, which states that a temporary migrant is someone who resides for more than three months and a half but less than a year in a country other than that of his or her usual residence. We refer, instead, to different modes of extended residence in a country under a temporary permit system in order to work or study. These modes were quite frequent in the 1990s and sometimes can become the first step towards permanent residence.

6.2.1 H-1B visas

H-1B visas are granted to a special category of temporary workers and are issued by the US Immigration and Naturalization Service. Workers within this category are workers with "specialty occupations", admitted on the basis of professional education, skills, and/or equivalent experience. These visas last for three years, can be renewed for another three and are valid as long as the workers have a job. The number of H-1B visas grew remarkably during the 1990s, paralleling the expansion of information and communication technologies. Towards the beginning of the decade, 65 thousand visas were granted yearly. In 2002, the number was three times as high.

As can be observed in Table 6, participation of South American countries is low at 6.4%. Asian countries, instead, have the highest participation. Indian migrants receive half of the visas granted to Asians and almost a third of the total. Computer-related professions account for 38% of the total, with an overwhelming predominance of Asian specialists and a very low participation of South Americans – hardly 2% of the total number of visas for computer-related professionals and 15% of the H-1B visas for the area.

Table 6. US H-1B visas by region of birth, total and computer-related visas, fiscal year 2002

Region of birth	Total	Computer-related
All countries	197 537	75 114
South America	12 732	1 500
Asia	127 625	62 121
Africa	5 994	1 308
Europe	30 840	5 901

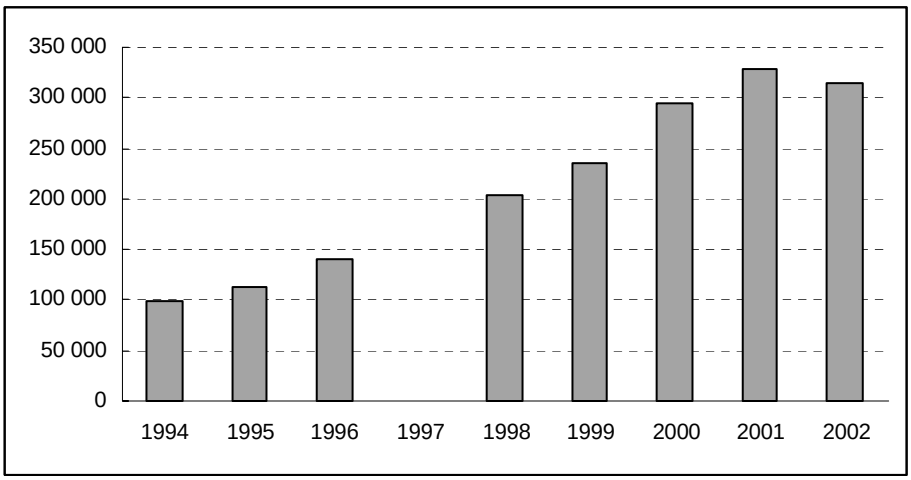
Source: INS.

6.2.2 Intracompany transferees

Another important category of workers with temporary visas are intra-company transferees to the United States. These are aliens "employed for at least one continuous year out of the last three by an international firm or corporation, who seeks to enter the United States temporarily in order to continue to work for the same employer, or a subsidiary or affiliate, in a capacity that is primarily managerial, executive, or involves specialised knowledge, and the alien's spouse and minor unmarried children".[31] This labour category is closely related to the presence of foreign companies in the United States or to mobility within multinational enterprises of US origin. Figure 11 shows the evolution over time of intra-company transferees to the United States.

31. INS (2003), Glossary.

Figure 11. Intra-company transferees to the United States, totals 1994-2002



Source: INS.

It is not surprising then, that most of the workers in this category should come from those countries with closest industrial, financial and commercial relations with the United States. The United Kingdom and Japan receive 27.4% of the granted visas (see Table 7).

Table 7. Intra-company transferees to the United States by region and selected countries of citizenship, fiscal year 2002

Region and country of citizenship	Intra-company transferees to the United States
Europe	**146 546**
France	19 641
Germany	22 330
United Kingdom	55 315
Asia	**73 670**
India	20 413
Japan	31 044
Africa	**3 909**
Oceania	**11 388**
Australia	9 323
North America	**40 075**
Canada	20 320
Mexico	15 283
Caribbean	**1 850**
Central America	**2 622**
South America	**37 082**
All countries	**313 699**

Source: INS.

As in other aspects, South American countries account for a small percentage of the total, some 12% of all intra-company transfers of foreign citizens to the United States. This proportion, however, is larger than the one corresponding to H-1B visas, which might indicate the importance of entrepreneurial relations between countries in the area and the United States. Moreover, the number of South American intra-

company transferees' visas has grown remarkably in the last decade. As Table 8 shows, the total number of admissions of intra-company transferees grew significantly in recent years, while, at the same time, the proportion of South American born workers increased as well. From the countries of the region, the number of admissions from Colombia, Argentina, Venezuela and Chile increased between 3.5 and 6 times. In 2002, Brazil was close to 10 thousand admissions, exceeding Australia and most of European countries. This regional growth is probably related to the lowering of trade and financial barriers in South American countries in the early 1990s, which brought about, among other effects, an increase of direct foreign investments, particularly from the United States.

Table 8. Intra-company transferees from South America to the United States, 1996-2002

	1996	1998	2000	2002
Argentina	1 524	2 580	3 764	6 628
Bolivia	42	69	88	173
Brazil	4 175	5 831	8 470	9 562
Chile	590	1 131	1 562	2 096
Colombia	1 128	1 929	4 709	7 692
Ecuador	211	255	496	886
Guyana	17	25	50	82
Paraguay	34	64	90	59
Peru	393	496	929	1 392
Uruguay	139	160	318	537
Venezuela	2 179	2 775	4 495	7 963
South America	**10 437**	**15 315**	**24 991**	**37 082**
As a % of total admissions	**7.4**	**7.5**	**8.5**	**11.8**

Source: INS.

6.3 Student mobility

One of the main aspects of internationalisation of higher education is university students' international mobility. The number of university students who complete their studies in a foreign country has increased at rapid speed.[32] University students' mobility is a form of highly skilled labour migration and at the same time an important precedent for subsequent migration.

The number of foreign university students who study in OECD countries is estimated at 1.5 million in 2000, of which 31% study in the United States. In Western European countries, mobility within the area is predominant – with the exception of France, which receives a high percentage of African students. In the United States, most students come from East Asian countries. South American students are a small proportion of foreign students in OECD countries. The exception is Spain, where 15% of foreign students come from South America. Table 9 shows that the United States receives most of South American students.

32. For a systematic discussion of the characteristics and magnitude of this tendency, see Tremblay (2002).

Table 9. Number of South American students enrolled in tertiary education in OECD countries as a percentage of students enrolled in the country of origin, based on head counts, 2000

	Countries of destination					
Countries of origin	**France**	**Germany**	**Spain**	**United Kingdom**	**United States**	**Total OECD**
Argentina	0.03	0.02	0.10	0.03	0.17	**0.39**
Brazil	0.06	0.06	0.04	0.04	0.32	**0.65**
Chile	0.08	0.11	0.18	0.06	0.31	**0.98**
Paraguay	0.04	0.05	0.08	0.03	0.43	**0.79**
Peru	0.03	0.07	0.11	0.01	0.25	**0.56**
Uruguay	0.05	0.04	0.24	0.04	0.40	**0.92**

Source: OECD (2001).

The number of South American students in the United States grew between 2001 and 2002, paralleling the general increase of foreign students in the United States (see Table 10).

Table 10. Foreign Students in the United States by place of origin, 2001/02

Place of origin	**2000/01**	**2001/02**	**% Change**
AFRICA	34217	37724	10.2
ASIA	302058	324812	7.5
EUROPE	80584	81579	1.2
LATIN AMERICA	63634	68358	7.4
South America	32447	35653	9.9
Argentina	3172	3444	8.6
Bolivia	897	953	6.2
Brazil	8846	8972	1.4
Chile	1553	1655	6.6
Colombia	6765	8068	19.3
Ecuador	2028	2364	16.6
Falkland Islands	4	1	-75.0
French Guiana	5	6	20.0
Guyana	409	359	-12.2
Paraguay	371	375	1.1
Peru	2660	3188	19.8
Suriname	121	100	-17.4
Uruguay	397	468	17.9
Venezuela	5217	5627	7.9
South America, Unspecified	2	73	3550.0
Oceania	4624	4852	4.9
Stateless	10	87	770.0
WORLD TOTAL	547867	582996	6.4

Source: Opendoors Report (Institute for International Education, 2002).

6.4 South American HRST in the United States

6.4.1 Scientists and engineers

The SESTAT data base of the NSF registers the group of people considered scientists and engineers (S&E). That group includes around eleven million people, and contains a smaller group formed by those workers active in research and development (see Table 11). Within the larger group, 87% was born in the United States. Within the group of active personnel in R&D, the proportion is slightly smaller: 82% were born in the United States. Consistent with the migratory profiles depicted above, most foreign-born S&E (57%) and most foreign active workers in R&D (59%) are Asian natives. The proportion of South Americans is 5% of the total foreign S&E and 4% of those active in R&D.

Within South American S&E in the United States, the major contributing countries are Colombia with 30%, Argentina with 24%, and Brazil with 20% of the total. The relatively low participation of Brazilians contrasts with the fact that Brazil has the largest researchers' community in Latin America.

Table 11. Human resources in science and technology in the United States, 1999

Country of birth	Not active in R&D	Active in R&D	Total
United States	7 103 178	2 491 048	9 594 226
Europe	174 754	104 364	279 118
Ex-USSR	21 510	12 566	34 074
Asia	428 386	317 589	745 971
North America	67 410	27 033	94 443
Central America	14 412	6 495	20 910
Caribbean	53 767	19 293	73 062
South America	43 384	21 481	64 860
Argentina	6 218	4 377	10 594
Bolivia	1 922	953	2 875
Brazil	6 212	1 845	8 056
Chile	1 651	1 485	3 136
Colombia	9 653	4 688	14 341
Ecuador	4 178	1 994	6 171
Paraguay	189	263	451
Peru	5 757	2 796	8 553
Uruguay	623	157	779
Venezuela	5 919	2 688	8 607
Not specified	1 062	235	1 297
Africa	38 256	19 722	57 982
Oceania and other countries	10 905	6 059	16 964
Total	7 955 970	3 025 643	10 981 613

Source: SESTAT, National Science Foundation.

6.4.2 PhD Holders

Within the group of foreigners obtaining their PhD degree yearly in the United States, participation of South Americans wavered in the 1990s between 3.5% and 4.7%, with around 400 PhDs per year (see Table 12). The predominance of Asian university students is overwhelming in this aspect too. In several years, they accounted for more than two-thirds of the total number of foreign PhD holders.

If we compare the number of South Americans obtaining their PhD in the United States with those obtaining their doctorates in their native countries, some interesting conclusions can be drawn. For the year 2000, it can be estimated that around 6 200 people obtained their doctorates in the whole of South America. This means that South Americans obtaining their PhDs in the United States were almost 7% of

the total, which does not appear as a particularly important number. However, near 80% of doctorates in the area are awarded in Brazil. If doctorates in Brazil and Brazilian PhDs in the United States are left aside, proportions change significantly: the percentage of South Americans obtaining their PhDs in the United States in relation to doctorates obtained in South American countries is around 25% when Brazil is excluded.

Table 12. Non-US citizens awarded doctorates in the sciences and in engineering, by country of citizenship and year of doctorate, 1991-2000

Country of citizenship	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total foreign citizenship	8 926	9 475	9 754	10 542	10 502	10 815	9 779	9 790	8 888	9 057
North America, total	525	515	506	547	505	530	462	545	532	605
South America, total	387	394	394	408	359	454	388	411	420	433
Argentina	62	86	53	56	49	66	67	70	53	76
Brazil	119	133	151	157	137	204	145	152	157	126
Chile	54	48	52	42	38	36	29	24	33	43
Colombia	49	37	35	48	45	42	38	26	45	54
South America, other	103	90	103	105	90	106	109	139	132	134
Europe, total	972	950	1 104	1 150	1 254	1 260	1 276	1 477	1 460	1 494
East Asia, total	4 486	4 865	5 010	5 484	5 486	5 597	4 555	4 531	4 069	4 249
West Asia, total	1 670	1 891	1 903	2 077	2 181	2 140	1 914	1 750	1 595	1 559
Pacific/Australasia, total	216	220	227	231	231	232	196	192	156	178
Africa, total	500	510	474	583	423	442	335	339	327	347
Country unknown	170	130	136	62	63	160	653	545	329	192

Source: SESTAT, National Science Foundation.

6.4.3 Scholars

An important proportion of students obtaining their PhD in the United States remain in that country. One of their main destinies is precisely the higher education system. Guellec and Cervantes point out that foreign scholars "include not only post doctorates in the narrow sense, but also research fellows, young scholars and scientists in 'tenure track' positions, as well as guest researchers and visiting professors holding temporary work permits".[33] This group has experienced a continuing growth, and the same has happened to scholars of the largest Latin American countries (see Table 13).

33. Guellec and Cervantes (2002), p. 78.

Table 13. Foreign scholars at US universities, by country/economy of origin

Place of origin	2000/01	2001/02	2001/02 % change	% of US international scholars total
World total	79651	86015	8.0	
China	14772	15624	5.8	18.2
Korea	5830	7143	22.5	8.3
India	5456	6249	14.5	7.3
Japan	5905	5736	-2.9	6.7
Germany	5221	5028	-3.7	5.8
Canada	3735	3905	4.6	4.5
United Kingdom	3352	3314	-1.1	3.9
Russia	3253	3123	-4.0	3.6
France	3154	2985	-5.4	3.5
Italy	2226	2257	1.4	2.6
Spain	1706	1822	6.8	2.1
Brazil	1315	1493	13.5	1.7
Australia	1212	1316	8.6	1.5
Chinese Taipei	1196	1294	8.2	1.5
Israel	1205	1270	5.4	1.5
Turkey	918	1141	24.3	1.3
Mexico	898	1068	18.9	1.2
Netherlands	1037	1001	-3.5	1.2
Poland	862	980	13.7	1.1
Argentina	638	837	31.2	1.0

Source: Opendoors Report (Institute for International Education, 2002).

7. Priorities for future research

Improving our understanding of recent trends in international mobility of highly skilled human resources in South America requires new information sources and further research and studies on different subjects. We can expect that, in the near future, interest on these issues will increase and wider and more detailed research programmes will be developed.

One of the main priorities concerns the production and the use of information sources, both about HRST and about international mobility. In this sense, having access to the outcomes of year 2000 censuses for the main countries in the area is essential. This will enable us to update information and confirm or rectify estimates on magnitude and composition of HRST stocks. Moreover, it will be possible to analyse outcomes concerning migrations within the area. As for data on higher education and the science and technology systems, important advances may occur if competent public institutions from the main countries in the area would undertake a more systematic production of statistics, and if on-line curriculum vitae systems are improved. As for international mobility of HRST, new information sources should be explored to include mobility towards Europe. The fact that a number of emigrates should be considered citizens in their destination countries on account of their heritage is a hindrance to assess this phenomenon. It could be useful to examine rarely explored sources, such as registers of professional qualification applications for health sciences, engineering or architecture.

Research on the mobility of specific groups of Latin American and Caribbean HRST to the United States, Western European countries, Canada and other South American countries should rely on other information sources besides the ones already available. A more precise understanding of mobility processes requires the study of main groups and channels, in addition to specific conditions for those

groups in origin and destination countries. Trajectories of liberal professionals, such as physicians or psychoanalysts who emigrate to the United States or Europe, are usually quite different from those of university researchers or qualified employees in multinational corporations. From this viewpoint, it would be very useful to do research on the participation of South American professionals in international expert communities, both within multinational corporation networks and within international institutions, non-governmental organisations and independent consulting. It would also be interesting to explore "brains without bodies" migration, namely, the electronic transmission of expertise instead of the movement of people.

Mobility of university students and scholars requires specific treatment. Consolidation of university institutions in the United States and Europe – and frequently of governments – with an aggressive global orientation has a bearing on opportunities of professional training and development for highly qualified university graduates all around the world. The recent launching of the Alban Programme by the European Union reveals their decision to compete with the United States in attracting the best graduates from different areas in the world, in this particular case from Latin America. Facing this process, destination countries are continually conducting studies to assess and evaluate its influence on their national innovation capacities and on their labour markets. As for South American countries, we still need an informed discussion of the effects of these HRST movements on universities and research centres, and on the stocks of human resources in each country. Changes in migratory policies in countries of origin and destination deserve specific attention. At the moment, we can rely on some systematic syntheses on migration policies towards highly skilled foreign workers in the main countries of destination, but we still lack consistent estimates on their influence on South American countries.[34] In the same sense, it is interesting to analyse the evolution of GATS negotiations concerning temporary mobility of service suppliers in relation to South American countries.[35]

Developing research programmes along the lines mentioned above would improve our understanding of the global dynamics of the mobility of South American HRST, its relation to global and national economic trends, and the effects of selective migratory policies devised by developed countries. It would also contribute to the evaluation of its consequences on South American countries and to the elaboration of alternative public policies aimed to diminish its negative effects and take systematic advantage of international mobility.

34. McLaughlan and Salt (2002).

35. For the EU, see Niessen (2003).

BIBLIOGRAPHY

Albornoz, M., L. Luchilo, G. Arber, R. Barrere and J. Raffo (2002), *El talento que se pierde*, Centro Redes, Buenos Aires.

Auriol, L. and J. Sexton (2001), "Human Resources in Science and Technology: Measurement Issues with Special Regard to International Mobility", in RICYT (2002), *Indicadores de ciencia y tecnología en Iberoamérica. Agenda 2002*, Buenos Aires, pp. 187-216.

Carrington, W., and E. Detragiache (1998), "How Big is the Brain Drain", *Working Paper* 98/102, IMF (International Monetary Fund), Washington.

CEPAL (2003), *Anuario estadístico de América Latina y el Caribe 2002*, CEPAL, Santiago de Chile.

CEPAL, "Globalización y migración internacional", in *Globalización y Desarrollo*, CEPAL (2002), Santiago de Chile.

Carlson, B. (2002), "Educación y mercado de trabajo en América Latina frente a la globalización", in *Revista de la CEPAL*, Nº 77, Santiago de Chile, August 2002.

CODHES (2003), "La otra guerra: destierro y repoblamiento", in *CODHES informa*, Boletín de la Consultoría para los Derechos Humanos y el Desplazamiento, Nº 44, Bogotá, 28 April 2003.

Ekeland, A. (1998), "Indicators for Human Resources and Mobility", *IDEA Paper Series* Nº 9, STEP Group, www.sol.no/step/idea.

European Commission (2003), *Third European Report on Science and Technology Indicators 2003. Towards a Knowledge-based Economy*, EC, Brussels.

Fuentes estadísticas, Inmigrantes, Nro 69, December 2002, www.fuentesestadisticas.com.

Gaillard, A-M. and J. Gaillard (2000), "International Migration of Highly Qualified People: A Bibliographic and Conceptual Analysis", in Charum, J. and J-B. Meyer (eds.) (2000), *International Scientific Migrations Today. New Perspectives.*, IRD-Colciencias, Paris.

Godin, B. (2002), "Highly Qualified Personnel: Should we Really Believe in Shortages?", *Working Paper* No. 15, Project on the History and Sociology of S&T Statistics, Montreal, Canada.

Gómez, M. (2001), "Mercado de trabajo e inserción laboral de los profesionales universitarios: ¿al borde de una crisis ocupacional?", in Jozami, A. and E. Sánchez Martínez (2001), *Estudiantes y profesionales en la Argentina. Una mirada desde la Encuesta Permanente de Hogares*, EDUNTREF, Buenos Aires, p. 106.

Guellec, D. and M. Cervantes (2001), "International Mobility of Highly Skilled Workers: From Statistical Analysis to Policy Formulation", in OECD (2001), *International Mobility of the Highly Skilled*, OECD, Paris.

Institute for International Education (2002), *2001 Open Doors Report on International Educational Exchange*, IIE, New York.

Laafia, I. and A. Stimpson, "Using the Labour Force Surveys Data to Measure HRST and other S&T Indicators on Employment", in RICYT (2002), *Indicadores de ciencia y tecnología en Iberoamérica. Agenda 2002*, Buenos Aires, pp. 159-170.

Lowell, B.L. (2001a), "Policy Responses to the International Mobility of Skilled Labour", International Labour Office, *International Migration Papers*, 45, 2001, Geneva.

Lowell, B.L. (2001b), "Some Developmental Effects of the International Migration of Highly Skilled Persons", International Labour Office, *International Migration Papers*, 46, 2001 Geneva.

Lowell, B.L. and A. Findlay (2001), "Migration of Highly Skilled Persons from Developing Countries: Impact and Policy Responses", International Labour Office, *International Migration Papers*, 44, 2001, Geneva.

Mármora, L. (1997), *Las políticas de migraciones internacionales*, Madrid-Buenos Aires, OIM-Alianza Editorial, 1997.

McLaughlan, G. and J. Salt (2002), *Migration Policies towards Highly Skilled Foreign Workers. Report to the Home Office*, Migration Research Unit, Geography Department, University College London.

Niessen, J. (2003), *International Migration and Mobility on the EU Foreign Policy Agenda. Is there a Case to be Made?*, paper presented at the PES Group Conference "Migration and Development. The Missing Link", European Parliament, Brussels, 20 February 2003.

OECD (Organisation for Economic Co-operation and Development) (1995), *Manual on the Measurement of Human Resources Devoted to S&T (the "Canberra Manual")*, Eurostat/OECD, OCDE/GD(95)77.

OECD (2001), *International Mobility of the Highly Skilled*, OECD, Paris.

Pellegrino, A. (2000), *"Drenaje, movilidad, circulación: nuevas modalidades de la migración calificada"*, document presented at the Simposio sobre Migración en las Américas, CEPAL-OIM, San José, 4-6 September 2000.

Pellegrino, A. and J. Martínez Pizarro (2001), "Una aproximación al diseño de políticas sobre la migración internacional calificada en América Latina", CEPAL-CELADE, Serie *Población y desarrollo*, 23, 2001, Santiago de Chile.

Pires Ferreira, S. (2003), "Personal en ciencia y tecnología: cuestiones metodológicas y análisis de resultados", in RICYT (2003), *El estado de la ciencia*, unpublished.

RICYT (2002), *Indicadores de ciencia y tecnología en Iberoamérica. Agenda 2002*, Buenos Aires.

RICYT (2003), *El estado de la ciencia. Principales indicadores de ciencia y tecnología Iberoamericanos/Interamericanos*, (in print).

Sáinz G., P. and M.R. La Fuente R. (2001), "Crecimiento económico. Ocupación e ingresos en América Latina: una perspectiva de largo plazo", in UNESCO (2001), *Análisis de prospectivas de la educación en América Latina y el Caribe*, Santiago de Chile, p. 96.

Salt, J. (1997), "International Movements of the Highly Skilled", OECD, Directorate for Education, Labour and Social Affairs. International Migration Unit, *Occasional papers*, Nº 3, 1997, Paris.

Salt, J. (2001), *Current Trends in International Migration in Europe*, Council of Europe, CDMG, 2001, http://www.geog.ucl.ac.uk/mru/docs/current_trends_2001.pdf.

Sarrible, G. (2001), "Propuesta de cambios en el concepto de migración internacional", in *Scripta Nova, Revista electrónica de geografía y ciencias sociales*, University of Barcelona, N° 94, 1 August 2001.

Tremblay, K. (2001), "Student Mobility between and towards OECD Countries: A Comparative Analysis", in OECD (2001), *International Mobility of the Highly Skilled*, Paris.

United Nations (2002), *International Migration Report 2002*, United Nations Population Division, 2002.

De Vries, W. (2000), "Indicadores de desempeño en México, o cómo cambiar un foco en un cuarto oscuro", in Kisilevsky, M. (co-ord.) (2000), *Indicadores universitarios. Tendencias y experiencias internacionales*, Buenos Aires, Eudeba, pp. 11-146.

Whitwell, C. (2002), "New Migration" in the 1990s: A Retrospective", Sussex Migration *Working Paper* Nº 13, Sussex Centre for Migration Research.