

PART 4. FLOWS AND THE EU

France

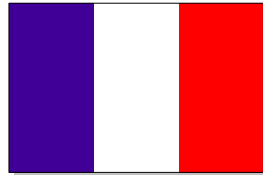


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France ¹

1. Analysis of Sources and Methodologies Used

For all that a substantial amount of investigative reporting has been dedicated to the subject of the emigration from France of entrepreneurs, business leaders and researchers seeking to further their studies or careers, few properly scientific studies have been made of it. Owing to the general failure of both French and foreign administrations to carry out a census that might measure the phenomenon, its true extent remains an unknown quantity, and the present paper has consequently had recourse to a methodology capable of tolerating the use of dissimilar and diverse sources.

A very large part of the resource material comes from journalistic articles. The following sources were particularly useful:

- A recent study conducted by the Direction des Français à l'étranger (the Department of the French Abroad, which is part of the French Ministry of Foreign Affairs);
- A survey carried out by the Rhône-Alpes Chamber of Commerce and Industry, viz.: "18-28 Ans et l'Emploi à l'International" (May 1997);
- A research paper by D. Terouanne entitled: "Presence français en science et ingenierie aux Etats Unis "Bureau du CNRS-Mission Scientifique et Technologique de l'Ambassade de France" published in 1997;
- A report by the Senate of the Republic of France, "La fuite des cerveaux: mythe ou réalité?"
- Information gleaned from various investigative reports by journalists examining the phenomenon.

As the list of resource materials evidences, information referring to the extent of the brain drain and the temporary migration of intellectual capital is extremely scarce, which makes it hard to obtain a complete picture of the current situation. More specifically, the absence of data referring to the migration of scientists and engineers from France makes the accurate measurement of the phenomenon impossible.

This paper chiefly concerns itself with the properties and magnitude of the migratory flow of researchers, engineers and business leaders to English-speaking nations (which are the main poles of attraction for French intellectual capital), as well as the contrary flow of qualified migrants from other countries to France.

Our decision to include business managers and entrepreneurs with researchers, engineers and, generally, those engaged in science and technology was based on the consideration that French literature on the subject usually groups them in the same category. The reasoning is that business people who quit the country should be regarded as part of the scientific brain drain because many of them function as fulcrums providing leverage to scientists engaged in applied research, and this is particularly true in the Anglo-American context. Where no clear dividing line separates business from research the level of mobility from one to the other is high.

¹ This paper was written by Professor Stefano Boffoof Sassari University for CNR-IRPPS Rome for the project *The Brain Drain - Emigration Flows for Qualified Scientists*.

2. Loss of Intellectual Capital or International Mobility?

Since the end of the Second World War, the English-speaking world has acquired increasing dominance in international economics and politics. What began as pure geopolitical power fifty years ago has become a fully-fledged cultural model whose extensive influence has profoundly affected many facets of western culture, ranging from work, health and politics to family identity, education and practically every aspect of social life.

Perhaps the best approach to understanding the brain drain is to view it as the logical corollary of the reigning Anglo-American economic model. Besides, the free movement of goods and people is, along with the aspiration for financial and monetary union, one of the European Union's founding articles of faith.

Bearing these observations in mind, we can ask ourselves several pertinent questions. Why do member states of the European Union, which are meant to be striving towards ever greater cohesion, feel the need to concern themselves with the issue of intellectual migration across borders that are by now inexistent? Is it meaningful to talk about a brain drain if it refers to movements within the 15 member states of the EU? What sort of time limit should we set to distinguish between a genuine brain drain and the merely temporary migration of intellectual capital? Does a "brain drain" really occur, or are the ideas of "drain" and "loss" just part of our inbuilt approach to issue? Does France have the means to exploit its home-based intellectual assets to the full, or are we witnessing an intellect over capacity akin to the over capacity that exists in certain industries? Finally, to what extent is the short-term outflow of intellectual capital offset by the inflow of returning intellectual migrants whose lengthy periods away from home have been instrumental in increasing their levels of excellence?

Our study does not pretend to answer all these questions. Its purpose, rather, is to encourage a multifaceted approach to the topic and prompt interested parties to experiment with untested ideas and new scenarios. This paper aims at stimulating reflections that may in time lead to the creation of new solutions. In these pages, we shall analyse the outflows from France with a view to elucidating the emigrants' motivations. We shall also look at the characteristics of incoming migrants.

Two recent studies on migration to the United States, and Silicon Valley in particular, were carried out in 2000. One was done by the French embassy to the USA, the other by the Public Policy Institute of California (PPIC), a San Francisco-based research body which, having looked at migration from China and India, proposed a new interpretation of the phenomenon:

*"Brains do not flee; the reason for their departure, even to attractive areas such as Silicon Valley, is to obtain knowledge, skills and remuneration which will allow them to be more successful when they return."*²

The report on the French population in Silicon Valley states that: "brains do not leave: they travel and return to their origin enriched with new experience, knowledge, and networks of relationships that no training can provide."

The return of expatriate intellectual capital, argue the authors of the report, delivers benefits to the French economy that are by and large greater than the costs of training.³

²Saxenian, A.L (1999) *Public Policy Institute of California, Berkeley University*, in *Le Monde Interactif* di Annie Khan. Paris, France.

³ *Quoted by Ledru, L., Raud, S. (2000) Présence française en technologie de l'information autour de la baie de San Francisco et dans la Silicon Valley, Ambassade de France aux Etats Unis, Washington*

According to Annie Khan, a reporter for *Le Monde*, those countries that favoured the outflow of brains were later to enjoy enormous boosts to their levels of trade. This claim certainly holds true for Ireland, which has seen its economy grow faster in the past several years than at any time in its modern history. The counter-exodus of intellectual capital, which had fled the country when it was in an economic slump, is a particularly conspicuous aspect of Ireland's success.

Jean Paul Vermes, Director General of COGEPLAN, even claims that the brain drain is a benefit:

*"I am strongly in favour of the brain drain because I am convinced that it provides France with a high profile abroad, which can only serve the commercial interests of our country."*⁴

Yves Couillard, Chairman of Hewlett Packard France, reiterates this concept, though from a different perspective. He maintains that these days, travelling abroad to train and learn about different ways of working is an absolute necessity. The idea of abroad has changed from what it once was, and France is now also a recipient country that hosts some of the world's best scientists, he argues. In these circumstances, the outflow of brains is simply part of an international trade transaction as well as a useful way for each country to present itself to and learn about others. This process has, for example, prompted France to look for its IT engineers in India.

Others, however, argue that the outflow from France has certain limitations:

*"The phenomenon of emigration that we have witnessed over the past ten years or so chiefly regards young graduates. The outflow of expert middle-level French managers, on the other hand, is very limited, and the reason for this, I think, is the social rigidity that is characteristic of France. For example, my company, which employs 5,000 people in France, has more than 3,000 foreign workers on its books, but no more than 50 salaried French workers abroad."*⁵

Even so and in spite of the favourable situation that obtains in HP's French divisions, the trend in recent years has been all the other way, and emigration to English-speaking countries has increased.

It is also worth noting that, in all likelihood, the increase has been amplified by improving educational levels in France and the relatively late development, compared to the Anglo-American world, of industries such as ICT and biotechnology (Table 1). As a consequence of its tardiness, France has hitherto been less able than other countries to offer employment opportunities for professionals active in these fields.

⁴ Vermes, J.P., (1998) *Les apports de la expatriation. La fuite des cerveaux : un phénomène bénéfique?* Paris, France.

⁵ Couillard, Y. (1998) *Entre fuite des cerveaux et promotion du travail non qualifié : un arbitrage impossible?* "Paris, France

Indicators	France	USA	United Kingdom	Spain	Germany	Sweden
Percentage of companies with Internet sites	25	54	51	16	48	54
Percentage of companies selling over the Internet	3	12	9	9	9	10
Value of goods sold on Internet in 1999 (Millions of Euro)	3,400	15,300	5,300	400	3,600	700
Percent of companies with an Intranet	18	29	30	na	30	100
Percentage of companies with an Extranet	4	8	5	na	8	61
Households with a PC (percent of total population)	26.6	51	37.3	27.4	35	64
Households connected to the Internet (percent of total population)	9.9	39.0	26.6	10.5	14.5	49.0
Number of inhabitants with Internet access (in millions)	4.6	70.1	9.8	2.9	9.2	3.5

So, what are the effects of the brain drain? Who loses and who gains from the exodus? What are the consequences for the individual, the recipient country and the country of origin? Do the experience and store of knowledge acquired abroad improve an individual's capabilities, and do these capabilities then benefit the country of origin? The absence of a single broad view of the entire phenomenon and the dearth of data make it difficult to build up a full picture. Nevertheless, in the following pages we shall try to provide as much information as possible about the flight of French intellectual capital. In addition to examining the effects of the brain drain on France, this paper also considers whether the country has the wherewithal to attract scientists from other countries. If the end aim is to reduce the emigration of scientists, researchers and business entrepreneurs (as defined above) to a minimum, it seems both sensible and advisable to consider the circumstances and problems behind the decision to emigrate from the country of origin on the one hand, and, on the other, the auspicious conditions in the receiving country that have helped it achieve a healthy rate of creativity and innovation.

3. The Research System in France

The system of research in France has certain peculiarities that distinguish it from the systems of most other European countries. Unlike most of their European contemporaries, for example, French research scientists enjoy a rare opportunity to dedicate themselves full time to laboratory experimentation, safe in the knowledge that their job is secure and that the flow of finance is assured.

The French research system also guarantees a certain uniformity and equality. No real or substantial differences exist between ISERM and CNRS, the two major research institutes of the country. On the whole, it makes no difference to scientists whether they belong to one or the other.

One of the differences between the French and the Anglo-American systems is that the former belongs to the public sector and the latter mostly to the private. The enterprise culture is predominant in the US world of research, whereas in France, where research lives in the domain of the public sector, the enterprise culture is naturally missing.

In Britain and North America, researchers are often intent on setting up independent laboratories. In France, on the contrary, researchers, including those who have spent time in US laboratories, are highly appreciative of the job security that the French research institutes offer.

Personal ambition is a secondary consideration in countries whose research scientists are salaried employees; but this is not the case in countries where they and the laboratories in which they work are subsidised according to the utility of the research (which is not necessarily judged by its social utility) and the results achieved.

The selection processes and criteria used by major French research institutes constitute a second major feature of the French system. Until the end of the 1980s, the custom was for laboratories to take on researchers who were completing their doctorate theses. As the general economic situation deteriorated, the recruitment practices became more selective and, rather than taking on researchers while they were still finishing their theses, the laboratories began to wait until researchers had reached the immediate post-doctorate stage before hiring them. As a result of this change, the pull exercised by the laboratories on researchers became weaker, and, in consequence, much of the intellectual capital created within the national boundaries began to leave the country.

What possible solutions are there to this problem? For whereas it is true that French research institutes are in a position to hire researchers on permanent contracts and, therefore, offer them the chance to see through long-term projects, it is also true that the system spawns red tape and a bureaucratic mindset. Indeed, it has been pointed out that certain senior researchers (i.e. in the employ of the institute for longer than others) have an “I’m-all-right-Jack” attitude, and scale back their input, which, of course, has negative repercussions on the general productivity of the institute. In a market where competition is global, the success of a laboratory or research centre in innovating is going to be measured using parameters that are certainly not the same as those currently used in France.

Part of the French Public Administration, and, in particular, the Senate of the Republic, is of the opinion that the flight of intellect is closely related to financial considerations, and has therefore proposed direct action to stimulate new-style business entrepreneurship and favour the repatriation of intellectual capital. The aim of the proposed action is to promote the creation of independent laboratories that will give rise to a new and more dynamic entrepreneurial culture that can cohabit with the existing public sector structures.⁶ This approach has, the Senate argues, two objectives: to stem the outflow of intellect to start with; and persuade those who left France for more competitive economies or organisations to come back home. The idea enjoys some degree of popularity. A French researcher and associated professor at the medical institute of the Rockefeller University of New York maintains that the Senate’s

⁶ French Senate, (2000) *La fuite des cervaux: mythe ou réalité?* From French Senate website, <http://www.senat.f>

proposal is necessary and will render French research more competitive.⁷ The researcher argues that in the current global economy, the relative lack of competitive power of the French model is a serious drawback that seems destined to become ever more acute, eventually becoming a chronic ailment that will be very expensive to cure.

Is this really the solution to the problem, if, indeed, it is a problem? Further, do entrepreneurs really make up the largest single part of the intellectual Diaspora? Indeed, can it be argued that expatriate French entrepreneurs are responsible for aggravating intellectual emigration by attracting French scientists and engineers to their companies and laboratories abroad?

4. The Extent of the Phenomenon

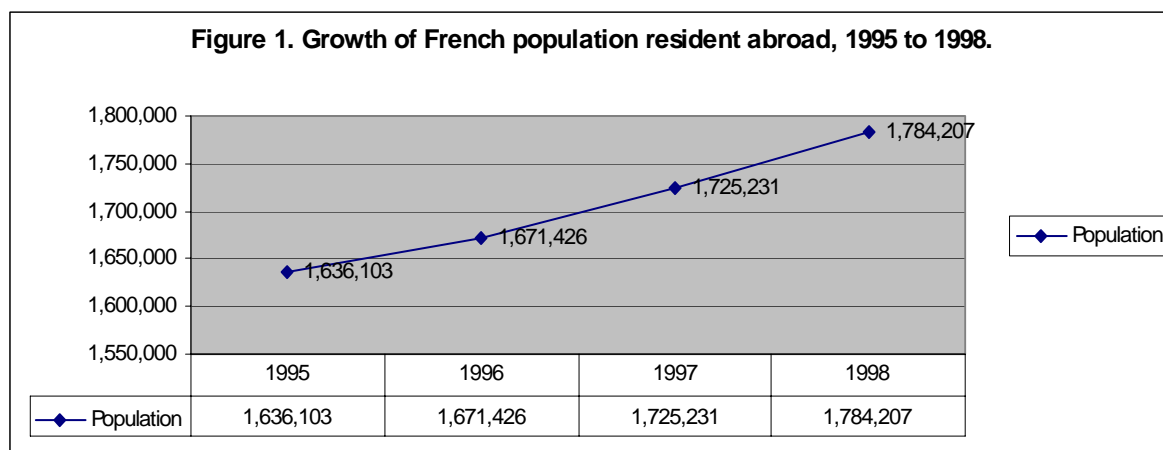
If we consider the process of globalization taking place throughout the world, we must conclude that, in purely numerical terms, the French are not a nation of emigrants. Roughly 1.8 million French live abroad. That is the equivalent of 2.9% of the population compared with 5% for Germany, 8% for Japan and 11% for Italy. Since 1992 emigration by the French has increased by 12%, according to statistics compiled by the Rhône-Alpes Chambers of Commerce and Industry (August 2000). But this increase is general throughout all of Europe. As we shall see later on, a relative increase has taken place in the number of migrants from France to Eastern Europe and the Near East, but the majority of French migrants still go to Europe, the United States and Canada. Some 53% of French emigrants in the 20-34 age group have obtained fixed residency permits (“green cards”) for the United States; while in the 18-30 age group, more than 65% of emigrants chose Canada as their destination.

It is difficult to estimate the number of engineers and scientists leaving France because no requirement exists for the emigrants to register themselves with French consular offices abroad.

The statistics available to the consulates refer to only a segment of the French population living abroad. Indeed, to calculate the probable size of the French population resident in a given country, the Ministry of Foreign Affairs takes the total of French citizens who have registered with the relevant consular office and multiplies it by a numerical coefficient that varies according to country. Obviously, this method produces no more than approximate numbers.

By applying its guesswork-methodology, the Ministry of Foreign Affairs estimates that in 1998, the total number of French citizens registered with consulates abroad, 988,247, translates into a real total for that year of 1,784,207 compared to the (estimated) total of 1,636,000 in 1995. The Foreign Ministry’s figures suggest that the number of French citizens living abroad has been in constant increase from 1995 to the present (Figure 1).

⁷ Desplan, C. (2/1997) *Lorsque “rentre” ne signifie pas uniquement : “au Cnrs”*... Medicine-Science, France.



Source: Direction des Français de l'étranger, Ministère des affaires étrangères (Department of the French Abroad).

Over the last six years, the number of French living abroad for reasons of work has increased by roughly 150,000 (+ 9%). Even so, according to a survey carried out in 1999 by the Economic and Social Council of France, the country still has a proportionately lower rate of emigration than other major nations (Table 2).

Country	Population residing abroad	Total population	Expatriate population as percentage of total
France	1,784,000	60,900,000	2.9
Germany	4,000,000	80,000,000	5.0
Italy	6,500,000	57,400,000	11.3
Japan	10,000,000	126,100,000	7.9
Switzerland	800,000	6,800,000	12.0

Source: Report by French Economic and Social Council: "L'Expatriation. Les Français établis hors de France, acteurs du rayonnement international de notre pays. Rapport du Conseil économique et social"

As a rule, French emigrants opt for the industrialised nations. The former overseas colonies of France are less popular than they used to be, the French Ministry of Foreign Affairs reveals. North Africa and the Francophone African countries account for only 10% of the French resident abroad, whereas Europe accounts for more than 50% and North America for just over 20% (Table 3).

Area	Registered population	Estimated non-registered total	Estimated total population	Estimated % of total French population abroad
Western Europe	500,472	409,200	909,672	51.3
of which United Kingdom	67,572	127,000	194,572	11.0
North America	125,615	235,300	360,915	20.3
of which United States	81,985	154,800	236,785	13.3
French-speaking Africa	102,219	23,690	125,909	7.1
East Asia	57,709	44, 210	101,919	5.7
Near East and Middle East	69,086	22,890	91,976	5.2
South and Central America	63,856	26,060	89,916	5.1
North Africa	38,374	14,650	53,024	3.0
East Europe	18,902	5,870	24,772	1.4
Non French-speaking Africa	12,014	4,090	16,104	0.9
Total	988,247	785,960	1,774,207	100

Source: Direction des Français de l'étranger, (Department of the French Abroad).

As Table 3 shows us, Britain and the United States are clearly the favourite destinations for French citizens living abroad for reasons of work. Taken together, the two countries contain 440,000 French emigrants, equal to 24% of the total (13% in the United States and 11% in Great Britain). The number of registered French citizens in the United States is 81,985 and the number in Canada is 43,630. When these figures are expanded to reflect the probable real population, the number of French citizens in the United States becomes 154,800, and the number in Canada 80,500.

In the United Kingdom, there are 67,572 registered French citizens resident in the country, which translates into an estimated 127,000.

These estimates are used in lieu of real statistics because the organisational difficulties and considerable costs of carrying out a census to obtain the true figures are too great for French consular offices to bear.

A mixture of intuition and empiricism is applied when determining the multiples used to convert the number of registered French residents abroad into estimates of the real totals. The multiple varies from three for California, whose Silicon Valley has attracted a large number of scientists and entrepreneurs since 1970 to two for the rest of the United States and Great Britain, and 1.5 or so for Developing Countries.

During a recent survey of the flight of intellectual capital, the French consulate in Washington declared:

"In the United States, the sense of security enjoyed by French citizens, their high level of integration in the American community and the relatively modest distance separating them from their own country, which has also been greatly reduced by falling communication costs, lessen French citizens' interest in registering themselves with the consulates."

In the United Kingdom the French consular authorities make much the same point:

"It is not easy to estimate the real number of French residents, and the highly approximate numbers must be accepted as such. In any case, the extreme closeness of France to United Kingdom and the ease of communication give the French very little reason to report their presence to consular offices."

A sense of security, unproblematic assimilation into the host community and the absence of bureaucratic impediments all contribute to the sense that registering oneself with a consulate is a pointless exercise.

The reluctance to register is even more pronounced among young French managers and entrepreneurs living in the United States. The figures presented by Ludovic Ledru and Stéphane Raud⁸ show that the great majority of managers and entrepreneurs do not report their presence to the French consular authorities.

Many of the interviewees declared that they felt registration was utterly pointless. Ludovic Ledru and Stéphane Raud's survey,⁹ conducted in conjunction with the Chamber of Commerce with Abroad and the Ministry of Foreign Trade, discovered that the rate of registration was higher among French citizens who had emigrated with their families and decided to educate their children in French institutes based in the foreign country.

With a view to obtaining figures that better reflect the reality of the situation, a research group from the French Foreign Ministry contacted major business schools and engineering faculties in the hope that an examination of student associations might divulge the number of French citizens resident abroad and enrolled in foreign universities. Unfortunately, the educational establishments did not have the information to give.

The figures relating to French companies operating abroad were obtained from the Bank of France and the Ministry of Economics and Finance.

Before concluding our examination of the magnitude of the brain drain, we should mention an interesting finding made recently by the Rhône-Alpes Chambers of Commerce and Industry regarding the migration of young French graduates.¹⁰ Over the last five years, the number of young graduates emigrating to English-speaking countries has indeed risen considerably, but the growth has not been explosive. On the contrary, intellectual migration would appear to be proceeding at a somewhat regular rate, though the period spent abroad is tending to lengthen.

⁸ Ledru L., Raud S. (2000) *Présence française en technologie de l'information autour de la baie de San Francisco et dans la Silicon Valley*. Ambassade de France aux Etats Unis.

⁹ *Ibidem* pag. 15

¹⁰ Chambre de Commerce et d'Industrie de la Région Rhône-Alpes, (1999), *Le départ pour l'étranger des jeunes diplômés: entre internationalisation de la carrière et mondialisation de l'identité*

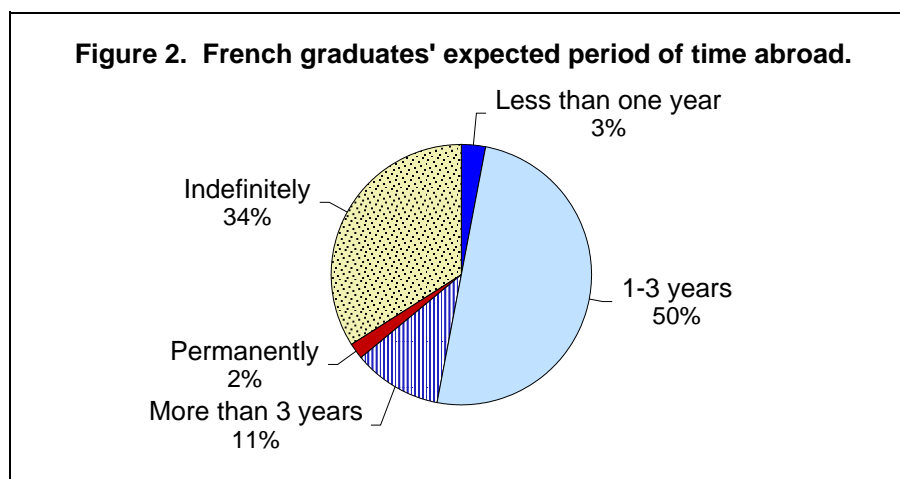
A particularly interesting statistic from 1999 shows that approximately 2000 graduates from the *Grands Ecoles*, roughly 12% of the total, moved abroad.

The same survey also found that on average 17% (or 1,100 a year) of doctorate students from the Grands Ecoles went abroad. The proportion was higher for those specialising in biomedical studies, for which the United States was the preferred destination.

That said, 60% of doctorate students from the *Grands Ecoles* left France for another country within the European Union.

A survey carried out on a sample of former students from the 40 or so *Grands Ecoles* who were living abroad found that:

- 50% remained abroad for a period of 1-3 years;
- 34% remained abroad for an indefinite period;
- a mere 2% emigrated for good;
- 3% intended to remain less than one year; and,
- 11% intended to remain abroad for more than three years.



Source: Taylor Nelson Sofres, July 1999.

5. Sharp Increase in Emigration

Over the past five years, the number of French emigrants arriving in major cities, notably metropolises such as London, San Francisco, Chicago and Atlanta has risen sharply (Table 4). Between 1995 and 1999, the number of French graduates resident in these four cities rose sharply: from 33% in London to 93% in Chicago. The increase is general for the English-speaking world as a whole.

A survey carried out in several cities containing French consular offices, among them Melbourne, New York, Barcelona, Sydney, Los Angeles, Montreal, Quebec and Washington, revealed that a growing number of French people of all levels (the survey was broad-based

and included students, first-time job seekers, trainees et al.) are interested in spending time abroad to work or study.

City	Year					Increase (%)
	1995	1996	1997	1998	1999	
Atlanta	1,994	2,356	2,565	2,661	3,056	53.3
Chicago	4,186	5,082	7,352	7,708	8,076	92.9
San Francisco	10,693	12,089	13,850	14,590	15,411	44.1
London	48,767	54,466	60,049	64,642	65,068	33.4

The figures show that the increase over the last decade in the number of French arriving in Britain is considerably higher than the increase in the numbers going to Eastern Europe (+11.3%). Apart from its geographical proximity, Great Britain has enjoyed strong economic growth and this, no doubt, explains the increase.

Thanks to the steady incoming stream of new French residents, London has become home to the second largest French community abroad. In the period 1995 to 1999, the French population in London expanded considerably but, interestingly, only 16% of French citizens educated to degree level remain in Britain after ten years.

Some of the migrants are young first-time job seekers looking for low-level employment ("Mac jobs"). But the majority are professionals working in finance and new technologies (ICT). The driving force behind the increasing demand for French professionals is the excellence of French schools, especially the *Grands Ecoles* whose engineering and ICT qualifications are highly esteemed on the British market. At the same time, the increasing prestige accrued by the City of London in the 1990s has added considerable attractive force to Britain.

Similarly, the French presence in the United States, especially on the east coast and California, has increased considerably over the past decade. The cities with the largest resident French populations are: New York (19,000), San Francisco (13,959) and Los Angeles (11,825). In just two years, the (officially registered) French resident population of San Francisco rose by 30%, largely as a result of the explosive growth of the net economy in Silicon Valley. In New York, the number of French residents rose by 15% in the space of five years.

A report on the brain drain to the United States produced by the French Embassy in Washington¹¹ notes that the increase in the French population in the United States can be seen not just from the official statistics, but inferred from various other sources such as schools, French associations abroad and the *Grands Ecoles* networks.

The French consulate in New York has recorded a steep increase in the number of applications for trainee posts, which often mark the first step into careers that are then pursued in the United States. Well-established organisations now see traineeships as a first form of

¹¹ *Bensimon, E. (1998) La fuite des cervaux français aux Etats-Unis, Ambassade de France aux Etats-Unis.*

investment in young people who are often invited to take up permanent posts after a period of on-the-job preparation.

The US Immigration and Naturalization Service (INS) and the Department of State also supply statistics confirming that a sizeable increase has taken place in the number of French professionals resident in the United States, especially among those who have doctorate and post-doctorate qualifications.

Bensimon's above-mentioned survey found that between 1990 and 1996 the number of French citizens with postgraduate qualifications resident in the United States increased by 60%.

6. Aspects of Migratory Flows

As far as educational qualifications are concerned, the French abroad make up a rather mixed group. The community includes young people with no educational qualifications who emigrated in the hope of making their fortunes abroad: sometimes enticed by the California dream, sometimes by the natural beauty of Australia and sometimes, simply, with a view to taking up residence with relatives who form part of the French community abroad (notably in Quebec). These young people often travel to learn a new language or obtain their first taste of the world of work. Ministry of Foreign Affairs statistics show, however, that most of the French community abroad consists of qualified people with graduate degrees, PhD and even post-doctorate qualifications (Table 5).

Category	Percent
Managers, professionals, intellectuals	31.1
Employees	30.3
Intermediate professions	20.2
Artisans, retailers, captains of industry	10.7
Blue-collar workers	4.6
Entrepreneurs	0.4
Job seekers	2.5
Source: Department of French Abroad - Ministry of Foreign Affairs.	

Managers and intellectual professionals are proportionately more numerous in French expatriate communities than they are in France itself.

This trend has become even more pronounced in recent years. In the period 1992-1998, the number French people resident abroad and holding graduate degrees or doctorates rose by 22%, an increase far greater than any that took place in other socio-professional categories.

The increase was much more marked in North America (38%) than Western Europe (19%). Between 1992 and 1996, the increased demand by the American market for highly qualified

professionals led to an expansion of more than 60% in the number of highly-qualified French migrants to the United States.¹²

The INS also reports an increase in the number of “green cards” (permanent work permits) granted to the following categories of workers:

1. Professionals endowed with extraordinary skills in business, sports, education, science or art. This category encompasses professors and research scientists working in universities or laboratories as well as middle managers and directors of multinational companies who have been transferred to the United States.
2. Persons with exceptional skills, a group that includes professionals with high-level specialist degrees and exceptional skills in the sciences, art and business.
3. Freelance professionals, including qualified and unqualified professionals.
4. Entrepreneurs, including those who have been granted a visa for having created jobs for at least 10 people, or invested at least 500,000 dollars in a start-up company.

As the table above shows, the pattern of French migration is different from what it was in the past. Traditionally, French expatriates were either very highly qualified professionals or else those with no employment opportunities at home. The past 20 years, however, has seen a new trend whereby young people choose to kick-start their careers abroad and then return home. It is important to note that experience abroad is regarded as a springboard to a career and something that can be used to good effect upon return to the home country.

A survey carried out in 1997 into intellectual migration from France to the United States¹³ detected a steady rise in the number of PhD students and holders of doctorate degrees who were leaving French universities to take up posts in laboratories or universities in the United States.

Between 1984 and 1994 the number of French students in American universities almost doubled, from 3,000 to about 6,000. This placed France in 16th place among the countries with sizeable student populations in the United States.

In 1985, 46 French students completed their doctorate studies in United States. By 1995, the number had risen to 117. A correspondingly sizeable increase took place in the number of French students enrolled in post-doctorate courses: from 1,810 in 1990 to 2,320 in 1996, making France the eighth largest source of foreign scholars present in American universities.

7. An Increasing Trend: Global Patterns of Intellectual Migration

International mobility among company managers and directors is not an exclusively French phenomenon. Rather, it is a tendency common to many industrialised economies and reflects the outgrowth of new industries in certain areas of the world, which are thus able to attract a large amount of intellectual capital.

¹² Ibidem.

¹³ Torouanne, D. (1997) *Presence Française en science et en ingénierie aux Etats-Unis: cerveaux en fuite ou en voyage? Mission scientifique et technologie. Embassy of France, Washington.*

In addition to the migratory flows between industrialised countries, such as we have seen, a flow of intellectual capital is taking place from Developing Countries towards economies with a high rate of growth.

As vertical and horizontal economic integration continues apace, businesses are finding that they must increase their openness to the outside world. Accordingly, French companies, especially those that operate globally, need to employ French staff who are capable of operating with ease and agility in international markets and a growing world economy, but must also employ non-French workers who are knowledgeable about the practices, behaviour and customs of new markets.

The emergence of young graduates, managers and entrepreneurs keen to work in professional environments and expand their horizons beyond the French market serves both to satisfy this new business need and fulfil personal aspirations.

Globalization is pulling down the physical, cultural and linguistic barriers that used to restrict the mobility of business managers. Business operations now transcend territorial boundaries, with the result that multinational companies look across international markets when seeking qualified workers capable of operating in a corporate environment. In the last 15 years, the internationalisation of corporate culture has begotten an elite managerial class made up of cosmopolitan workers willing to travel and capable of operating anywhere in the world.

Globalization has changed the practices and customs of many people, especially in the industrialised economies where the Anglo-American paradigm, present in the media, in the proliferation of fast-food vendors, in fashion, in language, in educational models etc., is firmly embedded. A survey carried out by *Nouvel Observateur*¹⁴ found that an increasing number of young French graduates are keen to work abroad to further their careers, but only 7% intend to stay abroad permanently.

The survey indicated that 40,000 French citizens are settled in California, and 200,000 in Britain. Although the poll was primarily journalistic and designed to heighten the profile of the *Nouvel Observateur*, it nonetheless provides an interesting snapshot of the mood of young French graduates with respect to the question of emigration:

1. It found that 83% of respondents wanted to spend part of their careers abroad.
2. It showed that the “brain drain” metaphor is inappropriate because only 11% of respondents wanted to stay abroad for more than five years, and 31% expressed a desire to work for a French company.
3. The phenomenon cannot be attributed to fiscal pressures. For 58% of the respondents going abroad was a way of enhancing their curriculum, 29% saw it as a way of increasing earnings, and only 8% as a way of being able to pay less tax.
4. The favourite destination is the United States (48%) followed by the United Kingdom (30%), but some Latin countries are becoming increasingly popular and Spain (10%) has overtaken Canada (9%) to take third place. The next most popular destinations are Italy (8%) and Latin America (7%).

¹⁴ *Fauconnier, P. (2001) Les diplômés français chantent l'international. Un sondage CSA - Le Nouvel Observateur. Paris, France.*

Looking at the *Nouvel Observateur* poll, might we not conclude that fears of a brain drain are greatly exaggerated? According to 49% of the young people interviewed, it is perfectly normal for young graduates to go abroad because “it forms part of a broader context of mobility among French salaried employees”; but 43% felt that the brain drain really exists because “the graduates with the greatest potential are the ones to go abroad.”¹⁵

Even so, a vast majority of interviewees felt that the French system of taxation ought to be listed as one of the causes of emigration. Only 45% of the interviewees concurred with the statement “the brain drain phenomenon is exaggerated.”

It should also be noted that the majority of young engineers (66%) and the majority of men were of the opinion that the magnitude of the phenomenon is actually less than polls suggest. A majority of university graduates (53%) and women (69%) were, however, concerned about current trends.

The polls indicated that a large proportion of graduates from French secondary schools (83%) intend to spend part of their working lives abroad. The poll made mention of another recent survey, this one carried out by a Swedish research body called Universum, which had found that 22% of young French people wanted to work in Latin America, 18% Asia and only 8% or so wanted to go abroad permanently. Fears of a brain drain, therefore, do not seem to be well grounded.

In any event, mobility among young people can hardly be avoided in a globalized economy. So if the costs of the intellectual exodus are, as some claim, too great for the French economy to bear, it also has to be acknowledged that reducing the outflow of scientific intellect will be difficult. Consequently, proper consideration ought to be given to carefully structured programmes of action that will entail not just the contracting of permanent and beneficial links with French expatriates, but also the formulation of policies capable of enticing brains from elsewhere in the world to France.

8. Main Causes of Brain Drain

The poll carried out by the Rhône-Alpes Chambers of Commerce and Industry, to which we have alluded, was based on a sample of 1,000 French professional workers living abroad. It found that 31% of the respondents had no intention of returning to France, and 80% declared that the decision to go abroad was mainly determined by the greater opportunities for professional success available in countries other than France.

The survey draws attention to official US figures showing an increase in the number of French citizens who have acquired permanent residence in the United States as a result of their top-level professional skills. The figures show an increasing tendency among French professionals to settle definitively in the United States, and this is especially true for those who have been resident there for at least five years. In 1975, French citizens who acquired permanent residency in the United States after a stay of five years numbered 1,634; by 1996 they were 3,079. Similarly, the number of French citizens to become naturalised Americans has been climbing: from 741 in 1980 to 2,257 in 1996. In these cases, a return to France seems highly unlikely, especially if the expatriates are business leaders. Those who have built up their own companies abroad are less likely to return home because, even though their

¹⁵ Ibidem.

fondness for their own country may be great, several other factors, such as the investments they have made in the receiving country to create their business, the customer base (which is not always transferable from one country to another), and the professional culture and level of quality in which they operate, militate against return.¹⁶

Among those who did return to France, the two motivations most mentioned were that they wanted to give their children a French education or that their partner had found it difficult to acclimatise himself or herself to the foreign culture. The greater the success achieved abroad, the more complicated and less likely return to France becomes. Furthermore, the onerous tax burden in France, which weighs particularly heavily on those with accumulated capital, drastically diminishes the attractiveness of France for émigré business leaders.

In 1997, the agency for the international promotion of French technologies and companies (CFME-ACTIM) carried out a survey of French people in the 18-28 age group employed in foreign countries, and found that young people are very anxious to get on to the international stage, especially in the early stages of their professional lives. More than 90% of the interviewees expressed the desire to go abroad and to begin their careers there.¹⁷

What reason is there for such keen interest? The answer is that young French people see working abroad as a strategic move conducive to career success. Some 60% of post-doctorate expatriate French workers in United States declared that the short “break” abroad was a key factor in ensuring them prestigious research posts in France.¹⁸

In addition to the reasons for emigration that we have already mentioned, other influential factors include awareness of the better financial rewards available abroad, the difficulties involved in finding a foothold in the French labour market, and the perception that experience abroad breeds greater independence and responsibility.

9. Patterns and Traits of French Migration

The Attractiveness of the Anglo-American world — At a time of market globalization, young French people, in common with their counterparts elsewhere in Europe, see the United States and Britain as having a winning economic model.

The United States in particular is seen as embodying the market economy. Not only is it enjoying higher economic growth than any other country (apart from Ireland), it is also a monument to successful innovation. The United States has built a technology society and succeeded in bringing together the worlds of business and scientific research.

A series of other economic factors, among them the identification of the United States as home to the New Economy, reinforced this image in the minds of young and ambitious business entrepreneurs, scientific researchers and managers. An increasing number of young people, persuaded that the United States is a place where enterprise creation is easy, the labour market is accessible and opportunities are there for the taking, have concluded that America is necessary port of call on the voyage to financial, intellectual or scientific success.

¹⁶ Ibidem.

¹⁷ CFME-ACTIM, (1997) *Enquete” 18-28 ans et l’emploi à l’international*, Paris

¹⁸ Ibidem

Aside from purely economic motivations, French emigrants with high educational qualifications appear to be drawn to the Anglo-American model because it offers fiscal and financial advantages such as a streamlined and less onerous system of taxation, limited bureaucracy, and a more agile banking system that is also capable of managing relations with companies.

The enormous growth in the quality and reach of the new technology markets of Britain and the United States has given French entrepreneurs, engineers and scientists another reason to look to the Anglo-American market as the natural place in which to fulfil their professional aspirations.

The Technology Boom in Silicon Valley — According to estimates from the French consulate in San Francisco¹⁹, approximately 40,000 French citizens are working in Silicon Valley. Even though the number has risen steadily over the past three years, the French are still underrepresented with respect to the British and the Germans. Between 1987 and 1997, the number of French migrants arriving in the United States was just one third the number of Germans, and one quarter of the number of Britons.

The recent collapse of the Internet economy and the impact of this on world financial markets seem destined to consolidate what has already emerged as the pattern of French emigration to the United States. As we have seen, most French migrants remain in the United States for less than three years and a mere 10% remain there permanently (more than 12 years).²⁰

Ledru and Raud's paper lists the desire to educate one's children in France and a strong sense of national identity as among the main reasons that persuade French migrants to return. Their study also notes that those with a university degree are more prone than engineers and holders of doctorate degrees to take up residence abroad.²¹

A comparison analysis of French, Indian and Chinese migrants to California found that Asians came in greater numbers and were more likely than the French to take up permanent residence. Indeed, the inflow of Asian and Indian migrants has been so great that, according to the author of the PPIC study, one quarter of high-technology companies in Silicon Valley are directed by people of Chinese or Indian origin.²²

A very important point needs to be stressed here: this migration to the United States does not mean that the emigrants' countries of origin have been deprived of their best brains. The statistics for the number of returnees varies considerably according to the strength of market demand in the US state in question as well as the capacity of the labour market in the sending country to absorb workers.

A study carried out by the National Science Foundation in 1998 estimated that around 20% of Indians and 60% of Taiwanese return home.²³

The advantages accruing to countries of origin from the migration phenomenon have been significant. The PPIC study also draws attention to the fact that the brain drain from China

¹⁹ Quoted. Ledru, L., Raud, S., (1999) *Les technologies de l'information dans la baie de San Francisco*, Ambassade de France aux Etas-Unis, Missionne pour la Science et la technologie, Washington.

²⁰ Ibidem.

²¹ Ibidem.

²² Saxenian, A.L.,(2001) quoted in *Bon Voyage aux cernaux* di Annie Kahn Le Monde Interactif. Paris, France

²³ National Science Foundation, (1998) quoted in: *L'expatriation des élites:atout ou échec national?* Annie Khan Le Monde Interactif June 2001. Paris. France.

has given rise to “a trans-national community of Chinese engineers”, and favoured the circulation of capital, talent and information between California and the Region of Hsinchu-Taipei in Taiwan. The exchange has been a two-way process, and, as the PPIC remarks: “some start-up companies founded by Chinese immigrants have benefited from financial backing from Asian sources, others have negotiated supply subcontracts for the export of hardware to Taiwan, or else drawn up software production contracts with India; and almost all the companies identified Asia as the export market for their products.”²⁴

The Taiwanese government has encouraged semiconductor manufacturers based in Hsinchu to form partnerships with firms in California. These agreements have made it possible for the region to adopt the practices of Silicon Valley, and Hsinchu’s semiconductor plants now compete with the best American and Japanese producers.

In the light of these observations, is it reasonable to suggest that these nations have suffered a loss of cerebral assets? In the particular case we have just been looking at, the market, intellectual capital, investments and economic development have combined to make it possible for both the receiving and the sending country to derive benefits from skilled migration. When we consider the success achieved in this instance, it becomes evident that we probably ought to rethink our paradigm. We should take a fresh look at the opportunities inherent in these new scenarios which, if approached with a narrow and rather “provincial” attitude, might well seem ill-suited to the creation of wealth, culture, scientific knowledge and financial strength.

Besides, how much sense does it make to talk about the brain “drain” in the context of a global economy? Are we not, rather, witnessing the emergence of new opportunities the full scope of which we have yet to grasp? The experience of certain countries would seem to indicate that the scientific, intellectual and entrepreneurial diaspora can have a series of far-reaching and positive knock-on effects whose importance easily outweighs the apparent loss of intellectual capital (apparent, at any rate, for those who examine the phenomenon superficially). If properly used and organised, the migration of intellectual capital can create network economies, unparalleled trade opportunities, financial wealth, scientific innovation and creativity.

Migration to Britain — During the privatisation drive under Prime Minister Margaret Thatcher, more than 1,500 French companies were formed in Britain. For the most part, they were branches and subsidiaries of major public sector groups. The companies currently employ more than 250,000 people, and so it is fair to say that Margaret Thatcher's privatisation programme greatly increased the French presence in Britain.

The French “invasion” (to use the term preferred by certain British newspapers) was the result of French firms making intelligent use of the opportunities that presented themselves on the neighbouring island. Today, French companies in Britain run 18% of drinking water distribution plants, provide more than 10% of national electricity supply, and control 20% of the waste management market and railway transportation system.²⁵

²⁴ Saxenian, A.L. (2001) quoted in: *L'expatriation des élites: autout ou échec national?* di Annie Kahn Le Monde Interactif June 2001. Paris, France.

²⁵ *Cit. Note sur l'expatriation des createurs d'entreprises français au Royaume-Uni. Ambassade de France au Royaume-Uni Mars 2001*

Thanks to its strong economic performance over the past decade, its less burdensome taxes and more streamlined bureaucracy, the British market has attracted, and continues to attract, many business leaders and professionals from France, including a particularly large number of engineers.

French entrepreneurs are also attracted by Britain's lower labour costs and greater market flexibility. In Britain, as in the United States, most of the immigrant business brains operate in the financial sector and in the field of new technologies. In both these sectors, demand for information technology engineers and other research professionals has been extremely high.

The strength of attraction exercised by Britain is, as we have already had occasion to note, the result of the country's European leadership in IT and related industries and the financial services sector. Britain also has a strong capacity to attract doctorate and post-doctorate researchers from the fields of biotechnology and medicine.

Between 100 and 200 new technology companies are created annually in the London area, though the strong growth seen during the 1990s has since ground to a halt owing to the collapse of the net economy.²⁶

10. Intellectual Migration to France

Does the Outflow of Graduates from the Third World to Wealthier Nations Debilitate Developing Economies? — Every cloud has a silver lining. According to William Carrington and Enrica Detragiache²⁷, “one important implication of the brain drain is that investment in education in a developing country may not lead to faster economic growth if a large number of its highly educated people leave the country.”

If we examine the statistics relating to Third World citizens with a tertiary education living in OECD countries, we find that India exports 2.7% of its graduates, China 3%, Egypt 7.45%, South Africa 8%, the Philippines 10%, Korea 15%, Iran 25%, Ghana 26% and Jamaica 77%.²⁸

This form of migration is traditionally seen as the worst possible because it is believed to aggravate the ills of poor countries by depriving them of precisely the type of highly qualified workforce that they need. Yet, not everybody shares this pessimistic view. Taiwan and Korea, for example, would appear to have profited from the external networks built up by their expatriate workers and, by putting in place policies that favoured the creation of high-tech business, also succeeded in benefiting from the skills acquired abroad by their skilled emigrants²⁹. During the 1960s India deliberately chose to develop its higher technology institutes rather than primary education, while the Philippines has built up a full-scale private-sector industry based on training personnel “for export”. As the OECD article we have cited observes, when an information technology engineer leaves India for the United States, India does not suffer the loss of this engineer because it could not have offered him or her the opportunity to hone his/her professional skills.

²⁶ Ibidem.

²⁷ Carrington W., Detragiache E., (1999) *IMF Quarterly Report, Finance & Development*, Washington USA.

²⁸ Ibidem.

²⁹ OCDE en chiffres 1999, Paris France.

Qualified migration is increasingly an aspect of the global economy at the heart of which lies the USA. Other Western economies now compete fiercely for these migrants. Britain and Germany, for example, are introducing new immigration policies that will make them more attractive for highly qualified workers. In France, the Ministry of Finance has plans to make substantial reductions in the tax take on qualified workers who work in the country for a limited period of time.

Paris Looks South Down a One-way Street — Countries such as Britain, Canada, the United States, Australia and others can offer intellectual and qualified migrants greater recognition and higher rewards for their work than France, and so, as we have seen, France is losing many of its engineers and scientists to these countries. Even so, this outflow is counterbalanced by France's importation of knowledge from emerging economies, especially Africa and South America (Tables 6 and 7).

North Africa, and Algeria in particular, are a case in point. Since the 1970s, Algeria has functioned rather like a reservoir of human capital for France. What caused so many Algerian research scientists to leave their native land? A study commissioned by the Algerian Ministry of Higher Education and carried out by the research division of the Inter-American Distance Education Consortium (CREAD) pointed to the underlying causes of the flight of intellectual capital and provided many answers which, unfortunately, as a recent article³⁰ points out, have since been rendered obsolete by the fundamentalist terrorism in the country.

Two sociologists, Mohamed Bengueria and Hocine Khalfaoui, conducted a poll in some of the main countries of destination for Algerian researchers namely: France, Britain, Canada and the United States. Their findings revealed that the loss of intellectual resources to industrialised nations, which had been sporadic in the 1970s, has now become a chronic problem for Algeria. Indeed, the only scientists to return from abroad are those who fail to integrate professionally or socially in the country of destination.

Algerian researchers, the report found, moved to industrialised countries because they offer not only superior working conditions, but also economic stability and a secure environment for the researchers' families.

This is particularly true for computer science graduates for whom France offers a far more dynamic market than their native land. The exodus has been so great that it is fair to say that Algeria now has an entire scientific community living abroad.

The CREAD study also found that emigration was not restricted to those able to procure scholarships, but also included many who were willing to pay the cost of bread and board as well as the often high fees charged by French universities.

One of the conclusions of the report was that Algeria is not only beset by extreme problems of Organisation (described at one point as archaic and disastrous), but also and most of all, that afflictions such as excessive bureaucracy, cronyism and corruption make living in the country untenable. Highly qualified workers, especially in the field of scientific research, are often very reluctant to operate in such conditions, and are therefore forced to abandon the country to pursue their careers.

³⁰ Quoted in: Grim,N., (2001) *Fuite des cerveaux, L'Algérie perd son élite* El Watan.

Researchers who acquired specialist qualifications abroad and then tried to return to Algeria to settle down often left again after realising that life in the country was both hard and unjust. Low pay, poor Organisation and inexistent funding are only some of the reasons that researchers leave Algeria. Most of all, they are driven out by the lack of social and professional recognition accorded to their qualifications.

Foreign Postgraduate and Doctorate Students in French Universities — In France, as in other Western economies, postgraduate and doctorate university courses are the main agencies that “catch” foreign intellectual migrants and make them part of the national academic system.

In the academic year 1999-2000, the number of foreign students enrolled in the universities of metropolitan France numbered slightly less than 129,000, an increase of 6% with respect to the previous year. In the same period, however, the number of French students declined by 1%.

According to a survey carried out by the Ministry of Education, the foreign student population in 1999-2000 amounted to 9.2% of the total, an increase with respect to the previous year (when it made up 8.7% of the total), but still considerably lower than during the 1980s when more than 13% of the student population in France consisted of foreign migrants (Table 6).

Table 6. Foreign students in universities of metropolitan France.							
Indicators	Years						
	1985-86	1990-91	1995-96	1996-97	1997-98	1998-99	1999-00
Number of students	131,979	136,015	129,761	125,205	121,624	121,582	128,788
Annual change (%)	-1.4	3.3	-3.5	-3.5	-2.9	0	5.9
Percentage of women	34.5	38.7	46.4	47.9	49.5	50.7	50.9
Foreigners as % of student body	13.6	11.6	8.9	8.6	8.5	8.7	9.2
Source: Department of French Abroad – Ministry of Foreign Affairs							

The situation today, however, is different from that of 15 years ago. Whereas in 1985, 58% of the foreign university students in France were of African origin, in the academic year 1999-2000 Africans made up only 49% of the foreign student population. The sharp decline seems to be above all the result of a fall in the number of students from the Maghreb.

The fall in the number of North African students has, however, been offset by a rise in the number of foreign students from other European countries whose presence has climbed from 17% of the total in 1985 to 30% in 1999. Since 1995, most of the growth in the European student population has been from non-EU countries. Only 13.5% of foreign students in France are Asians compared to 17% at the start of the academic year 1998-99. Students from the Americas have remained numerically and proportionately stable, and make up 7% of the total. The faculties that attract the highest number of foreign students to France are Political Economy and Medicine, which account for 13% and 11% of foreign enrolments.

The Faculty of Arts and Human Sciences account for 10% of foreign students, followed by Law (9%) and, trailing well behind, the Science faculties which have managed to attract only 7% of foreign students. The foreign presence in French University Institutes of Technology (IUTs) is very low, and accounts for just 4% of the total.³¹

As Table 7 below indicates, in the academic year 1999-2000, the largest group of foreign students were Africans (62,637) who make up 48.6% of the foreign student population in the universities of Metropolitan France. Of those African students enrolled in Science faculties, a large proportion (around 14,000) chose Statistical Sciences or Economics (12,549). Africans evinced less interest in the faculty of Medicine in which less than 9,000 of them enrolled.

If we exclude Europeans, Asians make up the second largest foreign ethnic group of students in France (17,382). Unlike their African counterparts, Asians students showed no particular preference for one faculty over another, and so their distribution is more even with 2,816 enrolled in Statistical Sciences, 2,199 in Economics and 2,824 in Medicine. It is also interesting to note that the number of females is much higher among Asians students than Africans.

The Europeans make up slightly more than 39,000 of the foreign students in France. Of these more than 27,000 come from EU countries. European students are concentrated in the Arts and Humanities (18,935 EU plus 13,697 non-EU students). Their presence in the Science faculties is considerably lower.

European students are relatively uninterested in Medicine (less than 10% pursue this discipline). Economic Sciences (4,726 enrolments) and Statistical Sciences (5,179) are also far less popular than the Arts and Humanities. It is worth noting that students from Central Europe have a proportionately higher presence in the science faculties than their colleagues from European Union countries.

A significant minority of students (2,507) is from the United States. They are very much concentrated in the Humanities (1,966). Only 29 American students are studying Medicine, 84 Economics and 104 Statistical Sciences.

As the figures in Table 7 make clear, the Science faculties of French mainland universities have a higher proportion of foreign students (30.2%) than the Humanities (just over 19%).

³¹ IUT offer courses for University Technology Diplomas (DUT), post-DUT training and national diplomas in specialist technologies (DNIS).

Table 7. Foreign students in France: faculties and country of origin.

	Law	Science and Economics	Arts & Humanities	Science	Medicine	Technology	Total	% of total foreign student pop.	% of Women
Europe	6,260	4,726	18,935	5,179	3,069	896	39,065	30.3	64.6
EU	4,477	2,856	13,697	3,614	1,870	711	27,225	21.1	62.9
Germany	951	564	2,681	728	395	103	5,422	4.2	62.7
Italy	488	306	2,065	627	269	86	3,841	3.0	60.6
Spain	489	372	1,735	619	326	85	3,626	2.8	62.2
Britain	629	310	1,741	287	57	108	3,132	2.4	64.9
Greece	586	259	1,334	217	129	10	2,535	2	68.9
Portugal	290	295	1,111	359	125	123	2,303	1.8	59.9
Belgium	299	225	740	312	278	78	1,932	1.5	55.9
Luxembourg	228	212	449	174	182	5	1,250	1	47.2
Sweden	126	76	65	110	19	5	951	0.7	75.4
Non-EU	1,783	1,870	5,238	1,565	1,199	185	11,840	9.2	68.7
Romania	343	214	560	494	628	30	2,269	1.8	63.7
Poland	296	302	983	156	68	44	1,849	1.4	79.7
Bulgaria	296	450	554	156	113	10	1,579	1.2	66.2
Russia	161	257	776	170	73	13	1,450	1.1	74.7
Switzerland	115	73	514	108	109	26	972	0.8	57.0
Asia	1,606	2,199	7,372	2,816	2,824	565	17,382	13.5	49.4
Lebanon	233	272	469	578	909	38	2,499	1.9	36.0
China	88	605	957	325	96	50	2,121	1.6	53.6
Turkey	295	329	620	253	110	140	1,747	1.4	51.0
South Korea	103	83	1,283	103	23	19	1,614	1.3	63.1
Japan	106	39	1,231	41	25	3	1,445	1.1	70.7
Iran	156	76	444	279	405	18	1,378	1.1	46.4
Syria	60	39	235	253	730	3	1,320	1.0	23.7
Vietnam	77	308	242	295	218	81	1,221	0.9	52.8

	Law	Science and Economics	Arts & Humanities	Science	Medicine	Technology	Total	% of total foreign student pop.	% of Women
Africa	7,856	12,549	16,664	13,873	8,744	2,951	62,637	48.6	41.2
Morocco	1,550	3,604	4,534	4,371	2,481	1,349	17,889	13.9	40.7
Algeria	1,224	1,531	3,682	2,899	2,844	351	12,531	9.7	46.5
Tunisia	745	1,026	1,605	1,377	786	132	5,671	4.4	39.8
Senegal	590	1,181	1,071	822	140	271	4,075	3.2	38.9
Cameroon	669	624	677	688	487	130	3,275	2.5	46.6
Ivory coast	495	667	459	455	193	66	2,335	1.80	40.5
Madagascar	175	546	513	390	469	103	2,196	1.7	52.1
Congo	436	574	550	300	204	131	2,195	1.7	33.2
Gabon	266	319	592	484	87	27	1,775	1.4	45
Mauritius	127	230	328	251	168	50	1,154	0.9	44.6
Benin	190	285	180	202	126	45	1,028	0.80	33.4
Djibouti	119	300	209	331	7	17	983	0.8	32.6
America(s)	1,110	642	5,598	1,322	551	105	9,328	7.2	61.2
United States	314	84	1,966	104	29	10	2,507	1.9	72.2
Brazil	117	75	765	262	121	11	1,351	1.0	59.1
Canada	138	51	609	122	39	13	972	0.8	60.8
Oceania	25	20	116	16	11	3	191	0.1	57.6
Stateless or undeclared	25	15	80	39	12	14	185	0.1	47.6
All nationalities	16,882	20,151	48,765	23,245	15,211	4,534	128,788	100	50.9
% women	53.6	45.9	65.9	30.2	42	37.5	50.9	-	-
% foreigners	9.3	13.0	10.0	7.2	11.0	3.9	9.2	-	-

Over the past 15 years, a very steep decline has taken place in the number of foreign students engaged in postgraduate and doctorate courses. In the period 1985-98, during which foreign enrolments in French universities declined steadily, the number of foreign postgraduate and doctorate students fell from 36.4% to 16.6%. The downward trend continued uninterrupted

until 1999 when the number of foreign enrolments rose to 4,273, an increase of 317 with respect to 1998 (3,956)³².

The situation for doctorate students is no better. Over the same period, the percentage of foreign doctorate scholars fell from 41.2% to 24.2%.

The conclusion to draw here is that, in terms of student numbers, France has certainly lost its ability to draw in intellectual capital from abroad and, in fact, has not even managed to attract brains from those countries that have traditionally supplied it with intellectual resources.

Foreigners/ type of studies	1985	1990	1995	1996	1997	1998	1999
Postgraduate							
Foreigners	6,529	5,093	4,537	4,279	4,051	3,956	4,273
% foreigners	36.4	24.4	17.2	16.5	16.6	16.6	18.2
Doctorates							
Foreigners	3,183	2,716	3,117	2,871	2,890	2,652	2,398
% foreigners	41.2	35.6	32.9	28.6	26.8	36.1	24.2

11. Strategies for Stemming the Flow

France currently lacks the sort of capacity for innovation and attractiveness that has made Anglo-American countries so successful in capturing intellectual capital. The new technology sector is not expanding nearly as fast in France as in Britain and the United States, and the research facilities in France are inferior to those of Britain and the United States. This gap and the inability that France has hitherto demonstrated in making up for lost time makes it difficult for the country to hold on to the professionals who have studied in its universities. France is even less successful at enticing business leaders who are, for obvious reasons, more forcefully attracted by countries whose bureaucracies, infrastructures and services make setting up a business easier. In short, France has so far failed to compete successfully with the rest of the Western world, especially the Anglo-American nations, for the scarce intellectual resources of the planet.

The French Senate therefore concluded:

*“Alternative measures must be considered, among them the creation of administrative and fiscal environment which, while certainly not turning the country into a tax haven, should have features in common with the Anglo-American model where the administrative formalities imposed on businesses, and therefore also the workers employed by businesses, are much more straightforward.”*³³

³² Dubois, M. (2000) *Les étudiants étrangers à l’université*, Note d’information, Ministère Education Nationale, Paris, France

³³ From website of French Senate (2001) *La fuite des cerveaux: mythe ou réalité?* Paris, France

The study carried out by the French Senate found that administrative convolution, heavy taxes and inflexible labour legislation undermine efforts to create new enterprise, develop scientific research and thus revamp the economy.

Given that it boasts an excellent system of training in new technologies and has a global academic reputation, France finds it particularly difficult to accept that it is only a second-rate country in the field of technological development.

The Senate report indicates that the primary course of action must consist in a reduction of the fiscal burden. In particular, the taxes levied on physical persons, capital and profits must be lowered. The report also recommends the simplification of procedures, the introduction of greater flexibility in labour legislation, and the creation of a more streamlined administration that better responds to real market demand.³⁴

The question that suggests itself here is whether the measures recommended in the Senate report, which are intended to encourage the repatriation of many emigrants, are really appropriate in the light of the problems and possible solutions that other analyses and surveys have identified.

Before turning our attention to this, we should first note that the introduction of fiscal measures aimed at reducing emigration and attracting back intellectual capital to France have had little success in reducing the outflow of qualified migrants. They have thus revealed themselves ill-suited to stemming the scientific diaspora.

All the measures implemented with a view to reducing the outflow, especially those benefiting businesses (such as the creation of a publicly financed risk capital fund and administrative simplification) have so far not only failed to stop the outflow, but have not even succeeded in slowing it down.

While it is true that an expansion has taken place in the number of new enterprises created in France in industrial sectors requiring a large number of highly qualified personnel, this is only the result of the exceptionally favourable global economic circumstances that occurred at the beginning of 2000. In conjunction with the legislative action mentioned above, the auspicious economic situation naturally generated opportunities for new entrepreneurs in France (and elsewhere), but there is nothing that allows the claim that the reforms influenced the pattern of migration which, as we have seen, did not even slow down.

So, returning to the question of whether the action proposed by the Senate report is likely to be effective, we must first look closely at the reasons behind the decision of young people, scientists, entrepreneurs and engineers to leave France. We can divide the intellectual emigrants into two major groups:

- Those who left France with the intention of setting up business abroad, notably in Britain or the United States, or those who work abroad as employees of large corporations. Essentially, then, this group consists of entrepreneurs and company managers.
- Those who left France to teach, carry out research, specialise or do doctorate degrees.

As regards emigration by the first group, expatriate entrepreneurs and managers have emphasised the need to change the cultural attitude towards business and businessmen in France.

³⁴ Ibidem.

In common with other Latin European countries, France has traditionally afforded greater protection to its intellectual élite (professors, lawyers, doctors, high-ranking civil servants, engineers) than to those with ambitions to become captains of industry.

Often, French families prefer their children to go into “safer” professions rather than face the risks and difficulties that they imagine are part and parcel of business life.

Young people are thus culturally deterred from entering the world of business. They also encounter extreme reluctance on the part of the banks to entrust them with risk capital for start-ups. These factors help explain why the enterprise creation in France proceeds at a far lower rate than in the United States.

A recent survey by the French Ministry of Foreign Affairs³⁵ estimated that 6% of engineers and 3% of commerce graduates had decided to set up their own company. The same survey found that possession of a postgraduate degree halved likelihood that a person would set up his or her own business. Evidently, the French system of education is more suited to creating salaried employees than entrepreneurs.

What are the reasons behind the emigration of so many French engineers and scientists to the United States? What are their general impressions regarding research work in United States and, more generally, North America? To answer these questions, we need to turn to the results of a recent survey³⁶ carried out among French engineers and scientists in North America.

The reasons for the decision to emigrate are set out in the two tables below, the first of which refers to French PhD students studying in the United States; the second to post-doctorate professionals. The main reasons given were:

- for those studying for doctorates: cultural curiosity (53%), the need to learn English (36%), the dearth of opportunities in France, and involvement in an area of research that has not been developed in France;
- for post-doctorate emigrants specialising in their field: the absence of opportunities in France (58%), the need to specialise in the United States in order to pursue a successful career in the research sector in France (56%), the opportunity of learning English (49%) and, finally, a recommendation to study aboard emanating from their research directors (35%) (Table 9).

³⁵ Lebranchu. M., (2000) *Assises sur la création d'entreprise* Secrétariat d'Etat, Paris France.

³⁶ Terouanne, D. (1997) *Présence Française en science et en ingénierie aux Etats-Unis, Cerveaux en fuite ou en voyage?* Bureau du CNRS.

Option	Number	Frequency (%)
Cultural curiosity and interest in the United States	90	53%
To learn English	61	36%
Absence of satisfactory opportunities in France	53	31%
Desire to leave France	47	28%
Interest in research themes not developed in France	44	26%
Need to obtain PhD in North America to acquire prestigious positions in French world of research on return home	33	20%
Suggested by research director	26	15%
Family reasons	17	10%
Recruited into world of business	9	5%
Other reasons	26	15%

Interviewees were free to choose up to three other responses
Source: Department of the French Abroad and the Ministry of Foreign Affairs.

Option	Number	Frequency (%)
Absence of adequate opportunities in France	155	58%
Post-doctorate qualifications acquired in North America a prerequisite to a high-level career in the research sector of France	149	56%
To learn English	131	49%
Suggested by research director	94	35%
Cultural curiosity and interest in the United States	88	33%
Interest in research themes not developed in France	46	17%
Desire to leave France	28	10%
Family reasons	7	3%
Desire to defer entrance into world of business	0	0%
Other reasons	19	7%

Interviewees were free to choose up to three other responses
Source: Department of the French Abroad and the Ministry of Foreign Affairs.

With respect to the pros and cons of doing research in North America, the same survey asked the research scientists and engineers to choose from among the options listed below in Tables 11 and 12. The results regarding the pros of research in America were as follows:

- 73% of researchers and engineers were particularly enthusiastic about the information technology instruments and the quality of the research material in American libraries.
- 49% were favourably struck by the dynamic pace of research work.

- 38% considered the stream of investment into research as particularly important.
- 37% were impressed by the communication interchange between different hierarchical levels.
- 25% regarded the relationship with the private sector as positive.
- 8% liked the strong sense of team spirit.
- only 3% of the sample failed to respond.

Option	Number	Frequency (%)
Dynamism of research work	218	49%
The key role played by investment	168	38%
Good communications between different levels of the hierarchy	166	37%
Interaction with private sector	111	25%
Quality of contract of employment	75	17%
Team spirit	35	8%
None of the above	12	3%
Responding to at least one option	431 out of 443	
Source: Department of the French Abroad and the Ministry of Foreign Affairs.		

When it came to the criticisms, which are listed below in Table 12, the interviewees expressed the following misgivings:

- 33% of the interviewees disliked what they see as excessive individualism;
- 26% were critical of the central role played by finances;
- 23% cited the absence of long-term planning and far-sighted vision;
- 19% were unhappy with the terms of their contract of employment;
- 17% mentioned cultural differences;
- 16% were against the practice of using research skills for purposes other than research; and,
- 16% experienced problems relating to the linguistic barrier.

It is worth stressing that a full 21% of the interviewees chose none of the negative options.

Table 12. Criticisms of research work in North America.		
Option	Number	Frequency (%)
Individualism of researchers	145	33%
Central role of finances	113	26%
Absence of long-term vision to guide research activities	12	23%
Failure to accord professional recognition	86	19%
Cultural differences	77	17%
Use of skills for purposes other than research	71	16%
Linguistic barriers	70	16%
None of the above	94	21%
Responding to at least one option:	349 out of 443	
Source: Department of the French Abroad, Ministry of Foreign Affairs.		

A notable difference between research work in United States and France is that in the former the scientists are obliged to “sell” their research results, and are therefore dependent on the munificence of financing bodies.

The results achieved by US researchers are regularly examined, and the future of the projects depends on their marketing and innovation skills.

The cultural difference with respect to France is evident. In France, research is to a certain extent detached from private financing, though the trend is increasingly to emulate the American way. Accordingly, French researchers enjoy more autonomy and have greater opportunity to dedicate themselves to long-term projects. The downside is that without commercial pressure, French research groups may lack the necessary drive and intellectual curiosity.

The motivations behind the decision of many doctorate and post-doctorate French academics to return to France, which are set out in the tables in these pages, vary according to which group (pre- or post-doctorate) we are considering. The professional situation of PhD students yet to hand in their thesis is, obviously, different from that of post-doctorate academics already engaged by research laboratories or universities. The average age of the first group is 27 years, and the second group 31.

As Table 13 demonstrates, PhD students maintain strong links to their homeland (49% of respondents). The reasons given for their possible return home included high appreciation of the French welfare system (34%) and family reasons (32%). A mere 7% of the sample complained of the uncertainty and precariousness of employment that so typifies the US market. A strong element of patriotism was evident in the high number of interviewees (22%) who listed “the desire to serve your country” as one of the motivations for returning home.

Option	Number	Frequency (%)
Cultural motives	83	49%
Quality of French welfare	57	34%
Family reasons	55	32%
Education of children	54	32%
Job security and independence offered by public sector research in France	37	22%
Desire to serve country	37	22%
Visa-related problems	37	22%
Uncertainty and precariousness of employment in United States	12	7%
Other reasons	19	11%

Source: Department of the French Abroad, Ministry of Foreign Affairs.

The order of preferences of French post-doctorate workers already engaged in research laboratories and universities was different, although, in common with the doctorate students, they also expressed strong ties with the country (48% of the sample). The main reason given by this group for a possible return to France was the security and independence offered by the French labour market and the public sector research system (50%). Once again, the French system of welfare was highly appreciated (36%), and 20% wanted to have their children educated in France. The desire to serve France was the preferred option of 20%, which makes the post doctorate group slightly less patriotic than their younger colleagues.

Option	Number	Frequency (%)
Job security and independence offered by public sector research in France	134	50%
Cultural motives	127	48%
Quality of French welfare	97	36%
Family reasons	85	32%
Education of children	53	20%
Desire to serve country	53	20%
Visa-related problems	36	13%
Uncertainty and precariousness of employment in United States	32	12%
Other reasons	20	7%

Source: Department of the French Abroad, Ministry of Foreign Affairs.

It is interesting to note that French researchers in America remain attracted to certain features of their country of origin, such as employment security, which were partly responsible for reducing the efficiency of the research system in France and contributing to the flight of intellect in the first place.

Two considerations suggest themselves here. The first is that when people move abroad they become more critical of their country of adoption of which, in all likelihood, they had previously held an idealised vision as a sort of paradise for research work. The second is that the experience of living abroad heightens one's sense of affection for the home country. It is therefore possible that the judgements made by expatriate French researchers are strongly influenced by emotional rather than rational considerations. It must also be stressed that the questionnaire consisted of a set number of options, and this necessarily limited the nature of the responses. Finally, we must acknowledge that for all that the respondents appeared highly critical of the precariousness of employment in the American system, they nonetheless expressed a desire to remain in United States, and were on the whole not interested in returning home until conditions in France changed.

12. Can a Brain Drain Really Exist in a Global Economy?

It is reasonably easy to see how the emigration of French engineers, researchers, company managers and entrepreneurs can eventually deliver benefits to France if the emigrants return home some day, or if their professional skills are used by French company abroad. This does not hold true, however, when an entrepreneur decides to base his or her business abroad, or when a research decides to emigrate for good. In both such cases, the loss to French society is absolute, unless some way can be devised of deriving indirect benefits. It goes without saying that the education of a person who then decides to go live in another country amounts to a net loss for a state -- unless the emigrant compensates in the form of financial remittances.

Although the diaspora of engineers, entrepreneurs and researchers may to some extent favour technology and knowledge transfer and even boost exports, it nonetheless amounts to a net loss of intellectual capital for France. The diaspora has evident social repercussions, and underscores the unpalatable fact that France is less competitive than the countries of destination.

Quite apart from the various financial, cultural and organisational reasons that may persuade researchers, entrepreneurs and engineers to emigrate, there can be little doubt but that the country of destination is considered superior to the country of origin because it offers better career prospects and greater opportunities for migrants to capitalise on their skills.

The flight of intellectual capital is all the more alarming if we consider that the new outflow of researchers, engineers and entrepreneurs from France is not at all counterbalanced by an inflow from Anglo-American countries. Migration is all in the one direction and has so far proved extremely difficult to reverse.

As we have seen, the new emigration is markedly higher among operators in the financial services sector and new industries such as information technology, telecommunications and biotechnology than elsewhere. These industries require professionals who are more willing than most to travel and whose working life encompasses territorial horizons that stretch well beyond French national boundaries.

To limit the loss, France has no choice other than to adopt strategies that will reduce the financial and social impact of the outflow, and minimise the loss to its stock of knowledge. The measures will no doubt have to vary in scope and direction, but must succeed in: attracting emigrant researchers and engineers home again; creating economic and knowledge-based networks to stimulate co-operation between the emigrant scientific community and French research centres; and, providing incentives to attract professionals and researchers from the Anglo-American world and other western countries to France.

The experience of two international networks is particularly interesting in this respect. The first network was created among a number of newly industrialised countries (NICs), which attempted, with some success, to effect the systematic repatriation and re-assimilation of scientists who had settled abroad.

There are several avenues open to countries of the southern hemisphere wishing to recover the lost skills held by their emigrants or “exiled” researchers and engineers.³⁷ Since 1977, the United Nations Development Programme (UNDP) has been supporting a project called TOTKEN (Transfer Of Knowledge Through Expatriate Nationals) which provides support for temporary scientific or technical consultancy missions by expatriate researchers in their countries of origin.

The second network is the result of a highly original project by Colombia to mobilise the resources of scientists and experts who have settled abroad. The project has since become the subject of study and scientific observation by a team of sociologists from the French Institute of Scientific Research for Development and Co-operation (IRD) and the National University of Colombia (UNC). In 1991, COLCIENGAS, a government-sponsored research institute in Colombia, created a network consisting of expatriate Colombian researchers, university academics and engineers. The chief objective was to encourage the scientific, technical, socio-economic and cultural development of Colombia by drawing on expatriate resources.

The principle underpinning the creation of this Colombia network of expatriate researchers and engineers is very simple:

“Many of our most highly qualified compatriots live abroad: this is not a loss but, rather, a resource on which we can capitalise. They have been trained and work in the best possible conditions, conditions that we could never offer them. If we can see to it that they take part from a distance in our programmes of research and development, we shall benefit not only from their skills and personal knowledge, but even more from the many resources that they mobilise around them every day.”³⁸

The network, which is called CALDAS, took shape and grew, and its ranks now encompass around 1,000 of the 2,000 or so members of the Colombian scientific diaspora.

A quarter of them live in other Latin American countries, 24% in the United States, 12% in Great Britain, 9% in France, 9% in Germany and the remainder in the rest of the world. Of the total, 23% work in technology and engineering, 16% in the natural sciences, 14% in the exact sciences, and 12% in medicine and health care. The network consists of 24 associations

³⁷ Meyer, J.B., (1996) *Fuite des cerveaux: comment mobiliser les compétences expatriés* Centre IRD Ile de France, Fiches scientifiques

³⁸ Meyer G. B., Charum J., (1995) *La fuite des Cerveaux est – elle épuisée? Paradigme perdu et nouvelles perspectives*. Cahiers des Sciences Humaines, n. 31. France

in as many countries and its ranks include students, scientists and technicians working in universities, laboratories and companies abroad. These various subgroups work together in conjunction with national teams to carry out joint research projects. COLCIENGAS operates as the general co-ordinating body, and the Internet provides the means for the exchange of information useful for joint projects, the evaluation of scientific programmes as well as training and research sessions.

This strategy of banding the expatriate scientific community together to form a network, now known as the “option diaspora”, seems to be a good practice that could be extended to other countries, and a study carried out in Colombia has set forth the necessary conditions for the successful reproduction of the programme elsewhere in the world. The main difficulties consist in finding the means to bring together the highly dispersed and widely scattered community and steering the manifold potential of the expatriate experts towards strategic goals of benefit to the country.

Availing themselves laboratory facilities, researchers from IRD and UNC conducted a pilot study based on the Colombia experience and succeeded in developing various scientific tools and documentation thanks to which it is now possible to apply information technology to the task of finding suitable project partners and identifying the sort of research themes that best lend themselves to collaborative scientific enterprise.

The development of these tools, which were derived from an analysis of the original Colombian experience, could enable other states to build their own federated networks of expatriate experts. This could be particularly useful for Africa, a continent that has been particularly hard hit by the dispersion of native skills and for some of whose ills “option diaspora” might prove to be the right cure.

The Colombian experience should also serve as an inspiration for France. It has validated a new approach to the brain drain phenomenon that is cohesive, organic and unified, and can be followed by policy-makers keen to devise effective ways of improving the general research standards in countries that currently export their highly qualified personnel. More generally, the approach should contribute towards the affirmation of the concept that emigration is an opportunity rather than a problem.

13. Conclusions

As often happens with sensitive themes such as this, the issues surrounding the brain drain phenomenon are often viewed through a prism that provides either a distorted or incomplete view of reality.

This is particularly true when it comes to assessing the effects of the “flight” of intellectual capital within the context of the European Union. Treating the movement of intellectual capital as if it were the same as a brain drain, and looking at the issue from the limited perspective of a single European country not only obscures the many advantages that this so-called “flight” generates, but also carries the risk of promoting an inappropriate and “provincial” view of scientific research.

It is appropriate to talk in terms of a flight of intellectual capital only in cases where researchers and scientists have found themselves unable to operate satisfactorily in their home country, have emigrated in a way that excludes the possibility of return, and have severed all research and organisational ties with their native scientific institutions. These academics and

professionals have repudiated their native scientific institute's organisational standards, salaries, administrative structures and environment, which may be based, for example, on a highly hierarchical culture of organisation and dominated by anachronistic working methods in which seniority is allowed to prevail over competence. Instead, they choose to continue their research in more hospitable environments, without maintaining any ties with their country of origin.

It is worth considering whether these researchers would have been able to achieve their ambitions had the organisations in their home country been more streamlined and less bureaucratic. In the absence of research centres capable of capitalising on the potential of their employees, does it make sense to hold on to intellectual resources if they are not going to be given adequate opportunity for scientific expression?

For how long - and at what cost - is it possible to hold on to intellectual capital if the conditions do not exist to allow that capital to produce and create? If our society is unable to encourage innovation, create the basic conditions to allow researchers to operate autonomously or sustain a culture in which merit is accorded just recognition, it risks completely alienating its academics and researchers, especially when, as often happens, they have been persuaded back to their home country by elaborate promises but then find themselves obliged to emigrate again.

In these circumstances, it would perhaps be wiser to allow that researchers should be free to leave, and then deal with the loss by encouraging the creation of scientific networks that can make optimal use of the skills that the expatriate scientific community has to offer its country of origin.

A country that has equipped itself with an efficient network linking expatriate with home-based scientists has no reason to fear intellectual emigration because, as many academics have observed, brains leave, travel and then return home. The temporary migration of intellectual capital brings enormous benefits both for the receiving and the sending country as well as, obviously, the individual himself or herself.

Organisations that have dedicated themselves to investing in research have been able to benefit enormously from the resources offered by the scientific diaspora. In pursuing national research programmes, the CALDAS network of Colombia mentioned above is able to draw on the joint potential of more than 25 universities and research centres across the world where Colombian researchers are present.

A common flaw of many papers on the brain drain phenomenon is that they analyse the subject from too limited a standpoint, and therefore propose solutions that are unlikely to prove effective in developing the research sector.

The most successful projects, it should be stressed, are those that permit intellectual migration but also work towards the strengthening of the ties between national research projects and the network of expatriate scientists. An effective policy is one that can look afresh at its nation's research system and promote action to redesign structures or projects as soon as they fail to assure levels of efficiency comparable to those achieved by successful countries.

All told, basing our conclusions on the studies we have mentioned, and considering the reasons given for emigration, we suggest the following steps for managing migration and encouraging the return of expatriate professionals.

In the short- to medium-term:

1. Researchers must be given the opportunity to emigrate during the most productive period of their life and to acquire skills in those environments where research is currently most dynamic.
2. During their period abroad, expatriate researchers must be encouraged to participate in joint projects and knowledge exchanges with their native country (c.f. the example of CALDAS). This approach would help maintain an ongoing relationship and create highly valuable knowledge networks.
3. Steps must be taken to bring about a cultural change with a view to improving the efficiency of public-sector research organisations. This will include measures such as the participation of home-based and emigrant researchers in decision-making processes and the avoidance of top-down decisions, which, though they look effective on paper, often prove quite the opposite in practice.
4. In the long-term the following more structural reforms ought to be made:
 - i. The state monopoly of national research should not be dismantled, but should be made more competitive by allowing the formation of independent laboratories that can compete with public sector bodies. The result ought to be a general improvement in the competitiveness and quality of scientific research.
 - ii. Public sector research centres must implement more competitive assessment criteria and link pay and prestige to successful scientific innovation and results rather than to years of service. This, however, entails a full-scale cultural shift whose effects can only be felt in the medium-to-long term.

To turn these recommendations into reality, France must take a completely fresh look at its current system of research, analyse the causes that draw intellectual capital to Anglo-American countries and keep it there, and, in the meantime, identify what benefits already or will eventually derive from the temporary or permanent departure of intellectual capital.

Is it possible to benefit from the departure of intellectual capital and, if so: how? It may perhaps be advisable to use North America as a benchmark, and allow the North American model to form a new basis of approach. Similarly, some thought should be given to the idea that spending on research might better be measured by the quality of output rather than the quantity of input. It is worth taking a look at the working conditions of professionals and considering the incentives, which are not always and only economic, that operate in high-level research environments. In short, we advise a more holistic approach to the world of research and a break with the tradition whereby hierarchies of power based on seniority and political connections count for more than results and excellence, even in the world of research.

In the end, the material that we have examined does not suggest that the flight of intellectual capital is primarily the result of individual economic calculation. Rather, the studies suggest that the real driving force behind emigration is researchers' need to find working conditions that given them freedom to think, create, produce valid products, and obtain fitting rewards, including economic compensation, for their efforts.

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