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Scientific Diasporas: A New Approach to the Brain Drain

by
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Contents

Summary

The migration of scientists and engineers between countries with different levels of development has long been a critical issue and an unsolved problem. Today, with the global knowledge-based economy increasingly relying on science and technology (S&T) skills and generating their international flows more than ever before, the issue has become even more crucial. However, the terms in which this concern is being addressed are changing, possibly giving way to new solutions. The rise of intellectual, especially S&T, diaspora networks during the last decade all over the developing world indicates such a new trend. Though the experiences differ from one country to the other, they all share the goal of systematically using their expatriate experts, scientists and engineers for development at home. Some lessons and policy implications may already be extracted from these recent attempts. They should pave the way for an efficient use of the S&T diasporas. These are indeed strong potential resources for effective and mutually beneficial co-operation between developing and highly industrialised countries.

The Brain Drain Issue in a Global Knowledge Society

The magnitude of the brain drain and more specifically of the emigration of scientists and engineers (S&E) has always been difficult to assess, due to the lack of comparable statistics across different countries. However, reliable – though partial – estimations have been made during the 1970s and 1980s, revealing the importance of the phenomenon in quantitative terms. One of these showed that 825,000 skilled immigrants entered the North American countries between 1960 and 1987 (UNCTAD 1987) and that the share of developing countries' nationals within this population had dramatically increased over the period. It is necessary, today, to prolong such estimations with new and different data, referring to the current stock rather than to the past flows of skilled people of foreign origin. This exercise is done here bearing two concerns in mind:

a) To give a realistic, though temporary, assessment of the extent of skills migration through stock data, that is by measuring the skilled foreign-born population present in the host country at a given date. Indeed, the flows data (entries and exits registered at the borders) only keep record of the number of *already* skilled migrants entering a definite country when it is clear, today, that the majority of skilled people of foreign origin acquire their professional qualifications in the host country. Evidence from both the United States and France – the major countries in terms of the number of foreign students – how that two thirds of the foreign-born scientists and engineers working in the former earned their doctorate in the U.S.A. (N.S.F. 1998, p. 3-19) and that only half of the foreign students receiving a doctorate or a post-doctorate in the latter return to their native country within two years (Martin Rovet et al. 1998). In other words, studies constitute *de facto* a major channel for migration in the S&T sector and the flows data are unable to reflect this since the incomers are not registered as skilled migrants.

b) To provide a relative reference with regard to the importance of skills migration for both the host (highly industrialized) and the home (developing) countries, at the end of the millennium. Beyond the general skilled population, the emphasis is put on the scientists and engineers and, among these, on those involved in research and development (R&D) activities. These sectors are indeed considered as the new major source of wealth and development and their magnitude characterizes the stage of knowledge society (Stehr 1994) which the contemporary world has partly reached.

Data is here mainly extracted from statistics of the National Science Foundation of the United States which provides the most precise and comparable information for this purpose.

The SESTAT database of the National Science Foundation (NSF) shows that in 1995, 1.434 million people (12%) out of the 12 million people who have science and engineering degrees or who work in science and engineering occupations in the U.S.A., are of foreign origin. Over 72% of these were originally born in a developing country. When looking at the level of qualifications, it appears that the higher the diploma the bigger the proportion of the foreign-born population. 23% of those having a doctorate are not U.S.A. born citizens and this proportion is even much higher in some key areas such as engineering and computer sciences (40%) (NSF 1998, p. 3-19). From these figures, it is obvious that the first country in terms of S&T capacity, of academic knowledge production and of technological innovation in the world, relies significantly and sometimes heavily on non-native skill holders[1]. The leading edge of the global knowledge society draws on human resources worldwide.

Viewed from the developing countries, figures indicate that an important part of their nationals involved in research and development (R&D) activities is located beyond their borders.

A realistic estimation of the S&E originally from a developing country and involved today specifically in R&D activities in the U.S.A. is about 170,000[2]. To extend this to the rest of the world in the absence of similar data, it is necessary to make a hypothesis. The one which is made here, based on estimations on the "triad" (U.S.A. – E.U. – Japan), which represent half of the world workforce in R&D (O.S.T. 1996, p. 341), is as follows: the proportion of foreign-born S&E in the E.U. and Japan should be roughly equivalent to what it is in the U.S.A. alone. It is a reasonable hypothesis for two reasons:

- these highly industrialized countries have a significant proportion of foreign students, like the U.S.A. and – especially in Europe – often much higher (O.S.T. 1996, p 391). The stay rate of the doctoral students is quite similar to what it is in the U.S.A. (about 50% for both France and the U.S.A.)
- like the United States, these countries also often have selective migration policies, favouring highly skilled people immigration or settlement (OECD 1998, p 55).

With such a hypothesis, the number of S&E originally from a developing country and working in R&D in the "triad" would be close to 400.000 people. In comparison, the total – home based – R&D personnel for all developing countries amount to 1,224,000 S&E (O.S.T. 1996, p 341). One must not forget that the "triad" does not include countries such as Australia, Canada, New Zealand and Switzerland, among others, which are also well known for their high rates of highly skilled foreigners. Therefore, to assume that the R&D workforce originally from developing countries and currently employed in highly industrialized countries represents one third of the home-based one, is a reasonable and rather low, hypothesis.

The figures presented above give an order of magnitude for the overall expatriate population of developing countries which is involved in R&D. These quantitative estimations must be combined with qualitative aspects. The expatriate scientists and engineers to whom it is referred here work in an environment which is far better than

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[1] The United States represent 22% of the R&D workforce, roughly 40% of the GERD (Gross Expenditure in R&D) and mainstream science production and between 30 and 50% (according to the European and American databases) of the patents of technological innovation, in the world (O.S.T. 1996 p341, UNESCO 1998, pp23-25).

[2]This inference is made on the following basis: of the almost one million scientists and engineers directly working in the research and development sector in the United States, 23% of these -whose positions and highly specialized occupations require advanced (doctorate) degrees- are foreign-born, of which (72%) are from developing countries (O.S.T. 1996, p 341). (see above)

the one of their peers in the country of origin. They indeed have access to funding, technical support, equipment, scientific networks, experimental conditions, and many other resources which are much more limited at home. The productivity of the "triad" R&D sector is, for instance, 4.5 times higher in terms of publications and 10 times higher in terms of patents than it is in the same sector for the developing world.[3]. This obviously only refers to both mainstream science and technological innovation. But these are precisely the ones that count for the international competitiveness of organizations and countries in a global knowledge-based economy. Consequently, for the developing nations as a whole and under the assumption described above, the R&D expatriate capacity is significantly higher than the one which is based at home.

This points to both the quantitative and qualitative importance of the S&T diasporas. They constitute for the developing countries a huge potential of additional resources. Is this potential more than an abstract view and a statistical artifact? Is it feasible for these countries to systematically tap even only a part of these resources? Today, the answer does not leave room for any doubt: it is a realistic scenario, conceptually grounded and based on evidence.

Using the Intellectual Diaspora: A New and Promising Strategy

Since the beginning of the 1960s, the brain drain has been identified as a problem, hence something against which policies had to and, supposedly, could react and struggle through voluntaristic decision-making. Until the late 1980s, these national or international policies have focused on countermeasures, either to prevent/regulate flows of skills or to cancel their negative effects through taxation. Though their design had often been thoroughly studied, they failed to bring feasible or effective solutions (Meyer et al. 1997). Today, it appears that these repeated failures are mainly due to the partially wrong underlying theoretical assumptions on which these policies were based. They basically referred, indeed, to human capital approaches where the skilled person is conceived as an individual capital asset, made of all his/her qualifications and professional experience resulting of prior investments (Gary Becker). Accordingly, the two ways to counter the loss of human capital is either to restrict the flows through authoritative or negotiated decisions or to evaluate its monetary cost and get financial compensation. It simply could not work because, in fact, the human capital approach reflects but a small part of the phenomenon.

For the past two decades, the sociology of science and technology[4] has brought a new understanding of the process of knowledge creation, transmission and application. It insists on the collective nature of such a process, emphasising the role of scientific communities (Robert Merton, for instance). They show that these are socio-cognitive communities, not only social or institutional ones (Thomas Kuhn's paradigm). They

[3] Calculation made by the authors on data from the Science Citation Index and the US Patents databases as processed and published by the Observatoire des Sciences et des techniques (OST 1998). Publications and patents reflect the S&T output.

[4] as well as the neo-evolutionary or schumpeterian economics of technical change

demonstrate that this socio-cognition is very specialised and thus enacted in local - not easily duplicable/replicable - conditions, involving partly collective tacit knowledge built through daily group practice and requiring the individual's enculturation (Harry Collins' core sets). This individual's abilities and activities only make sense and generate results with regard to the human and non-human entities to which he/she is linked (Michel Callon and Bruno Latour's actor-network theory)[5].

The approaches presented above reveal that -especially in the field of science and technology -the embodied knowledge of the people (human capital) is but one resource amongst many and one whose value and effectiveness is relative to its combination with the others. Empirical proof of this is provided by numerous examples of talented scientists or engineers being misused or underutilised when they go back to their country of origin where their abilities are disconnected from what used to make them powerful (see for instance Gaillard, 1991). This leads to an approach emphasizing connectivity and which departs from the traditional brain drain assumptions.

For the last two decades, the conception about the migration of skills has evolved, putting stronger emphasis on brain gain, which is based on the idea that the expatriate skilled population may be considered as a potential asset instead of a definite loss. The scientists and engineers abroad appear as human resources educated, trained through professional practice, and employed in much better conditions than those the country of origin could have provided to them. If such a country is able to use these resources largely shaped through others' investments, it would then gain a lot. There are two ways to implement the brain gain: either through the return of the expatriates to the country of origin (return option) or through their remote mobilization and association to its development (diaspora option).

The return option has been successfully realized in various new industrialized countries (NICs) such as Singapore and the Republic of Korea or big developing countries such as India and China (Charum, Meyer, eds, 1999). Strong programmes to repatriate many of their skilled nationals abroad have been put in place since 1980. They have created at home the networks in which these returnees could effectively find a place and be operational. However, these countries are not surprisingly the ones that could afford to significantly invest in S&T material as well as human infrastructure. They had started to build the research and technico-industrial web which could appropriately sustain such R&D activities employing returning S&E. Obviously the success of that option depends very much on this specific capacity. Such a prerequisite is not easily matched by many developing countries.

The diaspora option is more recent and proceeds from a different strategy. It takes for granted that many of the expatriates are not likely to return. They have often settled abroad and built their professional as well as their personal life there. However, they may still be very concerned with the development of their country of origin, because of cultural, family or other ties. The objective, then, is to create the links through

[5] More precise references are available in Meyer and Charum 1995

which they could effectively and productively be connected to its development, without any physical temporary or permanent return. This type of distant cooperative work is now possible as cases of international research projects or multinational corporations' (MNC) daily activities have already demonstrated clearly. Moreover, relationships between expatriate intellectuals and their mother country have often existed in the past. What is new today, is that these sporadic, exceptional and limited links may now become systematic, dense and multiple.

A crucial advantage of the diaspora option is that it does not rely on a prior infrastructural massive investment, as it consists in capitalising on already existing resources. It is thus at hand for any country which is willing to make the social, political, organizational and technical effort to mobilise such a diaspora. A promising perspective in such a strategy is that through the expatriates, the country may have access not only to their individual embodied knowledge but also to the socio-professional networks in which they are inserted overseas. It is quite an extensive version of a connectivity approach. This is what is at stake in such initiatives around the world today. A number of countries have indeed made use of the "diaspora option".

Forty-one expatriate knowledge networks have been identified around the world to date (*see table in appendix*). This list only includes networks having an explicit purpose of connecting the expatriates amongst themselves and with the country of origin and of promoting the exchange of skills and knowledge. Other recent expatriate networks do exist without any emphasis on knowledge, pointing to the rise of diasporic links as a more general and global phenomenon (Cohen, 1997).

The expatriate knowledge networks are tied to 30 different countries, some of these having more than one network. Two networks refer to a world region rather than a specific country: The Arab Scientists and Technologists Abroad (ASTA) and the Latin American Association of Scientists (ALAS). The networks were all initiated recently, during the late eighties and mostly the nineties. They emerged very spontaneously and independently of each other, thus they are all diverse and heterogeneous. These networks differ in size, scope, objectives, activities and structure. They also often ignored, until today, the existence of similar initiatives elsewhere. In an attempt to make sense of this vast array of information, it was decided to set up a typology of expatriate knowledge networks[6].

Intellectual Diaspora Networks: Evidence from Recent Experiences

The expatriate knowledge networks that were identified are here classified into five categories: student/scholarly networks, local associations of skilled expatriates, expert pool assistance through the Transfer of Knowledge Through Expatriate Nationals

[6] As this is the first exercise of this kind, we don't claim to have exhausted the information on these networks. We just aim at providing a better understanding of both their differences and similarities. Networks were identified through systematic Internet searches, personal contacts and a review of the literature.

(TOKTEN) program of the UNDP and intellectual/scientific diaspora networks. Among the latter, distinction is made between those networks which have not as yet stable or precise features (developing) and those which seem more established and organised. These provide material for a deeper analysis.

Student/Scholarly networks offer assistance to students studying abroad and encourage the sharing of information and dialogue between scholars. They often facilitate studies abroad and/or reintegration into the highly qualified labour market afterwards. They have a limited scope in terms of activities and contributions to the country of origin. Also, this category of networks is the only one which includes highly industrialised countries' initiatives.

Local associations of skilled expatriates are groups of highly skilled professionals who meet regularly on both a professional and social level. The aim is to promote the professional interests of members as well as to socialise on a more personal level. CESASC (China) for example organises various technical and professional meetings such as an Annual Technical Conference and provides employment listings in various professional fields which might interest members. The SIPA (India) however goes a step further: it aims to develop co-operation and exchange not only between highly skilled expatriate Indians, but also between the U.S.A. and India in high technology areas. Sometimes, these local associations constitute a nucleus on which global and more systematic networks may develop, as is the case of the Colombian Red Caldas network, the South African Network of Skills Abroad and the Philippines Brain Gain Network (BGN).

The **Transfer of Knowledge Through Expatriate Nationals (TOKTEN) programme** of the United Nations Development Programme (UNDP) uses the expertise of highly skilled expatriates by assisting them to return to their home country for short visits. These visits usually last between three weeks and three months during which the expatriates engage in various development projects or undertake teaching assignments at local universities. Dozens of countries have successfully used this programme occasionally, during the last two decades. However, recently some of them such as Palestine, Pakistan and Lebanon have started to set up more permanent structures to tap their expatriate human resources through the TOKTEN programme more systematically. The list of databases of people, organised by area for example, constitute embryos of real networks.

Developing intellectual/scientific diaspora networks are classified as such because they share certain characteristics with intellectual/scientific diaspora networks, but due to certain constraints have not fully developed into this type of network. Their aim is to make use of the highly skilled expatriate pool of their countries to contribute to the development process of the home country. The RBD project of Thailand initially only aimed at bringing highly skilled Thai expatriates back to their country for short visits to assist there in the development of science and technology. It has since turned its focus to setting up projects between Thai scientists at home and their counterparts abroad, without necessarily bringing the expatriate scientists back to Thailand.

The above-mentioned networks are also classified as "developing" because insufficient information is available at this time to assess whether or not they can be classified as real intellectual/scientific diaspora networks. They do however have a similar goal and purpose as these. The FORS Foundation (Romania) for example seeks to involve Romanian scientists both in Romania and abroad in contributing to the process of economic reform and socio-economic development in Romania.

The following discussion will be restricted to the analysis of the 15 **intellectual/scientific diaspora networks** that were identified **(refer to table).** In order to be classified as such, networks must fulfil the following criteria:

1. members must be mostly nationals of a particular country living and working or studying abroad;
2. members must be highly skilled, active in a number of professional fields, specifically conducting scientific research;
3. the networks must have as their main purpose the economic and social development of the country of origin;
4. there must be a degree of connection or linkage between different network members and between network members and their counterparts in their country of origin.

These networks will be compared and contrasted in terms of (a) their organization and administration, (b) their membership and (c) their objectives and activities.

(a) Administration and organization of the network:

All of the networks studied were set up in the early 1990s and were in some cases like the BGN of the Philippines initiated by a group of expatriate students or scientists and researchers who recognised the need for an initiative of this kind. The Internet is the main tool used by all the networks for promoting and making visible the networks to potential network members. All the networks have a website which is the initial entry point for potential members. These websites differ in terms of the presentation as well as the amount of information they offer. They usually contain an on-line membership application form which prospective members are required to fill in. After completing the form they officially become network members and are entered on a database.

IRSA (Ireland), the Global Korean Network and ANA (Nigeria) are completely independent and are not affiliated to any political party or to the national government. The other networks do have linkages to particular governmental agencies, notably the State Committee for Scientific Research in the case of the Polish Scientists Abroad network, the Ministry of Higher Education in the case of Iran, the Science and Technology Advisory Council in the case of the BGN and the Higher Council for Science and Technology in the case of ASTA. These linkages are important because they facilitate the implementation of joint development projects, however network members in many cases prefer that the network retain some degree of autonomy from government and other political organizations.

The networks are managed by an executive committee or executive council which varies in size according to the size of the network. ANA for example, which has a huge, well-dispersed network membership, is managed by an executive council consisting of 18 members. The fact that most of the networks are independent organizations means that all of them, except for the Tunisian Scientific Consortium, do not receive any funding from the national government and thus require their members to pay a fee which is the only source of income for most of the networks. The amount that individual members have to pay usually depends on the type of membershipwhich can range from student, professional or associate to corporate membership.

(b) Network membership

Membership for most of the networks is open to researchers, scientists, students, business people and in some cases such as IRSA, ATPAC (Thailand) and the Tunisian Scientific Consortium to research and business organizations interested in the development of the country of origin. Membership of some of the networks is exclusively for people in the fields of science and technology while other networks are more "multi-disciplinary". Most of the networks are oriented towards the natural sciences, except for SANSA and the BGN which cover a wider scope of disciplines. A significant number of their members are active in humanities and social sciences as well as management and administration.

Network members are in many cases dispersed all over the world, except for ATPAC, ATPER and ATPIJ (Thailand) which are more regional networks. For example, members of Red Caldas (Colombia) are located in 30 countries and those of SANSA in 57 countries, five main world regions and 800 different cities.

Most of the networks restrict membership to expatriate nationals of their particular country, except for SANSA, Red Caldas, the Tunisian Scientific Consortium and the BGN which allow anyone who is interested in the development of the particular country to join the network. Some networks, such as IRSA and the Tunisian Scientific Consortium, have quite a complicated membership structure.

Members of these networks are highly skilled and highly qualified with a number of members holding advanced degrees (masters and doctorates). More than half of the membership of the BGN and SANSA for example hold advanced degrees

(c) Objectives and Activities of the Networks

Intellectual/scientific diaspora networks aim at establishing and fostering communication and exchanges between members living abroad and linking them to their counterparts in their country of origin. The educational, social, cultural and professional advancement of their members is also high on the list of priorities. These are closely related to the main objective of all the intellectual diaspora networks, which is the economic, political and social development of the countries of origin.

To ensure that the above-mentioned goals are met, network members engage in various activities and organize different educational, developmental, social and cultural events. These include conferences, seminars, workshops, focus group discussions as well as social events such as dinners, Christmas parties and picnics. Networks like the Global Korean Network, the BGN, ASTA (Saudi Arabia) and the

Tunisian Scientific Consortium organise annual conferences which focus on specific issues of interest to members as well as the country of origin. ASTA for example organise collaborative conferences between itself and the Jordan University for Science and Technology, the International Energy Conferences and Exhibition in collaboration with the University of Bahrain, the Water Conference and an Environmental Conference. The BGN organises focus group discussions where members can share information and ideas regarding topics such as the opportunities for software development, opportunities for integrated circuit design, electric vehicles, public policy for technology transfer and alternative forms of power generation in the Philippines.

All the networks have a newsgroup or newsletter, in either a paper or an electronic version, to foster communication between network members and to inform members about the latest developments at home. In addition, particular networks like the Tunisian Scientific Consortium and ASTA have specific digests and periodicals in which scholarly articles and books written by network members are published. These disseminate research results and information and facilitate dialogue and discussion between members and between them and their counterparts at home.

To ensure the economic and social advancement of the country of origin, network members engage in various joint developmental projects with government agencies and private and non-profit organizations at home. BGN members devote themselves to projects involving the creation of companies in the Philippines, the provision of consulting services to Filipino corporations and government/academic agencies and the formation of foreign-based companies to do business in the Philippines. The Tunisian Scientific Consortium, in its drive to boost the economic and social development of Tunisia, organises short courses and training courses in the practical application of science and technology. They are offered to individuals in the academic as well as the industrial sectors. ANA has a number of committees such as an Education Committee, Technology Committee, Finance Committee and a Health Affairs Committee dedicated to specific areas of concern to Nigeria. On joining the network, each member has to indicate on the application form which committees he/she wishes to join.

Members of the Red Caldas network are encouraged to engage in collaborative research projects. Two such projects are the Bio 2000 project and a project for the transfer of technology in the area of robotics. The aim of the former was to apply instrumentation, developed for physics and engineering in the fields of biology and medicine (Granes et al., 1998). The latter project involves robotics, automation and industrial networks and aims at designing and constructing a multi-purpose industrial robot (ibid). The network members of all the different networks thus engage in purposeful actions and activities in order to contribute to the economic and social advancement of their country of origin.

The above-mentioned development projects are concrete examples of the role that highly skilled expatriate nationals can play in the transfer of knowledge from the more industrialised countries they work in to their home countries. However, there is not enough evidence that these kinds of projects are numerous and not enough information to assess the extent to which they are successfully implemented. Networks may face certain limitations and difficulties in their efforts to arrange and implement more developmental projects of the kind mentioned above.

Prospects and Policy Implications of the Diaspora Option

The fact that so many countries have set up intellectual/scientific diaspora networks at the same time, with comparable characteristics and structures, would indicate that the diaspora option is a significant strategy. To our knowledge, none of these networks has dissolved and a number of them have been around for almost a decade. Although some of them are not as dynamic in terms of activities and projects, the fact that they still exist today means that the purpose of their creation has not disappeared and that they still enjoy some form of support.

All these networks have achieved their initial goal of mobilizing highly skilled expatriate human resources, to varying success. Their sizes range from a few hundred to 2000 members. As far as the South African and the Colombian networks are concerned, they have managed to get between 10% (for the former) and 50 % (for the latter) of the identified potential members. Therefore, it is realistic to expect that only a part of the diaspora responds positively to an initiative of this kind. However those who do respond are usually very motivated and the evidence shows that their level of skills is indeed very high. So it is really a case of capturing the best expertise rather than the greatest number of expatriates.

It is difficult to determine the success of these networks in terms of input or impact on the development of the home country. The type of exchanges that take place between network members and the national community – for example scientific meetings, email information/data exchanges, training sessions, informal advisory opinions -not always bring tangible, visible or immediate results and do not allow for a statistical assessment. This does not mean, however, that these exchanges are not significant.

In terms of developmental projects and activities, the evidence has shown that attempts at co-operative projects between expatriates and the national community are indeed made. These consist of research projects, technology transfer and expert consulting. As these experiences are fairly recent and not enough information is available on their undertakings, their success is difficult to assess. However, it appears that these projects are not numerous and that they are in many cases spontaneous, isolated, initiatives. In fact, in order to generate joint projects between diaspora and national based actors, two things are needed: an information system and an incentives scheme. The information system displays the scope of potential partnerships in which any user can search for those in his/her field of activity. The incentives scheme directly provides or gives access to resources (material or not) to fuel the projects led by the members. This is a triangle of action: to facilitate undertakings in such a widespread and heterogeneous population, besides the network membership, technical as well as political support is needed (Meyer and Brown 1999). In this process, the commitment and involvement of national based actors and organizations is crucial. At this point in time, indeed, the networks exist and their highly skilled members are motivated. The onus is really on the national community to utilize this resource to the fullest.

The analysis of the 15 intellectual/scientific diaspora networks shows that good organization is required in a network of this kind in order to ensure communication, information-exchange and coordinated actions. This is where an interface or coordinating body appears necessary. The function of such a coordinating body would be to collect, organize and maintain the information needed for the systematic search of partnerships, but also to manage and promote the interests and actions of the multiple entities present in a network of this kind. The coordinating body would be responsible for opening up access to resources that can be used to generate action in the network. This body would consist of network members as well as interested parties from the national community; it would thus be a consortium of multiple partners.

What are the meaning and the future of the diaspora option in a global knowledge society? Does it make sense to rely on national based intellectual co-operation when communication has become pervasive and multidirectional? Why would a scientist resort to an expatriate when he could apparently call on any fellow scientist in any part of the world, whatever his/her national origin might be? The answer lies in the effectiveness of the links created by a diaspora/network compared to other possible, virtual, ones.

The world, today, is one where information is abundant. The problem for the user is to get access to the one which is relevant, useful and eventually translatable into action. This is what the diaspora network provides to its members and users, be they abroad or at home. Technically, through its databases or information system, it focuses on the information which is useful, especially for building partnerships. Socially, through a common identification, it acts as a community of knowledge and interests breaking the anonymity which hampers consistent interaction, and as a social network setting up the confidence which is known to be crucial for human transactions and undertakings. Finally, based on a national purpose unlike a casual connection, the network and its members may expect support from Nation-State entities such as governmental agencies, which remain the major actors in terms of capacity of resources mobilisation for R&D actions.

For both the home and the host countries, the diaspora option is a mutually beneficial co-operation strategy. On the one hand, the home country of the expatriates gains through the additional capacity that these may bring. On the other hand, the host country does not loose anything since the S&E working within its borders stay where they are. Moreover, their links with their country of origin may open opportunities for their country of residence. Scientific co-operation takes, indeed, advantage of the existing structure of the network which provides stability, recognition and access to remote actors. It thus gives a higher security for the investments of any kind that this country would be willing to make than a punctual, isolated, co-operation project. This may be seen in various projects and programmes such as, for instance, between French and Colombian universities or the U.S. N.S.F. with China and India.

The advantages that the diaspora option holds for co-operation have been perceived by international organizations such as UNESCO, the UNDP and, more recently, the World Bank. Their increasing awareness of and support for such a strategy is very constructive. In contributing to its development, they would definitely help it to keep its promises.

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Acronyms and Abbreviations

ALAS	Latin American Association of Scientists
ANA	Association of Nigerians Abroad
ASTA	Arab Scientists and Technologists Abroad
ATPAC	Association of Thai Professionals in America and Canada
ATPER	Association of Thai Professionals in Europe
ATPIJ	Association of Thai Professionals in Japan
BGN	Brain Gain Network
CESASC	Chinese American Engineers and Scientists Association of Southern California
CHISA	Chinese Scholars Abroad
EU	European Union
FORS	Forum for Science and Reform
IRSA	Irish Research Scientists' Association
JANET	Japanese Associate Network
MARS	Moroccan Association of Researchers and Scholars
MNCs	Multinational Corporations
NICs	New Industrialised Countries
NSF	National Science Foundation
R&D:	Research and Development
RBD	Reverse Brain Drain
S&E:	Scientists and Engineers
S&T:	Science and Technology
SANSA	South African Network of Skills Abroad
SIPA	Silicon Valley Indian Professionals Association
SCBA	Society of Chinese Bioscientists in America
TOKTEN	Transfer of Knowledge Through Expatriate Nationals
U.S.A.	United States of America

Country	*Name of Network*	*Type of Network*
Arab Countries	The Network of Arab Scientists and Technologists Abroad (ASTA)	Intell/Scien Diaspora Network
Argentina	Programa para la Vinculacion con Cientificos y Tecnicos Argentinos en el Exterior (Program for the Linkage of Argentine Scientists and Technologists Abroad) (PROCITEXT)	Developing Intell/Scien Diaspora Network
Assam	Transfer of Knowledge and Technology to Assam	TOKTEN Programme
China	Chinese Scholars Abroad (CHISA) Society of Chinese Bioscientists in America Chinese American Engineers and Scientists Association of Southern California (CESASC)	Student/Scholarly Network Local Association of Expatriates Local Association of Expatriates
Colombia	The Colombian Network of Researchers and Engineers Abroad (Red Caldas)	Intell/Scien Diaspora Network
El Salvador	Conectandonos al Futuro de El Salvador (Connecting to El Salvodor's Future)	Developing Intell/Scien Diaspora Network
France	Frognet	Student/Scholarly Network
India	Silicon Valley Indian Professionals Association (SIPA) Worldwide Indian Network The International Association of Scientists and Engineers and Technologists of Bharatiya Origin Interface for Non Resident Indian Scientists and Technologists Programme (INRIST)	Local Association of Expatriates Intell/Scien Diaspora Network Developing Intell/Scien Diaspora Network Developing Intell/Scien Diaspora Networks
Iran	The Iranian Scholars Scientific Information Network	Intell/Scien Diaspora Network
Ireland	The Irish Research Scientists' Association(IRSA)	Intell/Scien Diaspora Network
Japan	Japanese Associate Network (JANET)	Student/Scholarly Network
Kenya	Association of Kenyans Abroad (AKA)	Developing Intell/Scien Diaspora Network
Korea	Korean Scientists Engineers Association of Sacramento Valley The Global Korean Network	Local Association of Expatriates Intell/Scien Diaspora Network
Latin America	Association I.attino-americaine de Scientifiques (Latin American Association of Scientists) (ALAS)	Intell/Scien Diaspora Network
Lebanon	TOKTEN for Lebanon	TOKTEN Programme
Morocco	Moroccan Association of Researchers and Scholars Abroad (MARS)	Student/Scholarly Network
Nigeria	Association of Nigerians Abroad (A.N.A)	Intell/Scien Diaspora Network
Norway	Association of Norwegian Students	Student/Scholarly Network
Pakistan	Return of Qualified Expatriate Nationals to Pakistan	TOKTEN Programme
Palestine	Programme of Assistance to the Palestine People	TOKTEN Programme
Peru	Red Cientifica Peruana (Peruvian Scientific Network)	Developing Intell/Scien Diaspora Network
Philippines	Brain Gain Network (BGN)	Intell/Scien Diaspora Network
Poland	The Polish Scientists Abroad	Intell/Scien Diaspora Network
Romania	The Forum for Science and Reform (FORS)	Developing Intell/Scien Diaspora Network
South Africa	The South African Network of Skills Abroad (SANSA)	Intell/Scien Diaspora Network
Thailand	The Reverse Brain Drain Project(RBD) Association of Thai Professionals in America and Canada (ATPAC) The Association of Thai Professionals in Europe (ATPER) The Association of Thai Professionals in Japan (ATPIJ)	Developing Intell/Scien. Diaspora Network Intell/Scien Diaspora Network Intell/Scien Diaspora Network Intell/Scien Diaspora Network
Tunisia	The Tunisian Scientific Consortium (TSC)	Intell/Scien Diaspora Network
Uruguay	Red Academica Uruguaya (Uruguayan Academic Network)	Developing Intell/Scien Diaspora Network
Venezuela	In Contact with Venezuela El Programa Talento Venezolano en el Extrior (Program of Venezuelan Talents Abroad) (TALVEN)	Developing Intell/Scien Diaspora Networks

* We are aware of the existence of an Ethiopian network, a Croatian network and a Hungarian network. However the information on them is very limited, thus they were not included in the above list.