

Turning brain drain into brain networking

Ioan M Ciomasu

This article argues that, given the difficulties of reversing brain drain and of creating brain circulation, small developing countries should instead put efforts into brain networking, which is the systematic development of an ICT-based form of links between scientific diasporas and resident scientists. The study suggests that brain networking is the most realistic institutional platform for tackling developing countries' problems related to the loss of talent. Reviewing the strengths and weaknesses of existing diaspora initiatives in different countries, and based on an original survey of 133 Romanian scientific diaspora members, this article identifies a series of policy preferences and implications.

SCIENTIFIC TALENT IS ESSENTIAL for countries' development, because modern growth is about innovation. Loss of human capital in the form of emigration of highly skilled individuals is generally described by the concept of brain drain (e.g. Adams, 2003). Individuals regarded as highly skilled are those who have graduated from higher education to at least bachelor level or equivalent. In general, the direction of the brain drain is from less- to more-developed countries. The process that is symmetrically opposed to brain drain is known as brain gain, that is, accumulation of human capital in a country via immigration of highly skilled individuals from a less-developed country (Mahroum, 2005).

Brain drain can be a serious problem, because it is a loss of the essential human capital necessary for development. Indeed, brain drain can trigger a vicious cycle of general underdevelopment (Ranis *et al.*, 2000): the loss of the highly skilled worsens the situation in the country, which in turn reinforces the reasons for the highly skilled to leave. By contrast, brain gain improves the situation in a country, which in turn reinforces the reasons for the highly skilled to immigrate. Typically, there is a combination of pull factors (attraction by some foreign countries) and push factors (discontent with the context in home

country). Talent migration grows from a basic prisoners' dilemma: the individual strategy for success is not the best collective strategy for success (Ellerman, 2006). People of talent and drive, who represent limited and critical human capital in every country, are more likely to leave one country for another where the chances of self-betterment and success are clearly higher. Their exit reduces the pressure for general improvement in the country they have left.

Past discussions on potential solutions to brain drain developed around the Johnson–Patinkin debate, to which both a liberal, 'internationalist' model and a 'nationalist' model of migration can bring valid although opposite arguments (Young, 1962; Johnson, 1968; Patinkin, 1968). What remains is that restriction-based policies are not applicable — when applied, they have failed (Ellerman, 2006). On the contrary, solutions must begin with the recognition of the benefits of international migration for talented individuals and for the environment with which they interact.

Regarding the incentives, three basic long-term trends have been identified to reinforce current talent migration (Kwok and Hayne, 1982; Kapur and McHale, 2005; *The Economist*, 2006a), and must be addressed by countries undergoing talent loss:

1. Innovation-based companies in the developed world often face talent shortages. This makes rich countries ease inflows of highly skilled immigrants.
2. National budget and taxation rationale makes rich countries need highly productive foreigners to

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boost public budgets. This is why they often develop explicit institutional mechanisms to attract and integrate highly skilled immigrants into national science policy (e.g. Scholten, 2009; Skeldon, 2009).

3. Employers in rich countries usually understand better the true productivity of the highly skilled; therefore they tend to provide better chances for merit-based success.

In addition, and most importantly for our study, science is becoming more internationalized than ever.

How big is the problem with brain drain?

Numbers on the mobility of the highly skilled are scarce. Currently, most countries of emigration do not collect data on their migrants, not even on the highly skilled. The data they have is usually vague and unreliable, but it is known that skilled migration is increasing. Brain drain is negatively related to country size, with small countries having higher migration rates, especially the developing ones (Docquier and Schiff, 2009). Having 22 million inhabitants, and being (by 2008, according to the World Bank) 39th in the world in gross national product (c. US\$200 bn) but 49th in its estimated average *per capita* GDP at purchasing power parity (c. US\$14,000 and increasing at a pace above 5% per year), Romania is a typical case for both Central and Eastern Europe and for the developing world. The average income of the personnel in research is about one third above the national average, that is about US\$19,000.

According to the last report by the National Institute of Statistics (INS) (2008), Romania's expenditure on R&D in 2008 amounted to about US\$1 billion (2,981 m. lei), which represented 0.59% of GDP (stable from 2007), of which 70% was public expenditure. At the end of 2008, 43,502 employees of all education levels were involved in R&D (46% women), with the largest shares being represented by technological and engineering sciences (47%) and mathematics and natural sciences (16%). The number of PhD scientists employed was 14,851 (43% women).

Regarding the rates of migration, earlier studies on countries with above 20 million inhabitants estimated that the share of skilled emigration from total migration can range from between 0.6% in Brazil to 15% in Uganda (Carrington and Detragiache, 1998). More recent estimates give shares even higher than 50% (Docquier and Marfouk, 2004). For Romania, estimates of highly skilled emigrants in 2000 are roughly 200,000 (ranking 27th in the world) and an emigration rate of 10–15%, which is characteristic for Central and Eastern Europe (Vizi, 1993; Docquier and Marfouk, 2004), and about average within the world ranking. This results in roughly 20–30,000 migrants for any given year. It is not known how many of them work as scientists.

Are there any potential ways out?

For policy-makers, the question is: Are there any possible solutions to the problem represented by brain drain in countries where this happens? Potential solutions will necessarily be related to the present world context. First of all, mobility of individuals across the world must be seen as a fact, and part of any policy. Most countries, especially the developed-hence-highly-attractive ones, host communities of foreign-born individuals. And most countries, especially the developing ones, have a number of its individuals living abroad, either temporarily or for an indefinite period of time. All these individuals represent the country's diaspora. Sometimes, members of a country's diaspora associate themselves in cultural or professional organisations, usually functioning as networks which include individuals and local organisations that spread through entire countries, continents or even the entire world (e.g. Meyer, 2001). Diaspora networks can have various degrees of diversity, connectivity and density of agenda. This article focuses on a professional Romanian diaspora — scientists — and tries to identify the main lines of its involvement in the development of science in Romania in present international and national contexts. Because of the recently increased Romanian brain

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drain, the dimensions of the Romanian scientific diaspora have been increasing.

During the last few decades, humanity has been evolving as a knowledge society. In addition, we now live in a networking age. Therefore, international tacit knowledge transactions (Williams, 2007), and diaspora networks can provide means to escape the old stay-or-go dilemma at the origin of brain drain, as suggested by recent initiatives and dynamics (e.g. Meyer, 2001; Kuznetsov, 2006, Ciomasu, 2006, Cai, 2009). However, the same international experiences have shown that the brain drain is more complex a problem than is usually thought of. Thus, any *a priori* assumption that brain drain will ultimately trigger development in every single country is risky (Ellerman, 2006). In addition, brain drain is a somewhat misleading concept, notably when it is narrowly used to suggest an exclusively unilateral movement of talent. In reality, brain drain can also be a first step of a country's dynamic towards accelerating development of human resources. Thus, a reverse flux of talent can actually accelerate the technological catch-up of developing countries in comparison with the situation existing before any important brain drain (e.g. Dinar *et al.*, 2008; Paglayan and Lafuente, 2009). But before having a reverse brain drain, there must be a brain drain in the first place. Further, since a brain drain is a self-enforcing dynamic, reversing it requires a very large amount of effort and resources and an exceptional convergence of favourable factors of both policy and national and international context.

The wider dynamics of brain drain followed by reverse brain drain (or generally the world-scale mobility of the highly skilled) is known as brain circulation. This concept corresponds to a dynamic in which talented/highly skilled individuals first pursue study and personal betterment abroad and then return to seize good opportunities in the home country (Johnson and Regets, 1998). Yet, this still refers to the physical mobility of individuals, and does not take into account the possibility of intellectual capital

exerting influence through contemporary means of communication.

Romanian governmental efforts to relate to the Romanian scientific diaspora are new and, for the time being, not systematic. While some funding mechanisms have been established to attract the scientific diaspora, as inspired by similar mechanisms in the European Union (Box 1), their efficiency remains to be proven. Occasionally, some conferences and workshops have taken place. But there is no national strategy towards scientist expatriates. Recent signals indicate that some Romanian universities reflect upon the issue and may take a lead, thanks to university autonomy. However, ministerial support remains necessary.

Current knowledge about Romanian scientist expatriates is insufficient to allow efficient policies towards involving the scientific diaspora in Romanian science and technological developments. And, despite recent socio-economic improvements, a wide return of scientist expatriates — brain circulation — appears to be very unlikely. Recently, an alternative mechanism has been proposed (Ciomasu, 2006): brain networking, a form of mainly internet-based professional collaboration between scientist expatriates and their peers in Romania.

The goal of this study is precisely to identify which of the two approaches is favoured by the members of the scientific diaspora, and under what financial and administrative and cultural provisions. The hope is that the results of this study will enable further steps in developing informed policies and strategies, and discover whether brain circulation and brain networking should be viewed as necessarily exclusive rather complementary.

Method

From the publicly available internet database of the main non-governmental association of the scientists working in Romania and abroad (*Ad Astra*,

Box 1. Recent governmental measures for supporting the return of scientific diaspora

1. National measures to offer competitive ('western') salaries; frozen during the 2009 crisis
 - 1.1 Complex projects for re-integration of diaspora scientists (evaluation by foreign experts; 36-month projects, up to 7 million lei (c. US\$2 m.) — <http://www.cncsis.ro/PN2_res_umana_rc.php>. The website does not seem to be very efficiently organized. Eligible conditions are: minimum 5 years of research abroad after PhD; minimum Hirsch index of 3; acceptance of a Romanian research institution to host him/her as a Professor of Principal Researcher 1st degree. Income from the contract for the project director (i.e. returning scientists) up to 10,150 lei (c. US\$3,500) net per month.
 - 1.2 Research projects for stimulating the return of researchers — <http://www.cncsis.ro/PN2_res_umana_rp.php>. At the last website access, under the bold title 'to encourage scientists to return ...' it is mentioned simply that 'due to budgetary constraints, no further applications are being accepted'. No further indication on when applications are expected to be accepted again. This is unfortunately not something that will encourage the return of scientists to Romania. On the contrary, it unveils institutional weaknesses that expose public policies to context uncertainties. Return of expatriate scientists does appear to be a priority.
2. European Union's alternative version of the national re-integration grants can be awarded under the 7th Framework Programme:
 - 2.1 European Research Council — ideas, starting independent researcher grants, <http://cordis.europa.eu/fp7/dc/index.cfm?fuseaction=UserSite.FP7CallsPage>
 - 2.2 People, Marie Curie re-integration grants, with two options: international re-integration grants and European re-integration grants, <http://cordis.europa.eu/fp7/dc/index.cfm?fuseaction=UserSite.PeopleDetailsCallPage&call_id=250>.

<www.ad-astra.ro>), I have selected all individuals working abroad and having a record of internationally relevant achievements, as by 14 July 2008. Typically qualifying people had at least one recorded research article in peer-reviewed journals with impact factor listed by Thomson Scientific. Regarding the expatriate scientists' coverage of the study, two notes deserve to be made. First, while it is not possible to have accurate numbers on the size of the Romanian scientists abroad, the numbers should be (according to the website) in the range of tens of thousands, PhD students included. Specifically I have used the 'Who is who' section of the *Ad Astra* website, where scientists made a free choice to register themselves — their profile, affiliations, interests and achievements (personal webpages). Second, the employers of the selected/responding individuals at the time of the survey were usually the world's best universities (according to the Top 500 Shanghai, starting with the very top position in this ranking).

The date used here data is the best available at present under the above-mentioned criteria. This association is very active and the most visible among the global community of Romanian scientists; it is a regular dialogue partner with Romanian authorities in science. It also published the only ranking of

Romanian universities based on their research efficiency (now available for 2005, 2006, 2007), using methodology akin to that used by the authors of the Shanghai world university ranking.

In order to scan opinions and preferences at a given point in time, each of the 230 persons on the resultant list has been solicited by email to respond to a 10-question questionnaire (Table 1, Box 1). The responses received during the following three weeks (flash survey: 16 June to 6 July 2008) have been used to draw a synoptic map of preferences and provisions. The potential respondents have also been encouraged to provide free comments and to circulate the questionnaire among their expatriate scientist peers.

The priority of the questionnaire was to discern preferences between brain circulation and brain networking policy options. The main risk of the survey was that the questionnaire would be perceived as excessively intrusive (too many details demanded), too long or too complicated. This was a real concern since:

1. Only 230 potential respondents could possibly be selected from the mentioned database under the earlier-mentioned exigency of scientific performance; and

Table 1. Interview questionnaire

1A. Professional information

| | |
|--|--|
| Name (optional) | |
| Present professional affiliation (optional) (short name of the institution) | |
| Age | |
| Total number of years abroad (professional activity) | |
| Present position | |
| General field of activity | |
| Number of years after PhD (first PhD, if finished) | |

1B. Questions

| No. | Question | Yes | No | Undecided |
|-----|--|-----|----|-----------|
| 1. | Are you interested in collaborating with research teams working in Romania? | | | |
| 2. | Do you already have individual collaborations? | | | |
| 3. | Do you already have institutional collaborations? | | | |
| 4. | Would you like to return to Romania (e.g. using the recently launched ministerial program – 'western' salaries)? < http://www.ad-astra.ro/posts/view_post.php?post_id=818&lang=en > | | | |
| 5. | Do you prefer collaboration from abroad (brain networking)? | | | |
| 6. | How many hours per week can you use for brain networking? | | | |
| 7. | Do you prefer involvement only in research itself? | | | |
| 8. | Would you get involved in the reforming/development exercise of a Romanian institution (team of consultants)? | | | |
| 9. | Should the per-hour payment for brain networking be similar to that at your current host institution? ... | | | |
| 10. | ... Or could it vary? | | | |

Note: You may put an X in the appropriate box

- The response rate in such social surveys is usually below 50%.

In addition, it was anticipated that the answers would be biased towards those who want to get involved. The hope was to minimize this bias by doing everything not to discourage skeptic respondents from returning the questionnaire.

This being said, the final questionnaire used appeared to be the best compromise between detail and potential rate of response. When the responses were solicited by email, it was explicitly specified that the questionnaire asked only 10 questions and it took only three minutes to fill in. In their reply emails, many respondents appreciated this format, which suggested that this was indeed a good compromise. This was also confirmed by the response rate which actually neared 60%.

The set of questions accounted for the basic aspects associated with the main priority of the questionnaire:

- The existence or not of a real professional interest from the Romanian diaspora in the home country;
- The degree of actual involvement (collaborations) possible;
- Likely preference of either returning in Romania or brain networking;
- Financial aspects related to implementing brain networking;
- Administrative issues raised by institutional application of a system of brain networking.

Nine questions had three possible answers: 'Yes', 'No' and 'Undecided' (Figure 1), and one question was open (spontaneous answer).

'Involvement' is here understood as the will of principle of a member of the scientific diaspora to collaborate with teams in Romania, purely scientifically or institutionally or both. Obviously, a

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complete strategy needs an entire array of further details, but the decision was to obtain those without over-sizing the basic questionnaire. Thus, the synoptic map of preferences from the questionnaire has been used, together with the free comments provided by respondents and, with insights from the literature, to design a basic schematic of a potential strategy — a logically constructed set of recommendations — for actual involvement of the Romanian scientific diaspora in the scientific research activity of their country of origin.

Results and discussions

The synoptic map of preferences among members of the scientific diaspora

In the allowed time span, 133 responses were received (i.e. a 58% rate of response). Respondents had ages between 25 and 58 (36 on average); 2 to 36 years abroad (average 9); and 80% of them already had post-doctoral activity of up to 33 years (5 years on average). The map of the respondents' preferences (Figure 1) shows that the proportion of respondents involved in Romanian research was very high: 95%. This percentage is not surprising, since

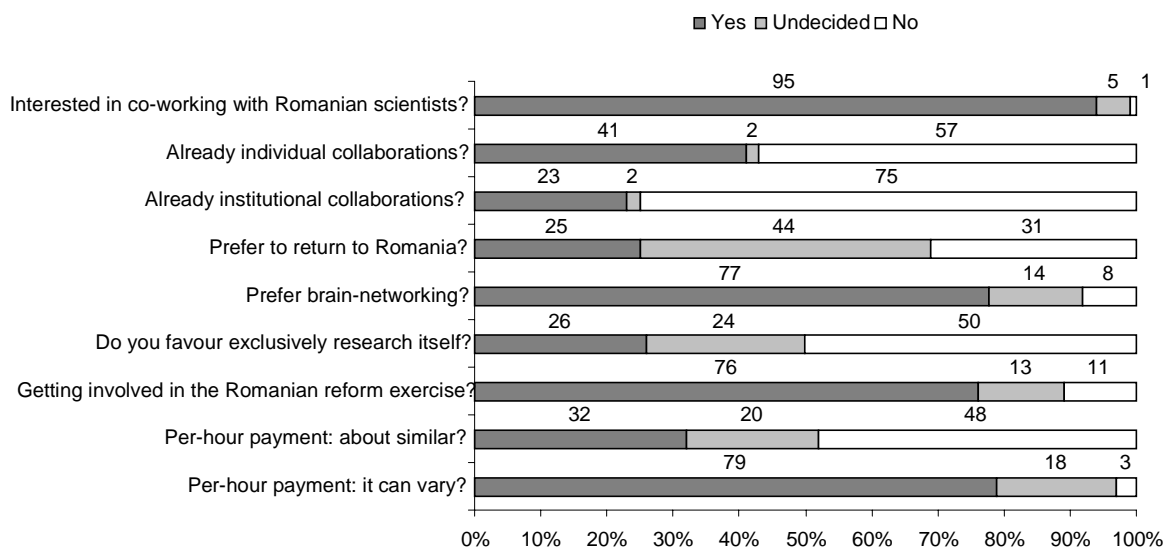


Figure 1. Relative importance (%) of the positive, undecided and negative answers provided by 133 respondents from the scientific Romanian diaspora, when confronted with each of the 10 questions

those who would answer ‘No’ had, by definition, little incentive to return the questionnaire in the first place. But the percentage is important as a reference for the interpretation of the subsequent answers.

Further, only about 2/5 of the respondents appeared to be involved in personal collaborations in Romania, and 1/5 in institutional collaborations. This indicates:

1. A large but unused involvement potential, but also
2. A large institutional deficit that needs to be addressed.

Regarding the preferred method of involvement, only 1/5 of the respondents would return to Romania, while more than 3/4 would engage in brain networking. The number of hours that the respondents estimated that they can spend per week for brain networking ranged from 1 to 10 hours, and averaged 4.4. This might not seem much, but the real value of this time is given by their very high qualifications and the importance of this work in capacity-building in the home country.

There is no clear correlation between the number of hours and the respondent’s age (Figure 2), number of years abroad (Figure 3) or years after PhD (Figure 4). This points to a great diversity of individual situations, which internet-based involvement can accommodate. It appears however, that responses crowd towards a lesser number of years and fewer hours spent.

Very interesting is the large proportion (about half) of those undecided whether or not to return to Romania. This means that a great number of the members of the scientific diaspora might like to return to Romania, but current factors prevent them deciding to do so.

The numbers in this study suggest that brain networking is preferred over brain circulation and, thus, that it must be seen as the most realistic — indeed pivotal — mechanism for human resource development in Romanian research institutions.

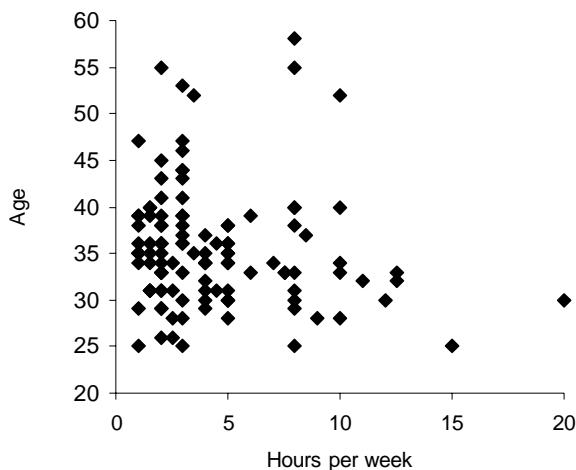


Figure 2. Number of hours per week in relation to age

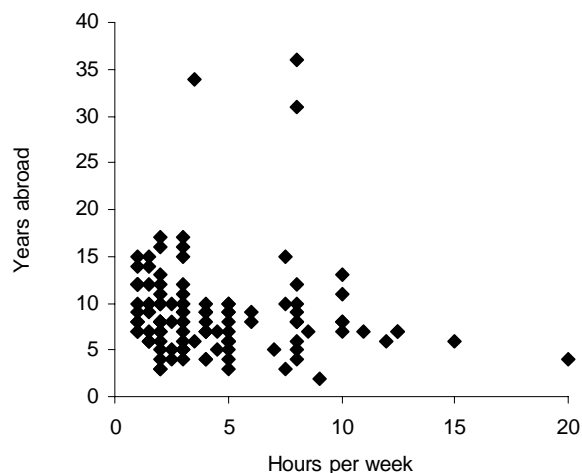


Figure 3. Number of hours per week in relation to number of years abroad

Current understanding of talent migration is that, in order to be successful, a diaspora integration program must give its subjects instruments to contribute themselves to cancelling their reason for exit (Ellerman, 2006). One way to do this is brain networking because:

1. It is a mechanism that is well received by diaspora; and
2. It provides a platform for building reciprocal trust and working experience with Romanian research groups where they might potentially return.

Thus brain networking can later facilitate the decision (among the undecided ones) to return home. This idea is supported by the answers to the next questions: a majority of the respondents are also interested in getting involved in scientific institutional reform and development. In order to grasp the true importance of these answers, one must understand the long-term-advantage of such a dynamic. Thus,

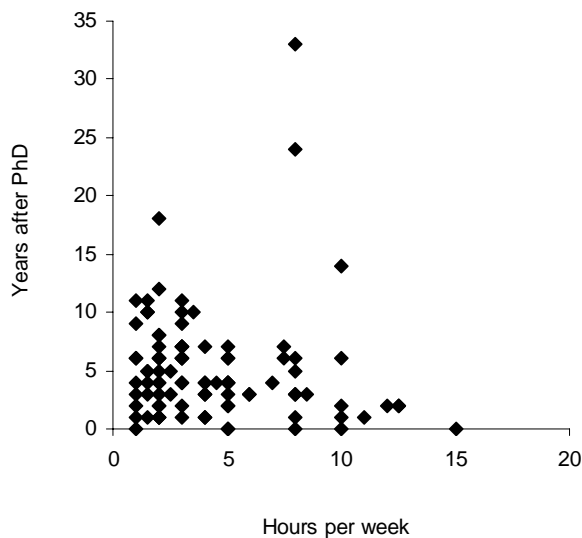


Figure 4. Number of hours per week in relation to number of years after PhD

readier involvement of diaspora via brain networking may accelerate the context evolution that many are waiting to see for an eventual return home, even those who responded 'No' at the time of the survey.

In the global competition for economic development, countries must play on their best assets, with scientific talent being one of them. If a country can find solutions to integrating among its assets the human capital represented by diaspora, then the original brain drain will have been turned into human capital development — hence a competitive advantage on the world stage. In fact, this should be regarded as a necessity in a highly globalized world, with powerful countries already able to concentrate most of the world scientific talent. One way to achieve this is to play on a 'snow-ball' dynamic of internationally educated talent with several poles of attraction (e.g. the best universities of the country), capable of attaining the innovation front waters (Fujita and Thisse, 2003; Dinar *et al*, 2008). In such a dynamic, initial success of return of few would be an incentive for others to return, which would improve conditions and further stimulate distance collaboration (or even return) of expatriate scientists. This way, by triggering a positive feed-back of return, indeed a dynamic symmetrically opposed to the brain-drain mechanism, brain drain may cease to be a 'curse' and start to be a 'blessing'.

Therefore the question is what to do to attract an initial critical mass at a research institution. The answers to questions 9 and 10 in Table 1 may give the first hint of the necessary main conditions: the salary is actually not the main driver, at least in a country such as Romania where salaries are currently average by world standards and fast increasing. Indeed, the respondents would prefer, on the part of the potential Romanian employer, about similar levels of payment with their current ones in the richer countries, but most of them would accept some variations. Instead, work conditions and carrier perspectives are essential. This may also explain the fact that most of the respondents are willing to get involved in the reform exercise: to improve the context of research up to international standards of performance. This was further confirmed by a great number of additional suggestions and recommendations received.

*Outlines for a strategy to involve the
Romanian diaspora with science development
in its country of origin*

There exists a process of convergence of both human development and innovation performance indices in Europe (e.g. Schibany and Streicher, 2008), but the explanations for it are not clear because of the intricacies of the process, the complexity of the socio-economic transition in Central Europe, and the limitations of the innovation evaluation tools (e.g. Tura *et al*, 2008; De Miranda *et al*, 2009). In fact, the apparent convergence may reflect more the

increased economic exchanges between Western Europe and Central Europe, and only to a lesser extent the achievement of a sustained growth in research capacity (as actually indicated by the strong brain drain still taking place). This convergence should not be taken as a reason for postponing strategies of benefiting from the Romanian scientific diaspora towards the development of human capital and scientific research in Romania.

First of all, achieving long-term commitment is a prerequisite for success in science and general business (Devane, 2006), and there is no reason to expect something different for the involvement of the scientific diaspora in the Romanian research. The map of preferences in Figure 1 suggests that it will be easier to obtain long-term commitment of expatriates to distance collaboration (brain networking) than to return (brain circulation). However, a policy towards scientific diaspora must address each of these paths, even if the two may interact with each other.

In addition, in order to better understand the long-term potential of any type of involvement of the Romanian scientific diaspora, experiences of other nations' diasporas must be observed prior to establishing a Romanian policy and strategy. For example, a series of lessons from case studies of national diasporas (notably from China, India, Columbia, Mexico, Scotland), has been summarized (Kuznetsov, 2006; Ciomasu, 2007) in three main features that are fundamental to the success of diaspora networks' involvement in the development of their native countries:

1. Diaspora networks link people possessing the very attributes of development: talent and strong intrinsic motivation;
2. Members of diaspora networks play both direct roles (concrete projects) and indirect ones ('bridges, antennae and springboards' for generating development projects in their native countries); and
3. They move readily from discussions to actions.

For the purpose of this article, the insights offered by our survey are being confronted with certain international diaspora experiences and gathered in a schematic of recommendations that can be used as the core of a strategy for involving scientific diaspora in Romania (Figure 5). These recommendations are discussed in the following paragraphs.

Feed-back from respondents suggests that the initiative for both attracting diaspora and for benefiting from its involvement must pertain in priority to universities, not to ministries of education and research. This is consistent with current knowledge on the matter. International experience warns that distrust in national institutions in the home country can be a serious brake on diaspora involvement. In particular, much energy and emotional capital have been wasted on policy dead-ends, for example, as cited

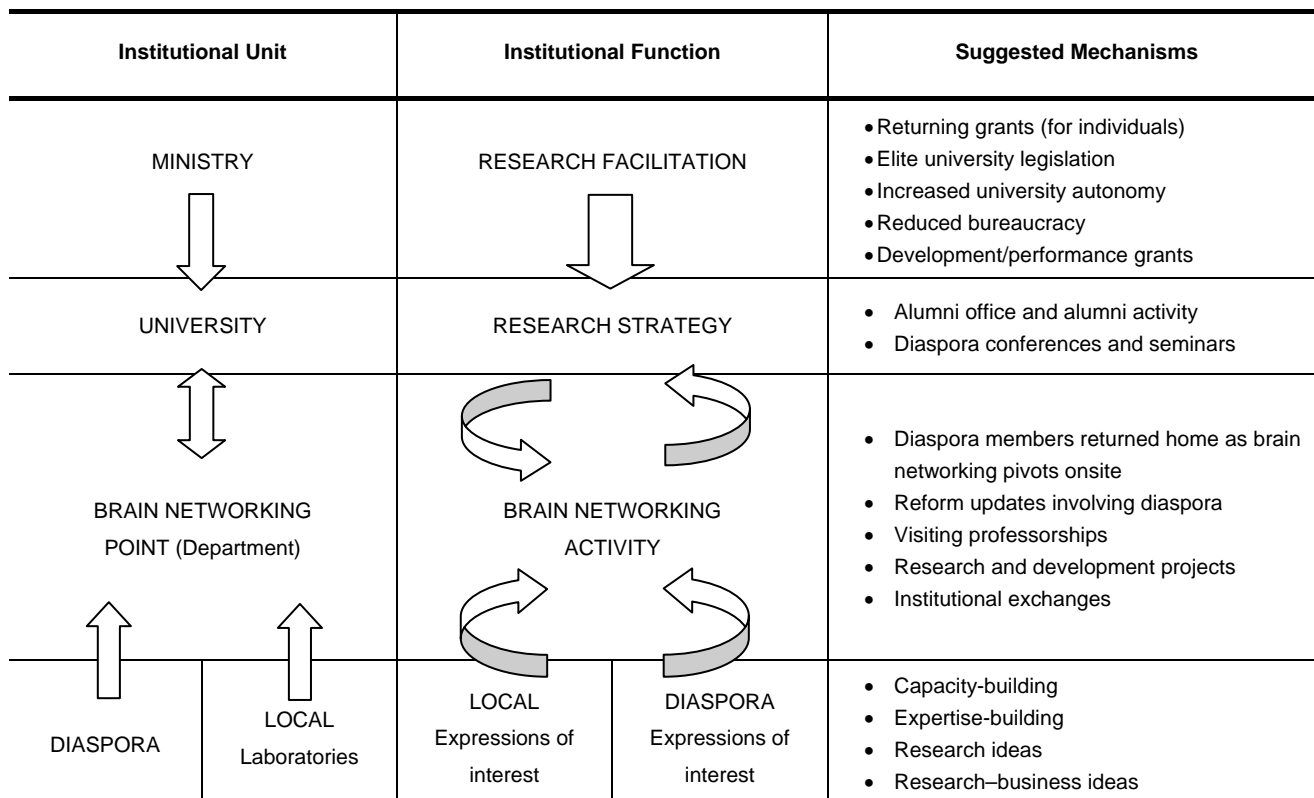


Figure 5. Implementation scheme for brain-networking in Romania

for the South African diaspora experience (Marks, 2006). Such situations are veritable traps, but both diaspora feed-back and international experience show that they can in principle be avoided, for example through the administrative flexibility allowed by higher university autonomy (e.g. Himanen *et al*, 2009). Thus, initiatives and strategies for brain networking should belong to individual universities, that is, explicitly part of their own development strategies.

Also, given their different roles in the science and education system, the ministerial authorities could more easily have a stronger (but not exclusive) role in attracting diaspora members towards Romania, while universities and research institutes would play a heavier role at the level of concrete benefiting from diaspora collaboration in research. Ministerial (but also local) authorities could help with penetration of scientific research in the real economy, by providing support in university–business interactions. Therefore, appropriate ministerial help for brain networking should be in tailoring support actions in the spirit of the university autonomy.

The ministry can also reward and support local excellence in science by designing a system of supplementary support for elite universities, a status which a university can gain by fulfilling certain performance criteria (e.g. Schiermeier, 2007). The need for establishing elite universities which can participate at world level is also confirmed by the exceptionally high mobility of elite scientists. For example, half of the world's most cited physicists work outside their country of birth — they tend to migrate to work places with very large R&D

spending. Even though there is no clear evidence that this move increases their scientific productivity (Hunter *et al*, 2009), their presence is valuable in that it stimulates scientific research and the development of the right environment, exigencies and references for high-quality science. Thus the aim of elite universities in Romania will be not only to halt elite brain drain, but also simply to have the country clearly anchored in the world science front waters and elites.

A particular type of risk that needs to be anticipated in a strategy for benefiting from the Romanian diaspora involvement pertains to the type of organisation of the diaspora network itself. For example, the internet-based network of nodes of Columbian diaspora members, the *Caldas* initiative, started quite promisingly (Chaparro *et al*, 2006), but it decided to restrict its focus to university-based collaborative projects (ignoring other industrial and social implications). This proved to be a bad decision, since it led the network to lose relevance and momentum, and funds dried up. Also, an essential weakness of their system was its centralized radial organisation. Thus, when the central node failed to work properly (leadership slowed down), other nodes collapsed.

The main lesson from this example is that the success of a policy for involving scientific diaspora must take into account the context issues that go beyond the narrow science or academic policies, such as national priorities and socio-economic development strategies, and institutional experimentation, development and consolidation. Governments appear already to take this reality into account, for

example, with the case of New Zealand's strategy to mobilise expatriate experts via a diaspora strategy incorporating knowledge, economics and leadership (Larner, 2007).

Further, a strategy must take into account the interests of both Romanian scientists in Romania and the individual interests of the members of the diaspora involved. This is true for both:

1. The process of attracting diaspora support; and
2. For maximizing its efficiency and durability.

As international experience proves — for example, the 'Globalscot' initiative of Scottish researchers (MacRae and Wight, 2006) — it is essential that the collaboration between the members of diaspora and local scientists is carried out to reciprocal benefit. Thus, in order to get members of the diaspora involved, they need to know clearly that there will be co-working. Among our respondents, to the question on whether they have personal/institutional collaborations with Romania, some responded 'I don't know': it seems that they were collaborating, but the collaborator in Romania really had questionable input into this relationship. This failure seems to be due to a lack of experience of a considerable number of the Romanian potential collaborators, which points to a need for coaching and leadership.

This example of failure is valuable for a future policy because it indicates one way in which a scientific diaspora can help developing research capacity in Romania. For example, diaspora members may associate with those local scientists who are experienced with western top research practices, and together provide the right references, collegial coaching and mentorship to those who may need it. Help from a diaspora is particularly important since, as in most countries, local mentors capable of institutionalizing scientific, technological and educational excellence tend to be rather scarce (e.g. Göktepe-Hulten, 2008), and so they often find themselves overwhelmed by daily tasks and responsibilities. Eventually, in the absence of some help from abroad, those local scientists or research teams which are excellent according to world criteria, instead of managing to change their environment in the right direction, end up exhausted in the interaction with an unsupporting environment. In the absence of help from a diaspora, a vicious circle is perpetuated, where local valuable talent is wasted and the deception of talented scientists will make them become part of the problem themselves. Actually, this is where the importance of the returning diaspora members (brain circulation) is probably most relevant. The results in this study show that an important number of members of its scientific diaspora are willing to return to Romania. By doing so, they will be closing a cycle of study and personal betterment abroad and returning to seize good opportunities at home — brain circulation (Johnson and Regets, 1998).

Regarding the incentives to return, it is important to take into account that returning scientists are likely to have developed their own professional networks before returning to the home country, networks made up by both co-nationals in the diaspora and other professionals in the host countries. Often, this reality may compensate for certain (not too many) shortcomings in the home country where they return. This allows for mechanisms that enable scientists who return to a less favourable environment to keep in touch with most recent developments in their field and to continue conducting good-quality research (e.g. Ackers, 2005; Melin, 2004). The most effective way for a university (and a country) to profit from these networks, and integrate local science and scientists in them, is to guarantee that the returning scientists have conditions to build up research teams, and so:

1. They are capable of performing the high-quality research that enables them to remain valuable members of such networks; and
2. They can develop the activities that may be required to nurture and reinforce their international links (e.g. attending international events, getting involved in international projects).

The best-known and highly telling example of international experiences of this type is the special technology parks in China. Such activities should be supported and encouraged, since they are the seedbed for the development of both local nuclei of world-class research and, simultaneously, effective 'networking hubs'.

In brief, the results of our survey signify that a Romanian university that wants to develop its capacity and value must manage to involve returning expatriate scientists in leading brain networking units (hubs) aiming at involving both diaspora and the individual international networks of each Romanian scientist who lives abroad and is ready to engage in distance collaborations from there. Setting up special units is probably the best approach because such hubs provide a set of essential advantages:

- They ensure easily identifiable references for local scientists;
- They provide a focus for communication and co-working between diaspora and local researchers, at least in the initial stages; and
- They represent a way of concentrating expertise to efficient training of local researchers in concrete co-working at international standards.

Some general policy considerations

A more general set of observations is appropriate at this stage of our discussion. First, the brain networking system must be designed with clarity, with unambiguous demands and benefits for all sides. Universities should try to involve the diaspora in

The brain networking system must be designed with clarity, with unambiguous demands and benefits for all sides. Universities should try to involve the diaspora in their institutional reform and development

their institutional reform and development; the numbers in this study suggest that 3/4 of diaspora members will welcome a proposal in this direction.

Involvement with brain networking should not be seen as some sort of exclusive approach to expatriates who remain in the host country. Other forms of involvement should be envisaged, such as participation in events in the country of origin (e.g. conferences, training, short specialised courses, juries) or local support at their current location (e.g. supervising PhD students or hosting of scientists from the home country during temporary stays).

Obviously, other existing systems of academic networking can and should be used during the process of developing brain networking. For example, the alumni network approach is an elegant way, capable of supporting and helping strengthen a brain networking platform, by recalling cultural kinship of expatriate scientists with their universities in their country of origin. Usually, universities are very skilled at creating alumni organizations, both for funding projects and participation in vision-building (Kuznetsov, 2006). Moreover, the existence of various types of knowledge networks between universities and society at large enhance societal trust in higher education institutions (Thune, 2007; Heitor, 2008; Göransson *et al*, 2009).

Further, cultural affinity is important for the initial engagement with diaspora members, but past experiences in the wider world has shown that typical material and institutional involvement must come into the process. For example, they must be paid for the allotted work hours (*The Economist*, 2006b) and they need be given a respectable academic status at the Romanian host university, commensurate with their experience and position at their main institution abroad. Good options are visiting professor, and similar arrangements. It is not unusual in the world for one scientist to be professor at two universities simultaneously, often in different countries or even on different continents.

Brain networking should be done on both an individual and an institutional basis, depending on each particular context. Some firms may even forbid their employees earning money with another institution, in which case only institutional approaches are possible. Diaspora networks are easily established by

individuals. But there is a dilemma for policy-makers: in order to sustain diaspora networks' involvement, one needs strong institutions at home. One pragmatic solution is to use individual champions to create institutions capable of sustaining diaspora networks, such as hubs (Kuznetsov, 2006).

Finally, it is important to have in mind that a diaspora is a dynamic system: its collective and individual propensity and ability to get involved in the home country depend on its structure (Figures 2, 3 and 4), that is, age structure, professional experience structure and average number of years abroad. Such details are important because they bring valuable information on the degree of integration in the foreign country, the degree of will and the available time to spend in collaboration with scientists in the home country, and about the degree of professional networking within the host country.

For example, Figure 2 shows that the highest number of hours that the respondents would spend for brain networking tend to crowd towards younger ages. This, together with the fact that the average respondent age was 36, with an average five years of post-doctoral experience, gives two essential ideas for Romanian science and development policy-makers.

1. The pool of respondents is at the most productive combination of youth and professional maturity, that is, a best-quality diaspora. This is excellent news for collaboration perspectives. However, several categories of diaspora members should be targeted, according to individual professional stages and propensities.
2. This current description of the Romanian diaspora will not remain the same with the passage of time; professional quality of the Romanian diaspora will probably increase during the next decade, but their commitment for engaging with the home country might decrease with their social and professional integration in their host countries, and even more so in the eventual absence of working policies to materialize their engagement with Romania.

In a way, the structure of the diaspora at the time of this survey could be seen as a sort of best situation at a given time, a 'golden generation' which can either be 'used' in the most noble and practical manner by Romanian institutions, or it can be 'wasted'.

Concluding remarks

In a world where human capital is vital for development, and is therefore actively attracted by development agents, universities tend to acquire more complex roles within society, moving closer to social and economic stakeholders and themselves becoming true development hubs, and main economic development engines (e.g. Göransson *et al*, 2009; Rapini *et al*, 2009).

The time is ripe to recognise and use the reality that the connectionist approach of intellectual diasporas opens great opportunities for innovation and development which go beyond the traditional cultural kinship understanding. Brain networking may be a good method to confirm this. The discussions on what makes the difference between failure and success of a policy or strategy to involve scientific diaspora in the science and development of the home country revolve around two requirements:

1. Solutions need to grow on incentives for all sides (not only the country of origin).
2. Solutions must rely on facts and concrete measures, not on suppositions.

The study presented in this article suggests that diaspora networks can significantly impact on national development. The study provides some empirical measures of policy preferences among diaspora members: a flash survey. Out of 133 individuals registered with a Romanian scientific diaspora database and who responded to a 10-question survey (representing a 58% rate of response, which is quite high), the interest in professional involvement in Romania appears to be very high (95%).

However, less than half of the respondents had some form of collaboration with Romanian scientists. When asked about potential future collaboration, 25% of them responded that they would prefer to return to Romania and 77% would prefer internet-based co-working, spending on average 4.4 hours per week. From a science development policy perspective, the first preference corresponds to what we call 'brain networking', and the second preference corresponds to what is usually known in the literature as 'brain circulation'. The clearly higher preference for distance collaboration can be explained by a series of causes, most notably the ease of doing it, and the need of the diaspora members to develop their links and collaboration before eventually taking the decision to return to Romania for the next stages of their scientific career.

The study suggests that the most realistic institutional platform for successful diaspora involvement in Romania is a system of brain networking which actually takes advantage of brain drain and is reinforced by brain circulation. Further research might also include surveys of the local scientists in Romania.

A strategy applying the recommendations from this survey should also take into account the international successes and failures of national diasporas. As models of success cannot be uncritically imported, the lessons from these success or failure stories must be confronted with the realities of Romania and of that of the Romania diaspora. While the main aspects have been discussed in this article, a follow-up article should review in detail this international experience, from a Romanian perspective.

The outlines of the core and general recommendations for a strategy to benefit from the human capital

represented by Romanian scientist expatriates shows that brain drain can actually be seen as a positive process, because it both offers personal betterment for Romanian scientists abroad, and it can be used as the first step of a strategy for Romanian science and society to benefit from individual professional gains via brain circulation and brain networking. The provided recommendations will hopefully inform the science-development strategies to be designed and applied in the near future.

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