

Scientific Diasporas Fostering Science and Technology in the Home Countries
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Abstract

Current interest in capitalizing on scientific diasporas' knowledge and networks to the advantage of developing countries has become more pronounced given the escalation in international skilled migration and the realization of the potential benefits to home countries from human capital abroad. This paper provides an overview of the experiences that a selection of countries have followed to engage emigrated scientists and skilled professionals into their development processes. Scientific collaborations, joint publications, temporary visits, and academic exchanges are ways in which scientific diasporas' knowledge can be channelled to their homelands. By describing the specific conditions and environments that enable or hinder the implementation of concrete initiatives and policies, this paper discusses main determinants ensuring thriving positive linkages which can contribute to strengthening national science and technology systems. It stands out that enabling structural settings and supportive policies together with a welcoming environment provided by local society are required.

Keywords: scientific diasporas, skilled migration, science and technology, knowledge transfer, development.

1. Introduction

Alternative ways to address the world knowledge divide between the North and the South¹ are especially important in the current context in which knowledge-based activities and the technological revolution have profoundly altered some of the basic coordinates of the world we live in. In the present context of knowledge-based economies, as argued by David and Foray (2002), innovation tends to be almost the only alternative countries have for advancing. The significance that knowledge holds for competitiveness and progress persists as something indisputable and therefore the differences in terms of science and technology potential and human capital availability between the North and the South remain a crucial challenge. Knowledge has always been at the core of economic growth and the progressive increase in social well-being (Foray 2004) (Stiglitz 1999), and the ability to innovate and create new ideas and knowledge has traditionally constituted a development fuel (David and Foray 2002).

While the proliferation of new information and communication technologies, as well as the increase in the knowledge world bank symbolized by these technologies, offer developing countries possibilities to reach higher levels of prosperity and productivity than ever before, their limited access to scientific knowledge and the slow advancement in technological innovation represent a considerable challenge.

A broadening of the focus from a national perspective to a global one in terms of science has consolidated, and international cooperation has grown as a result of the internationalisation of science and education. Yet, new poles of science have emerged and the competition among countries in terms of the procurement of talented human capital for innovation and knowledge production has ironically increased. Also, the expansion of communication and information technologies which enhances possibilities of knowledge production, deployment and transmission, and enables interconnections among scientific communities, is in fact augmenting global disparities (Hollanders and Soete 2010). As Bolay (2012) argues, at the international level, technological progress has not significantly reduced poverty and widespread inequalities within world regions, but it in fact “contributes to these disparities” (p. 6).

¹ The North-South divide is understood here in its conventional meaning and describes the opposition between the center and the periphery at a global level. The North implies development and refers to wealthy nations as opposed to belonging to the South which implies a lack of wealth and refers to poorer countries.

The disparities in the levels of development between world countries and regions are associated to the contrast in human capital investment as well as in the production of knowledge in the long term, as argued in the UNESCO Science Report 2010. The gap in R&D investment shows that while industrialized countries invest on average 2.3% of their GNP, developing and least developed countries only invest 1% and 0.2 % respectively. Dramatic inequalities are also shown in the world share of researchers insofar as 62.5% of world researchers are concentrated in industrialized countries (totaling 3,655.8 researchers per one million inhabitants –r/m), while the figure for developing countries is 37.4% (580.3 r/m) and for the least developed countries only 0.5% (43.4 r/m) (Hollanders and Soete 2010).

The growing inequalities and contradictions associated with these trends have encouraged recent debate on the possible alternatives to facilitate a more equal production and distribution of world knowledge and make its use fairer for the benefit of the less advanced countries. Two important changes at the global level influence the discussion. First, the motivation of countries to reinforce their capacities to both generate and acquire innovative knowledge and technology in order to generate socioeconomic progress is based more and more in international cooperation. While science and the production of knowledge have been traditionally dependent on international connections and exchanges, the intensification in international scientific cooperation has made it an influential instrument for the advancement of countries. This can be perceived in the increasing trend of researchers from different countries writing scientific articles jointly, a practice that in the last decade has been more obvious for emerging and developing countries as they have seen a greater increase in the number of countries with which they collaborate than developed countries (Vincent-Lancrin 2006). Second, new processes and dynamics reveal a major structural change given that state entities are losing power as the main constitutive and acting units in the world order. The power of global networks illustrates the participation of new actors, modifying the predominance of states as the main organizers of collective life and creators of national identities (Castells 1996, 1997). The expansion of new transnational actors promoting knowledge transfer through decentralized forms of cooperation for the benefit of the more disadvantaged countries is increasingly relevant.

Both the intensification of international cooperation and the increased relevance of transnational actors have been affected by the rise in the international migration of scientists

and skilled professionals in the last decades, opening new dimensions for collaboration between developed and developing countries. While world development calls for an effective transfer of knowledge from regions in industrialized countries where it is in abundance to regions in less developed countries where it is scarce, the current flows of skilled human capital usually follow the contrary course, from South to North, attracted by better opportunities and career prospects in high-income industrialised countries. Migration flows from developing to developed countries represent today the fastest-growing component of international migration (Özden et al. 2011a). A recent study shows that between 1990 and 2000 OECD countries registered an increase of 20% in the number of immigrants from developing countries with a primary education, while the increase in those with a third level education doubled (Özden et al. 2011b).

Traditionally, large-scale flows of human capital from the South to the North have been an important concern for developing countries of origin based on the idea that this affects their valuable knowledge bank and hinders their socio-economic progress. In the last two decades, the continuous rise in international skilled migration has encouraged the discussion of new policy options either for promoting, regulating or taking advantage of it, as well as an increasing academic interest in understanding its magnitude, characteristics and effects. This evolution responds to the advancement both in scale and scope as well as in the complexity of international migration. Skilled migration should be seen, as stressed by Castles (2010), as a complex and multidimensional phenomenon which is part of current social transformation processes. A new perspective that has gained attention in this context is the *diaspora option*, which replaces the traditional view emphasizing skilled migrants as a permanent loss by a vision considering them as potentially beneficial resources for countries of origin. More concretely, *scientific diasporas* made up of emigrated scientists and skilled professionals have gained recognition as promoters of research and the transfer of knowledge contributing to scientific, technological and socio-economic development in their home countries.

This paper explores the strategies and policies that a selection of countries have established to engage their scientific diasporas into their development processes. It observes three countries which have been pioneers in the implementation of mechanisms for capitalising on diaspora resources for the advancement of the science and technology sector. All three countries have shaped creative forms of cooperation schemes with their skilled communities abroad. Based on a review of the policies and an evaluation of specific national experiences, this paper

provides insights on the conditions and environments that enabled or hindered the implementation of concrete initiatives engaging scientific diasporas in the studied countries². All three countries are discussed separately and then a summary of the main factors influencing transnational cooperation and capitalization of scientific diasporas is presented in the conclusions in the final part.

2. Theoretical framework

Reference to skilled migration in the last decade, both in academic research and policy discourse, has tended to discuss new concepts and perspectives in an attempt to explain the linkages between migration and development. While research has aimed mostly at understanding the magnitude, characteristics and impacts of skilled migration, policy options try to find ways to take advantage of the emigrated human capital that remained abroad in benefit of national development.

In this context, two main issues have influenced the generation of new alternative ways to understand and evaluate international skilled migration. First, the view of skilled migration as a definitive loss for developing countries and benefiting only developed countries of destination, as interpreted by the nationalist perspective of the brain drain from the 1960s, was not sufficient to move from the general discourse to the establishment of concrete policies that could cope with this phenomenon. While this perspective saw the return option as the sole alternative to recover the “lost capacities”, in praxis more often than not, repatriation programmes were unsuccessful. Only a few countries in South Asia, for example, the Republic of Korea and China, experienced satisfactory return practices at a certain level, as a response to adequate scientific and technological structures and further incentive policies and conducive domestic environments (Yoon 1992) (Song 1992) (Saxenian 2005) (Wiesbrock 2008). Nonetheless, other world regions were not able to reproduce this model; for instance, countries in Latin America were particularly concerned about the examples seen abroad and their impossibility to follow suit (Pellegrino 2001). Second, the observation of skilled migrants’ behaviors and experiences in the destination countries made evident that they, as

² This paper is based on research on scientific diasporas, migration and development that the author has recently carried out through different projects at the Cooperation and Development Center of the Ecole Polytechnique Fédérale de Lausanne (EPFL). <http://cooperation.epfl.ch/ScientificDiasporas>

transnational actors, do not have an affiliation automatically attached to the particular geographical place where they physically are located but, rather, are able to hold multiple identities and to be connected to their host and home countries simultaneously (Levitt and Glick-Schiller 2004).

As a result, skilled migration started to be considered as an existing valuable human capital based abroad and subject to be mobilized to the advantage of the home country (Meyer and Charum 1995), replacing the traditional emphasis of irreversible loss and uncertain return by a feasible alternative of “*long distance association and multiple connections*” (Meyer 2010 p. XV). Transnationalism became then a popular theoretical framework in the study of migration and its linkages with development (Glick-Schiller et al. 1992) (Portes et al. 1999) (Portes 2001) (Vertovec 2004) (Faist 2010). Transnationalism sees migrants as carriers of their own identity without being uprooted from their home country while abroad and praises their ability to maintain several links over borders and connect with their communities of origin while belonging to multiple places at the same time (Vertovec 2001) (Levitt and Glick-Schiller 2004).

The *diaspora option*, encouraging interconnections between home and host countries enabling the transfer of knowledge, skills and further financial and social capital (Tejada et al. 2013), has acquired increased relevance ever since, and governments have attempted to intensify collaboration with diaspora communities recognizing their own aspirations and interest to “give back” to their home countries and trying to maximise their potential for development.

As part of this new perspective, the concept of *scientific diasporas* was coined at the beginning of the past decade (Barré et al. 2003) making reference to networks or organisations of emigrated scientists and engineers from developing countries living in industrialised countries working together to promote joint efforts to encourage transfer of knowledge to their countries of origin through diverse forms of cooperation from a distance (Tejada 2012). Related to this are *diaspora knowledge networks (DKN)* established using information and communication technologies as tools for collective transmission of knowledge aiming at making the most of the resources and networks of skilled migrants in benefit of the home country. According to Meyer (2007), DKN make available new policy options in the areas of innovation, science and technology, migration and development, and international cooperation.

Butler (2001) understands diasporas as communities established in diverse places outside the home country which act independently as a group in the host country, while they establish connections with their co-nationals situated both in the home country and all over the world. Diasporas' transnational actions are the result of communitarian practices, and therefore, as argued by Faist (2010), they should be understood as owning a collective identity. Both the unifying common ethnic identity and collective relationship of loyalty towards the home country (Bordes-Benayoun and Schnapper 2006) and the capacity to make creative contributions equally to home and host countries (Sheffer 1986, Cohen 1997) are among the main characteristics of diasporas.

The consideration of the significant role that diasporas can play in home country development also came into fashion in the global discussion on international migration, particularly when addressing the migration and development nexus, raising attention to the multiple ways in which emigrated communities can potentially and factually contribute to their home countries. For example, in 2005, the Global Commission on International Migration pointed out that “*diasporas should be encouraged to promote development by participating in transnational knowledge networks*” (GCIM, 2005). In a similar vein, the Global Forum on Migration and Development (GFMD) has addressed repeatedly the issue of diaspora engagement in its roundtables since its first meeting in 2007. As a response to the increasing interest of governments in diaspora issues, IOM organized in 2013 the Diaspora Ministerial Conference (DMC) as the first high level event dedicated to the question of diasporas, providing the opportunity to exchange experiences on diaspora engagement and empowerment aiming at enhancing their role as development partners. The summary of the DMC discussions stresses the participants' recognition of diasporas' propensity “*to build bridges between states and between societies*” and urges for strategies both at local and global levels aiming at harnessing their potential³.

The literature and empirical studies on transnationalism and migration and development look at the factors associated to diaspora engagement, highlighting that migrants' individual characteristics and profiles as well as the social and institutional contextual aspects both in

³ IDM 2013: Diaspora Ministerial Conference, 18-19 June 2013. Summary of discussions prepared by the Secretariat. <http://www.iom.int/files/live/sites/iom/files/What-We-Do/idm/workshops/IDM-2013-Diaspora-Ministerial-Conference/Diaspora-Ministerial-Conference-Summary.pdf> Accessed September 6 2013.

host and home countries have an influence in terms of enabling or hindering the positive effects. In the following sections of this chapter, I look at the experiences and efforts of three countries (Colombia, Moldova and India) engaging scientific diasporas to their development strategies, and I examine the determinants and conditions that enabled or hindered the success of such initiatives.

3. Examples of diaspora engagement for science and technology development

3.1 Colombian experience establishing a scientific diaspora network

To put the Colombian experience into context, I present first a brief overview of the evolution of science and technology policies in the country in the last decades. Notwithstanding major sociopolitical challenges, Colombia is considered to be one of the most stable and fastest-growing economies in Latin America. In the science and technology sector, the Colombian Institute for the Development of Science and Technology, Colciencias, was created as the entity in charge of science and technology in the country as far back as 1968; yet, the Colombian government began to recognise the importance of science and technology related activities for socioeconomic development only at the end of the 1980s, leading to the formulation and implementation of major policies in this area. Still, the lack of interest in building a long-term national scientific policy suggested that science and technology was not a top priority for the country. At this time, Colombian policies to link the competences of its scientists and skilled professionals based abroad with the home country were limited to the establishment of strategies to encourage their physical return, and taken as a whole this policy was not successful. Diverse incentives were offered by the government to Colombian returnees trying to ensure their sustained return, but the conditions in terms of infrastructure and suitable environment enabling them to reveal strongly that their accumulated skills and knowledge gained abroad were not satisfactory, with the result that many of them decided to leave, again attracted by better professional prospects in research and academic institutions abroad.

In the mid-1990s, Colombian economic growth declined dramatically, having had a considerable drop in national expenditure in science and technology in the years to follow, which fell from 0.55% and 0.56% of GDP in 1995 and 1996, respectively (the highest level

during the decade), to the lowest level of 0.32% of GDP in 1998 and 1999⁴. The year 2008 marked a turning point with the ratification of the new Colombian Law on Science, Technology and Innovation replacing the previous policy framework that had been in place since 1990 for a context promoting an interdisciplinary model linking academia and research with the national productive sectors. Science, technology and innovation became central issues for the development of the country, and Colciencias was transformed into an administrative department responsible for managing the National Fund for Science, Technology and Innovation, with a substantial increase in its budget over the following years.

As a result of these efforts, Colombia experienced a significant improvement in the sector of science and technology as well as in terms of its scientific potential represented by the increase in the number of human resources dedicated to research in the last decade. A systematic rise in the national expenditure in science and technology is observed, from 0.3% of GDP in 2002 to 0.44% of GDP in 2012⁵. However, this still lags behind the goal of 1% of GDP established by the Colombian government in the National Development Plan 2006-2010 for 2010 and the goal of 1.5% of GDP for 2019 with half of this coming from the private sector.⁶ The data reveal that the private sector has taken a significant position in science and technology, and it is expected that this will only grow in the years to come. In terms of the numbers of human resources dedicated to research, these increased by more than double in the last decade, rising from 7,426 in 2000 to 16,123 by 2010. Similarly, the number of doctoral theses completed per year grew from 19 in 2001 to 73 by 2010, with an average of 37.5 theses completed during the period 2001-2010⁷. Notwithstanding the importance of this positive evolution, the Colombian national science, technology and research system still has a long way to go in terms of knowledge generation. In this evolution, international scientific cooperation has been an important leverage, and it is expected that it will be intensified in the years to come.

When speaking about diaspora engagement policies to help enhance science and technology development, Colombia is a world case in point. The country was the first to put the idea of

⁴ <http://www.ricyt.org/>

⁵ Indicadores de Ciencia y Tecnología, Colombia, 2012. Observatorio Colombiano de Ciencia y Tecnología. <http://www.ocyt.org.co/>

⁶ Colombia Construye y Siembra Futuro. Política Nacional de Fomento a la Investigación y la Innovación. Colciencias, Consejo Nacional de Ciencia y Tecnología. 2008. http://www.cna.gov.co/1741/articles-311056_ColombiaConstruyeSiembraFuturo.pdf

⁷ <http://www.ricyt.org/>

the *scientific diaspora option* into practice with the creation of the Caldas Network of Scientists Abroad (Red Caldas), which was regarded as the most advanced version of an alternative option for the brain drain (Meyer 2001) (Tejada 2010). The situation of science and technology policies in Colombia at the time the Caldas Network was created was a special one. At the beginning of the 1990s, there were several drastic social and economic changes, which were mainly caused by the shift to a more open economic regime than the previous protectionist one. Various sectors of the economy were exposed to international competition, and one of their most pressing concerns was how to enhance their own competitiveness. In terms of the science and technology sector, the Colombian government perceived the need to mobilise its external resources in order to develop national scientific capacities, Colombia being a country with a small, dispersed and mainly inward-oriented scientific community. The risk of scientists being isolated led Colombian institutions to consider the importance of maintaining and strengthening the connections with Colombian scientists and skilled professionals abroad and also to explore the most appropriate mechanisms for their engagement in home country development.

An analysis of the situation leads us to believe that the country's committed support for implementing specific policies promoting the engagement of the scientific diaspora in the reinforcement of national scientific capacities was based on four complementary factors. First, the emergence of electronic networks and use of the information and communication technologies for worldwide interconnectivity at the beginning of the 1990s. Second, the presence of skilled Colombian migrants in top research and academic institutions around the world who were highly motivated and willing to contribute. Third, recognition of the potential gains the home country could obtain from collaboration with Colombian scientists abroad. Fourth, the belief that the Colombian national system of science, research and innovation was sufficiently adequate and capable of benefiting from collaborations with skilled Colombians abroad. While the combination of these elements inspired the subsequent idea of creating a network of Colombian researchers abroad, it should be stressed that the transnational activities of skilled Colombians abroad stemmed from their own individual or collective initiatives, with the government intervening only when the importance and the potential of migrants' practices became evident (Tejada 2010). In fact, the creation of Colext (Red de Colombianos en el Exterior) in 1990 was a pioneer initiative of Colombian scientists out of the country to communicate and connect with other Colombian researchers based in institutions around the world. This structure was taken over in 1992 by the Colombian

government, represented by Colciencias, to create the Caldas Network. The Caldas Network operated through its nodes in different countries, establishing links with important Colombian universities, with the aim of establishing collaborative research projects between Colombian research groups and Colombian scientists based in universities and research institutions abroad.

The Caldas Network was created as a very practical way to recover the skills and capacities of the skilled Colombians overseas without attempting their return to the home country. In a very flexible way, the network promoted diverse forms of cooperation with research groups and with scientists in Colombia, such as: exchange of information on cooperation opportunities, organization of conferences and scientific events, trainees in research laboratories and groups, as well as joint preparation of research projects. After a dynamic launch propelled by great enthusiasm and expectations, the Caldas Network lost momentum at the end of the 1990s. While official voices stress the main reason for this the lack of financial support for the projects combined with the general crisis in the economy and the country's science and technology sector, as evidenced by a financial crisis of Colombian institutions and universities (Chaparro et al. 2006), it is certainly true that the Colombian government was not in the position to provide long-term support to the network. Furthermore, the institutional capacity to host the projects in the local context was insufficient, hindering the potential impact of the network. The weak and highly fragmented Colombian scientific community which had only little interaction with it as well as with its colleagues abroad, and the lack of tools for the implementation of cooperation projects, were additional stumbling blocks limiting the functioning of the Caldas Network. As a result, many frustrations set in among the members of the Colombian scientific diaspora, who had placed great hopes in the project. The Caldas Network is remembered today as an innovative strategy designed to harness the capacities and resources of the scientific diaspora. However, it is also evoked as a project that created many hopes, but which ultimately failed to provide the appropriate response.

Linked to the Caldas experience, there are some associations of skilled Colombians abroad which are still running successfully and which can be viewed as good practices of diaspora engagement. One of these is the Association of Colombian Researchers in Switzerland (ACIS)⁸, which in the past functioned as the Swiss node of the Caldas Network. ACIS was

⁸ <http://www.acis.ch>

created by a group of Colombian scientists and engineers based in Swiss academic and research institutions as a platform for exchange and promotion of scientific collaboration with Colombia. The overall aim of ACIS is to contribute to the advancement of science and technology in Colombia through the exchange and transfer of knowledge. The functioning of ACIS is an example of the current global trend towards a decentralized and collective means of knowledge production (Tejada 2012) and is based on a thorough use of information and communication technologies as an instrument for knowledge transfer. The dual purpose of making knowledge available to the public and fostering its reproduction and circulation make ACIS what is called a *knowledge community* (Foray 2004). Throughout their organised collective activities based on joint aspirations, ACIS has played an important role by gathering the Colombian scientific community in Switzerland, and has contributed to the field of science and technology in Colombia through the creation and reinforcement of a critical mass in key development areas such as the environment, medicine and information and communication technologies. The experience of ACIS illustrates that both a community identity and intensive mobilisation encourage the participation and actions from a distance which benefit the country of origin. We observe, with the example of ACIS, that associative actions may play a key role in capitalizing on the effects of scientific diasporas. We see also that when the members of knowledge communities act as a group and strengthen their skills in an organised manner they facilitate collective influence in the country of origin, becoming agents of change (Tejada 2012).

The Colombian example shows that the formation of scientific diaspora associations and the implementation of research projects involving scientists in the diaspora and their counterparts in the home country are two of the most elaborate successful practices of the Colombian scientific diaspora making an impact on science and technology in Colombia. However, it illustrates also that diasporas' engagement in transnational cooperation faces important obstacles. The case of ACIS shows that continuous financial and institutional support has limited the scope and durability of its actions. Furthermore, despite the interest of the Colombian government in capitalising on diasporas' knowledge and skills shown through various recent initiatives implemented, a committed and sustained support for diaspora engagement remains unclear, while a strong policy strategy in this regard is still lacking. Also, the Colombian scientific diaspora still has to overcome its scepticism towards public actions, given the fact that Colombian institutions have created great expectations for their scientists abroad on several occasions in the past, without actually going on to give them the capacity to

fulfil them. An important task in this regard is to promote ownership of the new public initiatives by diaspora associations and organizations.

3.2 Moldovan policies engaging scientific diaspora and promoting migration and development linkages

The Republic of Moldova, a small country in southeast Europe landlocked between Ukraine and Romania, became independent in 1991 after the fall of the Soviet Union. During its transition to a democracy and market economy following its independence, the country experienced enormous pressure, similar to that of other Eastern European countries, with a significant decline of economic and social indicators, limited access to basic public services and impoverishment of a large segment of the population. Emigration from Moldova has happened at different stages, going from barely any flows of Moldovans leaving the country during the early 1990s to large flows of workers from the agricultural and related sectors searching for better employment and income prospects abroad after the collapse of the Russian economy due to regional financial crises in 1998 and 1999. Due to Moldova's high level of dependency on the Russian economy, the country faced an extreme breakdown which was much worse than in other former Soviet Republics, and this stimulated emigration. At the turn of the century, emigration of the Moldovan labour force increased progressively from around 100,000 in 1999 to more than 400,000 by the end of 2005 (Lücke, Mahmoud and Pinger 2007). While at first these migration flows were mostly of less skilled labour workers, flows of scientists, skilled professionals and students increased in the following years. Despite the fact that emigration is a relatively new phenomenon in Moldova, the country has at present one of the highest emigration rates in the world.

The uncertain situation of science and technology in the country has had a significant impact on skilled migration. The first ten years after independence, a hard economic crisis and long political transition ignored science and technology as a national priority, with the result that from 1990 to 2000 public investment in this sector was drastically reduced from 0.73% of GDP to only 0.18% (ASM 1990-2009). Insufficient funding, inadequate wages and deficient infrastructure affected the activities related to science, research and innovation in the country. Furthermore, management and promotion of science remained conservative with a regressive

rather than encouraging legislative framework triggering an important emigration of scientists and skilled professionals.

The annual reports of the Academy of Sciences of Moldova (ASM) show that from 30,000 scientific researchers that the country counted in 1990 the amount reduced to less than 5,000 in 2004, representing a fall of 83% of the country's scientific potential in one and a half decades (ASM 1990-2009). By 1 January 2011, Moldova counted only on 5,216 employees registered in research and development activities of the country, according to data from the Moldovan National Statistics Office⁹. An important additional driver of recent Moldovan skilled migration, mostly from young people, is the disconnection between the national education system and the real opportunities offered by the labour market, which causes a great competition for scarce job positions in Moldova and motivates a search of better professional prospects abroad (Gaugas 2004) (IOM 2012).

As shown recently by IOM (2012), Moldovans working abroad either on a temporary or permanent basis represent around 25% of the total economically active population.¹⁰ IOM data series for the period 2005-2012 show gradually increase in yearly emigration from Moldova and illustrates that an estimated 25% up to 30% of the working age population is involved in a migration project at any moment during such period. On a similar note, a recent study by OCDE (2012) shows that 56% of Moldovans in the age segments between 15 and 24 as well as 37% of Moldovans with third level education would emigrate permanently if they had the opportunity.

Particular aspects of the socio-political context make Moldova stand out from other countries in Eastern Europe when discussing the challenges of skilled migration and the policy options for the home country (Tejada forthcoming). These are: 1) Political instability and lack of full control over its territory (particularly the self-declared independent region of Transnistria); 2) Lack of cohesive national identity due to multi-ethnic population and historically rooted clashes influencing a continuous political debate between pro-Russia and pro-Western forces; 3) Moldova is the poorest country in the region with 65% of its population living below the poverty line (UNDP 2013); 4) The country is highly dependent on financial remittances which

⁹ <http://www.statistica.md/newsview.php?l=ro&idc=168&id=3744> (accessed on 19 August 2013).

¹⁰ Data from the Extended Migration Profile of Moldova. Based on data from the Labour Force Survey (LFS) of the National Bureau of Statistics (NBS) from the Republic of Moldova (IOM 2012).

represent 23% of Moldovan GDP and whose recipients account for 26% of Moldovan households (World Bank 2011); 5) The good reputation and scientific excellence of Moldovan scientists and the country's science schools remain remarkable.

Due to the specific complexity of Moldova's socio-economic and political situation, this case study denotes an exceptional instance to look at the challenges faced by a country going through a transitional stage and the policy options it has implemented in its efforts to link the emigrated scientists and skilled professionals to the national strategies of socio-economic progress. The country has implemented some concrete strategies and mechanisms both to promote retention of scientists and skilled professionals in Moldova and encourage those who are based abroad to be linked to the country and/or eventually to return to it.

As a first important step towards that goal, in 2004 the government launched a national strategy aiming at ensuring sustained support and adequate funding to science and technology and research and development, and activities related to these sectors, including improved professional conditions and prospects to Moldovan scientists and researchers. This strategy included three main complementary basics: the endorsement of the Code on Science and Innovation by the Parliament, the acceptance of the Partnership Agreement between the government and the Academy of Sciences of Moldova (ASM), and the commitment to increase consequently the expenditure in science and technology in the following years. In addition to those three actions, a concrete strategy to establish and reinforce connections with skilled Moldovans abroad was put in place.

In this regard, the government of Moldova, under the auspices of ASM, launched in 2008 a strategy aimed at encouraging cooperation with the Moldovan scientific diaspora. Moldova's firm resolution to boost relationships with the scientific diaspora should be understood as grounded on two issues. First, the conviction that the country can benefit from cooperating with Moldovan scientists and skilled professionals based overseas. Second, the belief that the Moldovan national system of science, research and innovation is sufficiently adequate to welcome diaspora initiatives and respond to them by providing support in terms of suitable infrastructure and a conducive environment for enabling transnational cooperation (Tejada et al 2013).

The Moldovan strategy focused on skilled migration is intended to curtail the negative impact caused by emigration from Moldova in general, and the loss of its highly skilled human capital in particular, by encouraging potential positive effects through the transfer of the accumulated knowledge and skills obtained by Moldovans working abroad. As part of the Moldovan strategy to encourage cooperation with the scientific diaspora, two concrete initiatives were recently put in place. The first of these is the programme for the temporary return of Moldovan scientists and young researchers, established under the EU-Moldova Mobility Partnership scheme by IOM and ASM. IOM Moldova has been in fact a crucial player in enhancing the migration and development dialogue in the country as well as in boosting the diaspora question in the policy agenda. The second initiative is the research project conducted by the ASM in collaboration with the Ecole Polytechnique Fédérale de Lausanne (EPFL) meant to “connect the scientific diaspora of the Republic of Moldova to the scientific and socioeconomic development of the home country”, a study which outlined the parameters of the Moldovan scientific diaspora and the propensity of its members either to return or to engage in home country development initiatives. The study found that while skilled Moldovans abroad do feel positive about their professional and study experiences overseas, they are also motivated to contribute to development in Moldova, and identified concrete determinants required to boost such contributions such as improved socio-economic prospects, political stability, and adequate infrastructure and services in Moldova, as well as concrete instruments for engagement (Tejada et al 2013).

Additional practical initiatives that Moldova has put in place as part of the strategy of cooperation within the scientific diaspora are: 1) Creation of the “Scientific Moldovan Diaspora Network”, aimed at supporting communication, exchanges and collaboration between Moldovan researchers abroad and the scientific community in the home country. 2) Creation of a database of Moldovan scientists living abroad as well as a forum for discussion to facilitate exchanges. 3) The creation of the ASM Certificate of Merit Award, which recognises outstanding results in science and innovation of the scientific diaspora, and also its help in promoting the scientific heritage of Moldova abroad.

Beyond the focus on skilled migration, the Moldovan government, while seeking to curtail the flow of emigration, is sensitive to the needs and concerns of Moldovans abroad, and therefore has put in place diverse policies encouraging dialogue with the diaspora, such as the National Plan of Action for Diaspora Management formulated by the Bureau of Inter-ethnic Relations

(BIR); the organization of the annual “Diaspora Fair” since 2007 by the BIR, aiming at reinforcing the partnership between the Moldovan government and Moldovan migrants, by discussing the most pressing issues of interest to both sides and finding ways for Moldovan migrants to contribute to Moldova’s progress and participate in the design of country policies.

As far as financial remittances are concerned, while highlighting the tangible benefits in terms of a lifeline to recipients from the transferred money which accounts for 26% of Moldovan households (Orozco 2008), the government acknowledges the key role of these people as a vital source of financial inflows with important socio-economic impact in the country (IOM 2009). Since the remittances are mainly used for daily needs, such as buying food and clothes, paying rent and making home improvements, they are hardly impacting deficient structural conditions. However, several on-going institutional initiatives have been put in place recently to promote the use of remittances for investment purposes (for example, the PARE 1 + 1 Programme).

The case of the Republic of Moldova shows that the initiatives targeting diasporas are taking place on a top-down basis at a national level headed by the Moldovan government. There is a clear institutional move to tap on scientific diasporas’ knowledge, skills and further resources and stimulate their transnational cooperation initiatives that may benefit the development process of the country. The promotion of return, temporarily or permanently, of Moldovan scientists and skilled professionals is another alternative option being fostered. However, for the country’s capacity to manage and benefit from the transfer of knowledge and skills from skilled migrants both through return or from distance collaborations through diaspora engagement schemes, only a conducive environment offering attractive career prospects, job opportunities and adequate infrastructure, quality of life and political stability in Moldova can make the pro-diaspora policies have an effective capitalising effect on home country development in the long term.

3.3 Experience of the Indian diaspora transferring knowledge and technology

When speaking about migration and diaspora contributions, India is certainly a world case in point for several reasons related to the particularities of the migration process from the Sub-continent. One of these reasons is that the magnitude of the Indian diaspora is very significant. The third largest worldwide after the British and the Chinese in terms of size and spread, the

Indian diaspora was about 10.7 million in 1979, representing 1.6 % of the national population at the time. Today, the number of people of Indian origin living abroad, estimated at 20 million at the turn of the century, is now believed to have risen to 25 million (MOIA, 2012). Another important reason is related to India's high quality of human resources, which has made the country an important place of origin of a significant number of workers who emigrate to almost every country in the world. While many low skilled workers have emigrated to the Gulf and countries of the Middle East, high skilled Indians have deemed the USA and other industrialized countries such as the UK, Canada and Australia as the most attractive traditional destinations in the last decades. Yet, over the past few years diverse countries in continental Europe are emerging as new destinations for skilled Indians (CODEV-EPFL, IDSK, JNU, ILO 2013). According to recent data from the OECD, the Indian community in OECD countries was around 1.9 million (about 2.6% of the total migrant population in OECD countries' area) in 2008 and approximately 4% of these had a third level education. Furthermore, about 5% of the highly skilled population of India immigrated to OECD countries (OECD 2008).

Another reason is the fact that an increasingly significant number of skilled Indians emigrate through the academic stream as students. Some estimates indicate that over 150,000 third level students leave India every year to study abroad (Khadria 2008). While Indian students tend to continue their education in academic and research institutions in the USA or the UK, increasing numbers have been moving to other destinations such as Australia, Germany, France, Canada, New Zealand and Singapore, as well as other countries in continental Europe. Over the last decade, the share of Indian students among all foreign students registered in third level education in OECD countries increased from 4% in 2001 to 7.3% in 2009, signifying the second biggest group of students from non-member countries, surpassed only by Chinese students (OECD 2011). Mostly in European destination countries, the retention of Indian students as long-term skilled workers for national labour markets after completing their studies is happening more and more as part of their strategy to attract skilled personnel as an economic buffer to meet skill shortages in specific sectors. Destination countries are adapting their policies in this regard and are implementing specific international student policies as tools in the international competition for skilled persons (Kuptsch 2006) (Mosneaga 2010). A recent study on host country environments for diaspora engagements offers a comprehensive policy review of France, Germany, the Netherlands and Switzerland with respect to their institutional settings and migration policies, with a focal point on Indian skilled professionals

and students (Tejada et al. forthcoming). The conclusions of this study indicate that host countries' settings are important in pulling skilled migrants but also in how they enable the transfer of knowledge to the home countries. Host country environments together with policies and structural settings provided by these countries facilitate the mobilisation of skilled Indians' resources and their engagement in knowledge transfer and further transnational activities.

There are diverse ways in which the Indian diaspora has contributed to socio-economic development in India. One tangible way has been through financial remittances whose total amount has not only made India the worldwide top recipient but has been considerably increased in the last decades. Data from the World Bank show that remittances from India grew six-fold between 1990 and 2000, rising from \$2.1 billion to \$12.3 billion, and they increased almost five-fold in the last decade, reaching US\$55 billion in 2010 (World Bank 2011). The transfer of financial remittances is only one type of contribution; yet the Indian case has experienced other ways in which Indians abroad, concretely skilled professionals, have taken part in initiatives linked to home country development, in the form of knowledge and technology transfer or encouragement of investments and entrepreneurial activities both from a distance and upon return.

Another element that has aided India as a country benefiting from positive effects of skills migration is the collective action of Indian engineers and technicians who mobilised many of their co-nationals into active associations and networks in the Silicon Valley region of the USA during the late 1990s, contributing to the reinforcement of India's scientific and technological capacities through knowledge and technology transfers as well as in the form of investment and business linkages (Saxenian, 2005, 2006). While the Indian experience in information technologies (IT) and the creation and strengthening of the software industry with the help of skilled Indians from the diaspora would seem to be a good example, it is also important to look at the costs that are involved, given the fact that many other economic sectors that are important for Indian development have been neglected, which would seem to indicate a major need to normalise unequal sector growth in IT by means other than R&D and higher education.

Return migration has been considered as another option and a powerful tool for development in the case of India. Several studies attribute return migrants, who count on knowledge and

technical skills accumulated overseas, with an important role in economic development upon their return to the home country. Even though the return of skilled migrants may be highly beneficial for the home country insofar as they bring improved levels of knowledge and skills with them and may create employment and entrepreneurial opportunities, the return option has still not been comprehensively explored concretely and the determinants influencing the process of transferring the knowledge of skilled Indians upon return have not been fully understood.

Advancement on this issue has been made recently by a study exploring the effects of skilled Indians' international exposure on their professional and social position after their return to India and the difficulties they face in the dynamics of transferring the skills they have gained abroad (CODEV-EPFL, IDSK, JNU, ILO 2013). This study shows that while skilled Indians in Europe associate their development aspirations to their return plans and believe that Indian society can benefit from their accumulated know-how, they face a number of difficulties within the course of knowledge transfer to the local context. Skilled Indians are highly motivated to contribute the knowledge, skills, experience and ideas that they have gained while working abroad to their employment and professional activities in India, but a reality check shows that local work culture, resistance to change, lengthy bureaucracy and lack of basic requirements in terms of infrastructure limit their potential. This shows how home country environment matters as well. As evidenced by this research, while skilled Indians have positive feelings about contributing to development activities in their home country, they show a lack of trust in India being able to provide the necessary enabling environment to trigger the capitalisation of their accumulated knowledge and skills gained overseas (CODEV-EPFL, IDSK, JNU, ILO 2013).

India has experienced in recent years an increase in the number of skilled Indians returning to their home country. Many skilled professionals, mostly but not exclusively from the IT sector, are returning to India from the US, as well as the UK and other European countries, in some cases pushed by the economic downturn in the destination countries which leads to insecure job prospects, but also pulled by economic, career, entrepreneurial and business opportunities they see, together with their family ties that India has to offer. In addition to their perception of an enabling environment based on their views of a good economic and social performance of India, their feeling of patriotism is an additional driving force motivating their return (Chacko, 2007) (Finegold et al. 2011) (CODEV-EPFL, IDSK, JNU, ILO 2013).

In terms of policies, the Indian government has recognised the potential advantages the country can obtain from collaborating with the diaspora, while it relies on India having the sufficient capacity to facilitate and provide a conducive environment to host such cooperation. As a consequence, the country has implemented concrete innovative policy strategies to benefit from the resources of the Indian diaspora. For example, a ministry dedicated to the non-resident Indians, the Ministry of Overseas Indian Affairs (MOIA), was set up in 2004 as proposed by the Report of the High Level Committee on Indian Diaspora, which was created as early as 2000 with a view to exploring the possibilities of diaspora engagement¹¹, with the mandate of connecting the Indian diaspora community with the motherland. Additionally, the Overseas Indian Facilitation Centre (OIFC), set up in 2007, aims at promoting investments of the Indian diaspora in India and facilitating business partnerships and advisory services related to investments for Indians based overseas. These two structures (MOIA and OIFC) initiate and manage most of the government actions regarding the Indian diaspora.

One initiative implemented by the MOIA, addressing concretely skilled Indians and encouraging knowledge transfer in particular sectors, is the Global Indian Network for Knowledge (Global-INK)¹², which aims at creating a network by drawing on the knowledge, skills and expertise of Indians abroad and in India in the areas of environment, healthcare, innovation and science and technology, and it functions as a portal of knowledge management, exchange and collaboration. A further initiative, by the Indian government, is the creation of the website Scientists and Technologists of Indian Origin Based Abroad (STIOs), which is aimed at mobilising overseas talent and expertise and contributing and sending knowledge back to India. The network provides its members with access to opportunities to collaborate with the Indian diaspora. The members, mostly Indians residing abroad who interact through this network, represent a wide range of industries, research institutes, laboratories, universities and businesses and they interact with counterparts back in India¹³. Some specific examples of projects have taken place to benefit Indian development, like the implementation of schemes involving short visits by Indian scientists to STIO laboratories around the world; the establishment of technology transfer corridors; and the creation of high-tech firms in India that use techniques and resources provided from abroad.

¹¹ <http://moia.gov.in/>

¹² <https://www.globalink.in/>

¹³ <http://stio.nic.in>

While concrete policy strategies from the Indian government to engage with the Indian diaspora were implemented some time back and concrete initiatives are taking place, a recent study on skilled Indians in Europe and returnees shows that a majority both of diaspora and returnees have little knowledge of the various initiatives take on by the Indian government to engage with its diaspora. This study suggests that the government needs to improve its communication about such policies with the diaspora community (CODEV-EPFL, IDSK, JNU, ILO 2013).

Conclusion

The discussion of the issue of diasporas in the global dialogue on migration and development has moved from the recognition of their potential contribution to their home countries to the reflection on how governments' policies and strategies can enhance such linkages (Agunias and Newland 2012). For this, it has been stressed that a good knowledge of diasporas is a necessary condition for the implementation of adequate policies to connect them to national development strategies, and therefore increasing importance is given today to empirical research and studies mapping diasporas' volumes, profiles and characteristics, as well as their conditions in destination countries and their connections with the home country. The adaptation of conceptual frameworks for the interpretation of the determinants and effects of diasporas' engagement is also taking place¹⁴.

The country experiences presented here show that while skilled emigration may be determined by choice, professional career, academic opportunities and the globalisation of science and education, it is also fuelled by economic factors, limited employment and career prospects and low level of wages in the countries of origin. Both contexts in countries of origin and countries of destination influence skilled migration. Scientists and skilled professionals from the diaspora in general keep connected to their countries of origin and have positive feelings about their possibility of contributing to development activities there.

¹⁴ Diverse recent studies have contributed to the mapping of scientific diasporas of Colombia (Tejada and Bolay 2010), Moldova (Tejada 2013) and India (CODEV-EPFL, IDSK, JNU & ILO 2013), and identify the main determinants of their transnational interventions in home country development. More recently for Colombia, the project Creation of Knowledge Diasporas Incubators for Latin America (CIDESAL) studies the Colombian scientific diaspora and proposes new tools and digital platforms of interaction and cooperation opportunities among its members enabling Colombia to benefit from this talent (<http://www.msh-m.fr/cidesal>).

While in some cases diaspora transnational cooperation projects take place at the individual level and lack a collective organisation, more structured communitarian-based actions are taking place in other cases, which are considered as crucial for enhancing the scale and effect of transnational cooperation and for facilitating the influence in the home country. In fact, recent studies show how the ability to mobilize is a decisive factor in enhancing diasporas' potential (Tejada and Bolay 2010) (Agunias and Newland 2012).

The aim of this paper was to provide an overview of concrete strategies and policies that a selection of countries have established to engage their scientific diasporas into their development processes. The three countries studied here have shown innovative forms of diaspora engagement and of institutional mechanisms for capitalising on their resources for harnessing positive impacts, particularly in the science and technology sector. The objective of this paper was not to offer a comparative analysis; neither was it to examine or suggest the possibility of replication of practices, given that these are based on specific case country contexts and historical backgrounds. The experiences shown take place in different geographical and political contexts, illustrating that the particularities of the concrete country context influence the ways scientific diasporas' knowledge and further resources can be channelled to their homelands.

While the diversity of the country contexts helps to explain why skilled migration can play a positive development role in some cases but not in others, it is evident, as stressed by de Haas (2008), that the possibility of influencing positive change in socio-economic terms in the home country by skilled migrants hinges both on the individual profile of the migrants themselves and on broad structural conditions. The experiences presented here show that adequate conditions and conducive environments to host transnational cooperation linkages and ensure knowledge transfer, such as sufficient scientific and technological infrastructure available, receptive and welcoming local culture, adequate environment for investing and creating employment and attractive career prospects are all determining factors that have to accompany the implementation of initiatives and policies for engaging scientific diasporas in development efforts and harnessing positive impacts. In other words, while government initiatives may be important, the general political and socio-economic context in the home country seems to be the determining force in the capitalisation of diasporas' resources.

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