Chapter 8
Globalisation Challenges and Knowledge Transfer from the Indian Scientific Diaspora

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Abstract This chapter looks at the opportunities and uncertainties of globalisation in terms of the production of world knowledge, with an emphasis on the factors that limit the distribution and fair use of this knowledge for the benefit of less advanced countries. We show how existing disparities between developed countries and emerging and developing countries relating to the level of higher education, the resources available for research and access to technologies and innovation have made scientific cooperation an indispensable mechanism for advancement. Having established this context, we then turn our attention to the transfer of knowledge for the benefit of developing countries, as promoted by the scientific diaspora. Taking the case of India and its relationship with Europe as an example, we present a qualitative analysis based on interviews held with Indian students and researchers who are either living in Europe or who have returned to India, and with some other key informants. India is a paradigmatic case in terms of knowledge, science and technology insofar as the country is a source of skilled personnel for many developed countries, including the European countries that have become popular as new destinations. We look at three determinants for channelling knowledge transfer: institutional mechanisms for bilateral cooperation, transnational collaboration and the affective capital of migrants. We observe how these channels foster scientific cooperation and strengthen the critical mass in the country of origin. While our findings point to a trend whereby scientific diasporas become carriers of knowledge for their countries of origin in the South,

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there is a need for further studies to examine the specific level of impact that these forms of knowledge transfer generate in the Indian context and to see whether the local society obtains actual benefits from them.

1 World Changes and Globalisation

The world changes and it is now changing at an ever faster pace and in more globalised manner. To confirm this, we only need to consider present-day technological innovations that facilitate exchange and communication, the liberalisation of international rules that is encouraging the movement of people and goods, the internationalisation of models and references that leaves an imprint on cultures and social relations universally and the opening up of markets which is causing an explosion of economic production and the worldwide expansion of the distribution of commodities. There is increasing evidence that these elements of globalisation are having an impact on the global economy, on underlying strong growth and on the balance of the environment, which is now marked by inescapable climatic change and a permanent degradation of available natural resources. Globalisation has also led to social and cultural tensions in several countries, and this has called current national and international political structures into question. In this fast-moving international context, the world of knowledge is experiencing a broadening of educational systems and a diversification of learning models, but it is still unable to prevent the emergence of new disparities.

In an article published in the International Journal of Sustainable Development, Bolay (2004) endorsed some of the criteria most commonly cited by experts to describe the globalisation that we refer to today when we speak of international exchanges. Firstly, it should be remembered that for the last 30 years the expansion of economic flows has arisen mainly from a paradigm shift on the political front—even though the reality is often even more complex. For reasons related to a shared desire to boost international trade, all the countries represented at the United Nations (UN) and the World Trade Organisation (WTO) have gradually rejected a number of customs barriers in favour of a neoliberal policy. According to England and Ward (2007), the concept of an effective market is transcended into a driving force that targets a reduction in the scope of state involvement in the economy, in which individual dynamism is favoured over socially run companies.

The notion of globalisation encompasses two significant changes in our lives in relation to both space and time. The development and distribution of new communication technologies (e.g. mobile phones, TV, Internet, geographic information systems) that are increasingly efficient in speed and level of influence has led to a practical and symbolic compression of this space–time continuum (Chase-Dunn et al. 2000). We can maintain permanent and immediate contact with almost every corner of the world. In this new highly technological context, social interaction works on a multitude of levels and scales. We can interact with a large

number and a wide variety of people at the same time according to our needs and wants (as demonstrated on a daily basis by Facebook and other social networks). This may also be possible on various spatial levels, ranging from our work colleagues to our next-door neighbours, from a relative who may be somewhere in Europe to our fund manager in Singapore. In his three books on the Information Age, Castells (1996, 1997, 1998) clearly demonstrated that globalisation was made possible, thanks to technological advances, and this is precisely what is driving us towards an 'information society', which creates new social relationships on both an economic and a political level. This concept of globalisation has come in for some criticism on the grounds that the quest for 'new territories'—often military in its early stages before becoming commercial—has been a constant for many centuries. This 'globalisation' of trade has gradually established capitalism as a world system made up of strongholds and interconnections. Social theorists of capitalism have shown that such trade has been corroborated by a reproduction of socioeconomic inequalities in all the societies that are involved in these exchanges (Robinson 2001). Gunder Frank flamboyantly referred to this trend as the 'development of under-development' in 1975 (Gunder Frank 1975).

Yussuf (2001) defines the key aspects of globalisation as the growth of international trade, the increase in international capital flows and their investment potential, growing migration, more extensive information and communication and the spread of advanced and innovative technologies. Walby has suggested (2009) that the existence of increasingly interventionist international organisations on an international scale also deserves attention.

Joseph Stiglitz, the former Chief Economist at the World Bank and a critical and pragmatic thinker, noted in 2007 that anything is still possible but that it has been demonstrated that the current process of globalisation is producing unbalanced outcomes, both between and within countries. Five main issues seem to be at stake here: the rules that govern globalisation are unfair, being designed to benefit the advanced industrial countries; material values take precedence over concern for the environment; the management of globalised sectors has taken away much of the developing countries' sovereignty; plenty of evidence shows that globalisation produces many losers in both developing and developed countries; and the Americanisation of economic policy or culture causes resentment in many countries.

A link has thus been established between globalisation and development, knowing as we do that globalisation started on the pretext of opening up markets to benefit the better integration of all countries in world trade, with a strong emphasis on the manner in which the poorest countries could benefit from these new rules. However, facts are facts and the figures do not confirm this idyllic view. Some emerging countries have seen significant improvements at an economic level, yet many others among the least technologically advanced countries have actually experienced a decline. Even the best macroeconomic results have not led to an automatic reduction in social disparities. On the contrary, with the aid of World

Bank statistics, Stiglitz (2007) claims that, with the exception of China, poverty in developing countries increased from 36 % in 1981 to 40 % in 2001. For the same period, Africa, the continent most affected by this phenomenon, saw extreme poverty rise from 41.6 to 46.9 % (Stern 2002). On the other hand, a more recent study, conducted by Fosu in 2011 and based on statistical data provided by the World Bank, confirms a global reduction in poverty as a result of economic growth. However, the clear disparities between social classes and countries are having a direct impact on poverty terms. The stronger the disparity between the social classes in a given country, the more significant the poverty from both an individual and a financial point of view.

As defined by Sassen (2007), the sociology of globalisation allows one to 'problematise the notion of a global/national duality' and to distinguish how key elements of globalisation—within the field under consideration in this chapter—such as knowledge, and more specifically the role of scientific diasporas—are as much globalised trends that now influence all the countries and stakeholders concerned as they are strategies, policies and actions implemented at a national level.

This multifaceted global evolution is not inevitable since it is not a natural phenomenon but rather a modern social construction resulting from a technological revolution (Bellon 2007) as well as a strong international trend which is redefining the role of the state, the role of the productive sector and diplomatic and economic relations between countries.

2 From Globalisation to Development Issues

The phenomenon of globalisation once again raises the question of the driving forces of development in today's world. Without attempting to rewrite history, it is necessary to recall that this terminology—development, under-development, developing countries, etc.—dates from the post-World War Two period and therefore from the resolve of the leading powers to shape the world in the image of the industrialised nations that sprang up from the technological revolutions of nineteenth-century Europe. It was pragmatically vital to rebuild a Europe that had been destroyed physically and demographically after 6 years of bloody conflict. It was primarily with this aim that the International Bank for Reconstruction and Development (IBRD), better known as the World Bank, was created. As highlighted by Rist (1996), development is all about a Western belief system which is projected by one party onto another, the former taken by surprise when the latter does not in fact engage in this unequivocal model of economic growth, the impact of which should theoretically be beneficial to all. In his work on development theories (2002), Azoulay shows how thinking on the topic has changed from the 1950s to the present day and how, from the struggles for independence that marked Africa in the 1960s to the environmental battles of the 1970s as well as the

structural adjustment policies of the 1980s, we have gradually come to rethink development, whether from within or outside the market.

In more recent times, two dates are significant:

- The Earth Summit of 1992 held in Rio de Janeiro, which spread the concept of 'sustainable development' (WCED 1987; Brunel 2004) to a global level and supported the political will to try to reach a balance between environmental, social and economic issues.
- The year 2000, when the UN 'invented' its Millennium Development Goals (MDGs) to serve as action guidelines for all bilateral and multilateral agencies of development cooperation, all public authorities and all development stakeholders (Bolay 2012b).

Setting the context is useful as it enables us to make sense of the options chosen at an international level for the leading sectors of social life and then to compare these with the results achieved over the last few years. The World Commission on Environment and Development, appointed by the UN at the end of the 1980s (WCED 1987) to prepare the Earth Summit in 1992, established what would become 'the alphabet' of sustainability by hinging development on two essential components: the time factor, by emphasising that development can only be sustainable if it meets the needs of the present without compromising the ability of future generations to meet their own needs, and the balance between three fundamental elements delineating the sustainability of eco-development, as coined by Sachs (1997): social equity, environmental protection and economic efficiency. Social equity is one factor since the mechanisms to distribute existing wealth among the individuals of a society foster justice as well as productivity and ingenuity in all fields. Environmental protection is a second factor since natural resources are largely exhaustible and degradable and must therefore be used in a rational and optimal manner. Economic efficiency is a third factor since the laws of profit on their own do not cover the direct and indirect costs of production, which affect users and increase inequality between the 'beneficiaries of the system' and those who incur its real cost.

The turn of the millennium offered a major opportunity to thoroughly review the issue of development. The Millennium Declaration (United Nations 2000), adopted in September 2000 by the UN General Assembly, laid down the main principles which should collectively guide international action. Firstly, it raised the issue of collective responsibility to apply the basic principles of human dignity, equality and equity at a global level, in particular towards the most vulnerable populations, all the while promoting peace and justice at a national and an international level. Now that these options have been defined, the UN is proposing that they be converted into more specific actions so that globalisation can become a positive force for humanity, recognising that its costs and benefits have been unequally distributed until now.

To achieve these objectives, it is necessary to assert political priorities and implement development programmes to meet them, in particular to mitigate the

prevalence of extreme poverty in many countries. With regard to the framework for intervention, the approaches include the following: good governance, better access to financial resources, particular attention to the specific needs of the poorest countries as well as a better integration of their products in international markets, total debt relief for the poorest countries and appropriate treatment of other developing countries' debt as well as an increase in development aid. According to the UN, if these priorities are efficiently addressed, they should achieve the following significant results by 2015: halve the number of people in the world who are living on less than a dollar a day (i.e. 1.2 billion persons today), ensure that all children complete a full course of primary education, reduce the maternal mortality ratio by three-quarters and under-five mortality rates by two-thirds, halt and reverse the spread of HIV/AIDS, provide special assistance to HIV/AIDS orphans and improve the living conditions of 100 million slum dwellers.

The range of UN proposals was rapidly examined by the World Bank, which calculated their cost. Whatever the method used, an additional 40–60 million dollars needs to be made available every year by donors in order to be able to reach these goals (Devarajan et al. 2002), and this the equivalent of twice the amount of international aid granted in the first decade of the twenty-first century. It was highly unlikely that these commitments would be respected following the unclear decisions about development funding taken at the Monterrey Summit in March 2002.[1]

Lapeyre (2006) argues that the MDGs reflect a technocratic vision of development 'articulated in terms of target groups and vulnerable populations', which the world elites would support massively, forgetting that the 'poor' are not passive objects but that they take action in the face of the hardships that confront and destabilise their lives. Besides, the MDGs inevitably favour models from the North, which refer to governance (a less restrictive terminology) rather than democracy (Tujan 2006). Drawing on the highlights of numerous discussions on the issue, Melamed and Scott (2011) contend that after 10 years of existence the main successes of the MDGs are raising awareness among elites and political mobilisation for sustainable development and the fight against poverty. Criticism of this relates firstly to the fact that the entire strategy adopts a top-down approach, based on the UN system and donors, without ever taking into consideration how much of a challenge such goals are for the most disadvantaged countries and their populations. With this in mind, there are no real appropriate solutions for the most impoverished communities of the South, knowing by experience that in all development programmes, close to 10 % of potential beneficiaries end up being excluded, as they do not have the minimum resources to form part of these programmes. Looking beyond 2015, Melamed and Scott suggest four avenues that are worth exploring in terms of sustainable development and which have barely been

[1] United Nations International Conference on Financing for Development 18–22 March 2002, Monterrey, Mexico. http://www.un.org/esa/ffd/ (Accessed 13 February 2013).

contemplated since the beginning of this century: urbanisation; climate change; chronic poverty and the growth in inequality; and unemployment, under-employment and conditions of employability.

The final UN declaration of Rio+20, made in Rio de Janeiro in 2012 to mark the twentieth anniversary of the Earth Summit stated that the 20 years since the UN Conference on Environment and Development in 1992 have seen uneven progress, including in sustainable development and poverty eradication (United Nations 2012). Item 48 of the declaration recognises important contribution of the scientific and technological community to sustainable development. It states that UN is committed to working with and fostering collaboration among the academic, scientific and technological community, in particular in developing countries, in order to close the technological gap between developing and developed countries and reinforce the science–policy interface as well as to foster international research collaboration on sustainable development. The focal points of intervention will therefore be priorities that have been established for sustainable development: poverty eradication, changing unsustainable patterns of production and consumption, promoting inclusive and equitable economic growth, reducing inequalities, raising basic standards of living, fostering equitable social development and inclusion and promoting the integrated and sustainable management of natural resources and ecosystems.[2] In January 2013, but without being more precise, the General Assembly of the UN created a working group to redefine the sustainable development goals set by the international community for the post-2015 period[3] as a means of addressing new world challenges.

3 Development and the Production of Knowledge: the Role of Science and Technology

To return to the point that interests us here—knowledge and the means conducive to spreading its distribution and broadening its content—the Annual Reports of the United Nations Development Programme (UNDP) on the progress towards MDGs show that education is as important as health and the environment in development terms, but that the focus is exclusively on basic education, in order to ensure that by 2015 children everywhere, whether they be boys or girls, will be able to complete a full course of primary schooling. However, the MDGs do not address higher education, science or technology at all, and one might suggest that this implies that the UN does not see them as a focal point of development.

[2] http://www.un.org/french/documents/view_doc.asp?symbol=A/RES/66/288 (Accessed 13 February 2013).

[3] http://www.un.org/apps/newsFr/storyF.asp?NewsID=29680#.UQ-XcmdyF8E (Accessed 13 February 2013).

In its 2012 report on the MDGs, the UNDP[4] underlines both the progress made and the inability to reach the goals set within this programme and hence the need to pursue these goals beyond the 15 years initially planned. The number of children enroled in school to complete compulsory education in sub-Saharan Africa increased from 58 to 76 % between 1999 and 2010, which is remarkable in itself. However, tremendous efforts are still needed in this area, depending on the region. According to UNESCO,[5] there were still 775 million illiterate individuals in the world in 2010, equal to 16 % of the world adult population, and 64 % of these were women. The two most affected regions are southwest Asia and sub-Saharan Africa, the world's most rural regions where the illiteracy rate is 37 %.

4 Higher Education and Research

The issue of higher education has also been a topic of discussion for some time and relates as much to research as it does to the training of scientific and technological elites. This is all the more so since the establishment of what some experts like to refer to as a global post-modern society founded on a 'knowledge-based economy' (OECD 1999) with the help of technological innovations in which intangible capital (Gorz 2003)—meaning both intellectual work and the resulting products as well as the technologies that support it—becomes the main driver of economic growth, expansion and development. The knowledge-based economy poses new challenges for the educational sector including the need for investment from private and public stakeholders. It involves universities, research centres and knowledge institutions in a role allied more closely to economic market value. However, the knowledge-based economy also constitutes a new barrier between the countries and regions of the world. According to Castells and Cardoso (2005), it offers the technological capacity to provide new ways of conveying knowledge and information around the world—which are instrumental in driving innovation—yet it is not easily accessible in space or time. It also places technological and financial barriers to the detriment of the poorest countries, and as statistics show, investment in R&D clearly distinguishes the leading countries (USA, Europe, Japan and China) from the rest of the world, with the latter contributing only 18 % of world investment (Bolay 2012a).

Higher education, therefore, represents a crucial challenge for the world economy, especially in countries where this human capital has not yet reached the critical mass necessary to fully contribute to intellectual and technological emulation. Sub-Saharan Africa, a region with very rapid population growth, has seen a

[4] http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2012/English2012.pdf (Accessed 13 February 2013).

[5] http://www.uis.unesco.org/literacy/Documents/fs20-literacy-day-2012-fr-v5.pdf (Accessed 13 February 2013).

huge rise in the number of students over the last few decades. According to the UNESCO Institute for Statistics (2010a), the student population in this region increased more than 20-fold to 4.5 million between 1970 and 2008. However, the higher education sector has not benefitted from matching resources. A shift from standard universities to research universities is still wishful thinking in most African countries, and even though market opportunities have sustained high growth since 2000, they often remain uncertain because of a lack of consistency between the courses of study, learning and investigation methods and the needs of society. Things have started to change with the establishment of higher education systems directly derived from the European model, the creation of doctoral schools and a more significant role for scientific research. However, Jones et al. (2007) indicate that a lack of harmonisation among African academic establishments, states and donors makes it difficult to assess the progress that has been achieved up to now.

The UNESCO Science Report (2010b) provides a few indicators, which allow us to form a rough idea of the specific features, differences and impact of the knowledge sector at an international level. Hollanders and Soete (2010) note that the sector is increasingly part of the globalised economy. Two particular aspects are highlighted. First, the most powerful emerging countries—China, India, Brazil, Mexico and South Africa—are gradually investing more in R&D and transitioning countries such as Russia are doing the same. Second, over the last decade, the economic recession and world financial crisis have seriously weakened Western countries, particularly the USA and Europe, whereas businesses from emerging economies have experienced continued growth, based on—and this is a new trend—their own technological innovation processes and the development of autonomous production lines often linked to the involvement of the academic world in these innovations.

UNESCO reports that R&D investment increased from 790 billion to 1,145 billion dollars between 2002 and 2007. During this period, emerging and developing countries increased their R&D contributions from 17.2 % of the total amount invested to 23.7 %. The share of R&D in their GNP rose from 0.8 to 1.0 % in 2007. Only the least developed countries have stalled, contributing 0.1 % of the total world figure which represents 0.2 % of their GNP, and no noticeable change has been observed in either of these figures over the entire period.

The number of researchers in the world has also risen sharply, increasing from 5.81 million in 2002 to 7.2 million in 2007. This growth of about 25 % has essentially benefitted emerging and developing countries, and the world share of these countries has increased from 29.8 to 37.4 %. The least advanced countries have remained stable with a 0.5 % share of the total number of researchers. Again, only a handful of the leading countries are driving this change. China is at the forefront, and with 1.42 million researchers in 2007, it accounts for 19.7 % of world human resources in this field, almost on a par with the United States and Europe. In other parts of Asia, Japan remains strong with 710,000 researchers compared to only 155,000 in India. In comparison, Latin America as a whole has

257,000 researchers, while Africa has 158,000 and there are only 40,000 in sub-Saharan Africa, excluding the Arab countries and South Africa.

Generally speaking, the trends are positive with regard to the involvement of emerging and developing countries in the production of knowledge, research and higher education and their distribution in relation to R&D, technological innovations and transfers. It is still essential to stress the challenges that await the science sector in these regions of the world, which stretch beyond the progressive marginalisation of the poorest countries. Although it is obvious that these issues—whether they be scientific and technological advancement or investment in these areas—need to be addressed differently from country to country, it is possible to identify some common points.

Firstly, it should be recognised that expenditure (funds allocated to R&D and researchers) in developing countries remains substantially lower than in the industrialised countries. The OECD[6] showed that R&D expenditure, as a percentage of GDP, amounted to 2.14 % worldwide in 2011, which breaks down to 2.4 % for all OECD countries, 3.4 % for Japan, 3 % for Switzerland, 2.7 % for the USA, 1.9 % for the EU, 1.7 % for China, 1.1 % for Brazil, 0.9 % for South Africa, 0.9 % for India and 0.16 % for Colombia. With the exception of China, all emerging and developing countries invest less than 50 % of the amount allocated by industrialised countries, and very frequently this figure is closer to between 10 and 20 %. These discrepancies undoubtedly have an impact on the scientific strength of these countries and their capacity to be at the forefront of innovation. Africa is probably the continent that is the most symptomatic of such socio-spatial disparities. For the nations on this continent, R&D amounts on average to 0.3 % of GDP, though South Africa alone represents 90 % of the 3.5 billion dollars invested across Africa every year in this sector. The remaining African countries share a tiny fraction of research funding.

Gaillard (2010) adds that in most developing countries, which have relatively limited resources, research is carried out in a small number of establishments and these rarely offer the conditions required to have a sustainable impact on scientific production. Besides, there is an insufficient critical mass of researchers in many areas, inadequate pay, little or no modern equipment and an institutional governance that does not favour a balance between academic teaching and research. In many countries, notably those in sub-Saharan Africa, only one or two establishments carry out research and there is little emulation within the region or with the outside world. While the author argues that this is certainly one of the factors to explain why the most brilliant researchers emigrate to industrialised countries, he also points out that they may contribute to the transfer of knowledge and skills between developed and developing countries.

This situation has an impact on the number of publications per country and their citations by the international community. In general, fewer articles are published

[6] http://www.oecd-ilibrary.org/science-and-technology/gross-domestic-expenditure-on-r-d_2075843x-table1 (Accessed 13 February 2013).

by scientists from developing countries and they are less frequently quoted compared to those by researchers from leading countries. Most African, Latin American and Asian countries have an impact that is lower than or equal to 0.5, whereas North America reaches 1.4 and the European Union, 1.0 (The Royal Society 2011). On the other hand, it is interesting to note that the growing availability of means of communications has led to an increase in international cooperation in scientific research, particularly in the production of referenced papers in international journals. Co-authorship, which brings together researchers from at least two different countries, only accounted for 10 % of research in 1988, but this number had risen to 30 % by 2006. This figure reaches 36 % among the EU member countries and an average of 46 % in terms of collaboration including researchers from developing countries, e.g. more than 50 % for Africa and Chile, more than 60 % for Cuba and more than 80 % for Vietnam, Costa Rica or Senegal, overcoming the isolationist constraints linked to the number of researchers and poor investment, by making optimum use of scientific cooperation. Since major emerging countries like Brazil, India and China have objectively less need for it as they can count more easily on their own resources, the percentage of international collaboration only amounts to 20–25 % (The Royal Society 2011).

The opportunity afforded by international scientific cooperation means that researchers engaged in joint projects should have similar levels of education. This is still rarely the case. Such discrepancies between the regions of the world are especially evident in the comparatively low percentage of researchers with a PhD or even a Master's degree. Inevitably, this is reflected in the level of scientific skills and the capacity to participate in research. To draw a comparison, in 2011, Latin American countries as a whole delivered 29,613 PhDs,[7] the United States delivered 67,716 [i.e. one-third of the world's total according to *The Economist* (2010)], Brazil 11,314 and Mexico 4,167. There were only 1,504 PhDs delivered in Argentina, 369 in Chile and 208 in Colombia, which are nonetheless among the most scientifically recognised countries on the South American continent. Europe produces more than 90,000 PhDs each year (Eurostat 2007) and Germany 20,000, whereas Swiss universities alone attributed 3,566 PhD titles in 2010[8] for a population of 7.8 million. In other regions of the world, statistics also shed light on this issue: the figure in China has exploded, with an increase from 2,556 PhD graduates in 1992 to 23,446 in 2008 (Nerad 2010), India produced around 5,900 science, technology and engineering PhDs in 2004, a figure that has now grown to some 8,900 a year (Cyranoski et al. 2011). And there were 1,200 new PhDs in South Africa in 2009 (MacGregor 2009). Like with other indicators, this overview shows that there is consistent and strong growth among the most dynamic emerging countries, but there is also a continuing gap among industrialised countries and the vast majority of emerging and developing countries, with the notable exception of China.

[7] http://www.ricyt.org/ (Accessed 13 February 2013).

[8] http://www.bfs.admin.ch/bfs/portal/fr/index/themen/15/08/dos/blank/15/03.html#ExcelDateien (Accessed 13 February 2013).

5 International Scientific Mobility and Diasporas

Even though the context described above reflects some complexities and challenges that reveal an uncertain panorama in terms of overcoming global disparities, the value that knowledge holds for competitiveness and progress persists as something irrefutable. This prompts us to reflect on the possible alternatives to increasing efficiency in the production of knowledge and the means that facilitate its distribution and make its use fairer for the benefit of the less advanced countries. While science and the production of knowledge are increasingly dependent on international relations and exchanges, scientific collaboration has become an indispensable mechanism for the advancement of countries. In science terms, the current context has consolidated a broadening of the focus from national perspective to a global one, and this has been reinforced by the persistence of a new paradigm at a conceptual level, advocating cooperation and the creation of links that move beyond the traditional confrontation view of the centre–periphery focus (Tejada 2012). However, it should be pointed out that the academic and scientific internationalisation that characterises this context, in which new poles of science have emerged in the world, has not escaped from the competition between countries and research and higher education institutions as they seek to attract foreign talent (Tremblay 2005; Mosneaga 2014). Indeed, this competition has paradoxically increased at the same time as international cooperation has augmented.

The actions undertaken by scientists, academics and students originally from the countries of the South but living in the North offer new dimensions for cooperation between world countries and regions. Although development at a global level requires the effective transfer of knowledge from the areas or regions where it is in abundance (developed countries) to regions where it is scarce (developing countries), current migration flows of skilled people generally go in the opposite direction—that is, from South to North, as part of the total migration from developing to developed countries, which is in fact the fastest growing component of international migration (Özden et al. 2011a). Whereas OECD countries registered a twofold increase in the number of immigrants from developing countries with a third-level education between 1990 and 2000, there was only a 20 % increase in the number of immigrants with a primary education (Özden et al. 2011b). For the developing countries, this is a major concern because a reduction in their knowledge bank hinders their competitiveness. From the UNESCO viewpoint, Hollanders and Soete (2010) stress the gravity of the ‘exodus’ of human capital suffered by developing countries and its interrelated challenges, but they also point out the central role increasingly played by diasporas in innovative actions of technology transfer and knowledge spillover.

This vision is part of the perspective that emerged in the 1990s and which considers that skilled migrants tend to establish links with their home countries, acting as bridges to make contributions in the form of knowledge transfer, investment links or diaspora networks. Over the last few decades, this view has led to a change of focus within two areas mostly. On the one hand, the area of public

policies reflected in the growing interest of countries to implement innovative mechanisms that promote the transfer of the knowledge and other resources of their emigrated scientists and skilled professionals and which they no longer see as an irreversible loss. On the other hand, within the field of research, where more and more studies seek to provide empirical evidence of the determinants that are necessary to ensure that diasporas can have a positive influence on the development of their countries of origin. Several world examples have shown how skilled migration can lead to a reinforcement of the scientific and technological capacities of the countries of origin. One such instance is that of Indian and Chinese skilled professionals and technicians residing in the USA who encouraged knowledge, technology and investment linkages during the 1990s through their well-organised activities, contributing to a strengthening of their countries' scientific and technological competitiveness (Saxenian 2005, 2006). The case of Colombia shows how scientific collaboration promoted by Colombian researchers around the world has contributed to a reduction in the isolation of the local scientific community and a reinforcement of their capacities (Tejada 2010). Other cases have shown how countries with limited scientific capacities and resources have implemented programmes that focus on using the skills and experiences of the diaspora to fill knowledge and skill gaps, by engaging them in temporary return schemes. For example, the programme for the temporary return of Moldovan scientists and young researchers put in place recently by the International Organisation for Migration (IOM) in collaboration with the Academy of Sciences of Moldova (ASM) has helped to strengthen the links between Moldovan scientists abroad and the local scientific community, thereby increasing the international competitiveness of Moldova (EU, ASM, IOM 2012).

The term scientific diasporas was coined as part of this view (Barré et al. 2003) to refer to networks of emigrated individuals, scientists, engineers and professionals, who are mainly involved in producing and circulating new knowledge and creating cooperation opportunities with the country of origin, primarily within the areas of science, technology and academia. As knowledge communities (Foray 2004), scientific diasporas act collectively in organised systems or scientific networks, allowing the production of knowledge through decentralised cooperation procedures and encouraging the exploitation of its benefits. Here, the logic of diaspora connectivity based on the multiplier effect of the personal interest to participate in a community action is essential because it facilitates collective influence in the country of origin (Meyer 2001, 2011). Even though discussions of the scientific diaspora option occasionally include a strong regulatory component that can complicate its harmonisation with a broad vision that seeks to clarify the complexity of the processes of scientific mobility and the transfer of knowledge between the North and the South, the recognition of the flows of human capital as a part of the moral universalism of science is never called into question. As Caloz-Tschopp (2010) points out, the mobility of human capital cannot be confined to a purely utilitarian vision of the free movement of economic factors in terms of ends and means.

6 Cooperation and Scientific Mobility Between India and Europe

International cooperation has experienced a significant rise in recent years. This can be seen in the proliferation of scientific articles co-authored by researchers from institutions in different countries, a trend that is more significant for emerging and developing countries in view of the fact that in the last decade they have witnessed a greater increase in the number of countries with which they collaborate than that seen in developed countries (Vincent-Lancrin 2006). Despite the intensification of international cooperation between developed and developing countries, there are still many questions that need to be answered about the effects of this cooperation on scientific mobility and on diaspora knowledge transfer.

Taking the case of India and its relations with Europe as an example, we explore some determinants channelling knowledge transfer for the purpose of strengthening local research and knowledge capacities. Based on qualitative interviews with key informants as well as Indian students, researchers and skilled professionals who either live in Europe or who have returned to India, we try to identify some of the elements that facilitate the transfer of the knowledge of both the diaspora and returnees. A total of 30 in-depth interviews were conducted between 2011 and 2012 with scientists, skilled professionals and doctoral students from India living in Europe; beneficiaries of scientific collaboration programmes with India; and representatives from the embassies and consulates of France, Germany, the Netherlands and Switzerland in India. Four European countries were chosen as destination countries in the study, and India was selected as the country of origin. An analysis of these experiences is useful in terms of outlining trends on skilled migration and fostering public policies that promote the capitalisation of diaspora resources for the benefit of greater knowledge and improving science and research in developing countries.

India is a paradigmatic case in this discussion given its extreme inequalities in many social and economic dimensions. While the country has achieved a relevant world position in terms of economic growth and scientific and technological innovation, the other side of the coin shows huge disparities in education levels, an adult illiteracy rate no lower than 30 %, and the majority of the Indian population lacking a decent education (Drèze and Sen 2013). With about 4,000 organisations dedicated to research and development, important systems of organised knowledge production and millions of persons involved in knowledge-based activities within a selection of areas ranging from agriculture to the most specialised industries, together with the fact that the country boasts an immense diversity of natural resources, the opportunities of the potential results are immense (Banerjee 2009). Vincent-Lancrin (2006) measures international scientific collaboration by looking

at the number of countries with which scientific articles are co-authored,[9] and his analysis shows that India saw a 12 % increase in international collaborations, and the number of countries with which it collaborated rose from 90 to 101 between 1994 and 2001. Other emerging countries such as China, Brazil and South Africa witnessed more significant increases: Brazil went from 85 to 102 (20 %); China from 78 to 103 (32 %); and South Africa from 58 to 95 (63 %).

India plays an important role in the production of knowledge in science and technology at a world level, and despite contributing only 2.32 % to the world production of scientific publications, it occupies 10th place worldwide and there is a particular emphasis on physical sciences, life sciences, health sciences and engineering (Mehra and Pohit 2013). The country occupied third place in world terms among the countries that do not belong to the OECD, after China (6.50 %) and Russia (2.33 %) in 2008 (Banerjee 2009). The regions of the world with which India collaborates most are Europe and North America, which respectively account for 43.54 and 42.47 % of all its international collaborations.[10] In the order of importance, the countries with which it has the most collaborations are as follows: United States (37.3 % of the total), Germany (13.94 %), the United Kingdom (12.88 %), Japan (10.11 %), France (7.50 %), Canada (5.64 %), Italy (4.33 %), Australia (3.83 %), the Netherlands (2.98 %) and Switzerland (2.81 %). During the period between 1997 and 2007, India saw an increase in publications co-authored with Switzerland, Germany, France and the Netherlands, which are the four countries that we studied in the research that has produced this volume.

Cooperation strategies in science and technology between Europe and India have inspired various types of measures promoting bilateral collaboration. These are based on a focus that has gained strength in recent years and which will prevail in the future. This focus is based on three premises. First of all, confirmation that cooperation with India should be based on the establishment of partnerships among equals. The Minister Counsellor, Head of Science and Technology at the Delegation of the European Union to India in Delhi made a reference to this when he said: 'It is not the rich helping the poor, but it is actually two countries in different situations helping each other for something that is good for everybody' (P. de Taxis du Poet, personal communication, 14 September 2011).

Secondly, assessments of the mobility of human capital and the importance of implementing provisions that stimulate the exchange and circulation of students and researchers in both directions.

> If you want to build cooperation, it is very important to invest in people. I mean not only Indian students, researchers and professors willing to go to Europe, but also European students and researchers coming to India, because they will have a sort of inside knowledge which is important to build cooperation. (P. de Taxis du Poet, personal communication, 14 September 2011)

[9] With the database of the Institute for Scientific Information, Science Citation Index and Social Sciences Citation Index, CHI Research Inc.; and National Science Foundation, Division of Science Resources Statistics.

[10] Measured by average of co-authored scientific articles between 1997 and 2007.

Thirdly, bilateral scientific programmes promote collaboration in a complementary manner on the understanding that having high-level international partners with whom to pair the research work is essential in terms of ensuring that scientists and institutions receive mutual benefits. A lecturer in plant molecular and cellular genetics in Kolkata referred to this by saying:

> These days, research has become very competitive and technology more advanced. It is not always possible to find so much expertise in one person; you cannot be an expert in all fields. In India we do not have such advanced technology, and facilities and international exchanges are crucial.

Using scientific cooperation between India and Europe as our framework of study, we look at three basic determinants that influence how international cooperation, and the mobility of human capital linked to it, makes it possible to transfer the knowledge and other resources of the diaspora. These determinants are as follows: (1) institutional cooperation mechanisms; (2) the diasporas' transnational collaborations; and (3) the motivation of scientists and skilled professionals abroad to contribute to their country of origin. The following section examines each of these.

6.1 Institutional Cooperation Mechanisms

Bilateral collaboration agreements are one of the formal cooperation mechanisms currently being used by India and the four countries of this study. These have a particular relevance since they facilitate the development of cooperation at an institutional level among various universities and research centres in Europe and India, and they promote scientific and academic exchanges in areas that are of priority for the two signing countries. With Germany, there is the German–Indian Science and Technology Cooperation Agreement (STC), which has been in force for more than four decades and which consists of scientist and student exchanges, the launch of joint research projects and the organisation of workshops, conferences and reciprocal visits; these are promoted through the German Academic Exchange Service (DAAD), the Alexander von Humboldt Foundation and the German Research Association (DFG).

With Switzerland, the bilateral agreement on science and technology, signed in 2003, reinforced the existing dialogue between both countries and it established specific collaboration mechanisms. The Indo-Swiss Joint Research Programme and the Leading House of India established at the Swiss Federal Institute of Technology in Lausanne (EPFL) were created within this framework to foster collaboration research between scientists from both countries, promote exchanges of students and lecturers, facilitate access to specialist equipment and resources in the other country and encourage the transfer of technology between the two countries. Another initiative is the Indo-Swiss Collaboration in Biotechnology (ISCB), which during its four decades of existence has promoted collaboration and

scientific mobility in both directions within several areas of biotechnology, and it has also facilitated the transfer of technology to private industry.

With the Netherlands, the Memorandum of Understanding (MoU) on bilateral cooperation in science, technology and innovation, signed by the Indian Ministry of Science and Technology and the Dutch Ministry of Economic Affairs, guides bilateral collaboration that can have both a scientific focus and a focus more centred on innovation through public–private partnerships (PPP) within the priority areas: life and health sciences, food and nutrition, water and renewable energies. The MoU envisages the inclusion of programmes focused on training at a doctoral and postdoctoral level, which will facilitate scientific mobility.

There are three mechanisms to facilitate bilateral scientific and academic collaboration between India and France: research projects in partnership; exchanges of doctoral students; and the co-supervision of doctoral theses. Both countries recognise that for bilateral collaboration to be successful, it is necessary to facilitate the mobility of scientists and students. In this regard, they highlight the MoU of the Indo-French Educational Exchange Programme, as well as the Indo-French Consortium of Universities, which promotes student mobility within the framework of academic training, with the diplomas recognised in both countries. The Indo-French Center for the Promotion of Advanced Research (CEFIPRA) is a good example of an institutional mechanism that promotes collaboration between France and India. Centred on the promotion of bilateral scientific cooperation in basic sciences, start-of-the-art technologies and exchanges of scientists and researchers, CEFIPRA came about as an institutional response to the interest of scientists from both countries to collaborate. During its more than 25 years of existence, and with an annual production of about 100 publications in high-impact journals, it has become a successful model of scientific cooperation in science and technology, helping to strengthen the critical mass and facilitating the mobility of scientists and students between both countries.

We can observe that all these institutional mechanisms are based on the notion of the value of international exchanges for scientists and the advancement of science. The previous examples include structures that facilitate the mobility of scientists and students, which are common when the aim is to strengthen academic links and promote alliances within the field of international cooperation. While the return to the country of origin is seen as a part of the mobility process, this does not usually occur in practice due to a combination of personal reasons and the contextual structural factors of the countries involved. Reality shows us that even though research institutions in India stipulate that young researchers should have international experience before being contracted as faculty members, in the end they often do not have either the mechanisms or the suitable conditions required to attract them back and take advantage of their overseas exposure. The Director of CEFIPRA said:

> They must go out somewhere, learn research and teaching, gain experience spending some time out of the country, and only then come back. When thinking of brain gain, you must think about some mechanisms whereby you can give good facilities to scientists and some freedom and independence, so that they can come back and work here. (A. Amudeswari, personal communication, 16 September 2011)

We observe that the difference between the Indian Institutes of Technology (IITs) and the universities with regard to being able to offer attractive conditions places a limit on a balanced distribution among the various academic and research institutions in India of the scientists who return. Young Indian researchers want to return to the country with a permanent job that can offer them a good level of infrastructure, an adequate salary and sufficient resources, as well as freedom in their research tasks. They generally find this at the IITs but not at the universities. However, while the number of places at the IITs is limited and the competition is tough, the universities cannot provide the attractive conditions that the best candidates are looking for. The unbalanced distribution of scientists who return to academic and research institutions in India (mostly between the IITs and other selected top research centres, and all the rest) is linked to a broader and more complex problem related to the higher education system. As Drèze and Sen (2013) argue, the difference in the quality of the higher education offered by specialised institutions such as the IITs and Indian universities with regard to academic arrangements, facilities and salaries lies in the deficiencies of the Indian education system.

Institutional mechanisms tend to favour research conditions in India, and the scientists recognise this advantage. One lecturer at the Bose Institute in Kolkata referred to this point: 'This programme gave us a good amount of funds to purchase reagents, chemicals and instruments and develop our lab facilities. Only with such facilities can we pursue the type of work we are doing; otherwise it would not have been possible'.

However, comparing the contexts of European countries and India in relation to infrastructure conditions and practices during the research process, the Indian scientists who have returned see significant differences with regard to access to available financing. One assistant lecturer at IIT Delhi said: 'Resources are way ahead in Germany…. I will not say that India does not have money, but you have to be really choosy about the subject you work on; it has to be of national importance and only then do you get grants'.

6.2 Diasporas' Transnational Collaborations

The recognition of migrants' involvement in more than one context and belonging to several places at the same time has made transnationalism a common theoretical framework in recent studies on migration and its linkages to development (Portes 2001; Vertovec 2004). Appraising the connections with communities of origin that span borders, the study of diaspora transnationalism addresses migrants' involvement with their places of origin through sociocultural activities, economic ventures and diverse forms of collaboration as a response to their long-distance obligations with their home country (Levitt 2001). Diaspora transnationalism is influenced by several factors such as individual profiles of the migrants, their activity in the host country, their length of stay abroad and their reason for emigrating, as well as their plans to return to the home country.

In the case of skilled Indians living in Europe, we observe that they tend to cultivate their transnational links with the country of origin through different types of practices, encouraging scientific and academic collaboration. On the basis of their testimonies, we can see that the scientific links that they maintain with the scientific and professional community in India are mostly oriented towards two objectives: promoting collaboration and preparing their eventual return. As far as the first of these is concerned, we can see that India's professional and scientific community can access contact networks and increase its chances of establishing international collaborations, thanks to the transnational actions of the Indian diaspora. An assistant lecturer at IIT Delhi referred to the importance of creating networks and participating in them: 'Networking is always beneficial and equally important, whether it is Germany or India; the more you network, the more types of collaborations you have.'

We also see that the professional contacts acquired by skilled Indians abroad through scientific and academic exchanges usually intensify during the international exposure attained through participation in international conferences, and this can result in the establishment of alliances. A researcher at CERN in Geneva mentioned: 'Through international conferences and through journals we get to know each other, expand our networks and then become research partners.'

Furthermore, for the purpose of establishing collaborations of several types, the close relations created between teachers and students in India before the latter go to study or take up internships abroad are maintained and perpetuated over time. A lecturer at the Bose Institute in Kolkata referred to this saying: 'Seven postdocs are under my supervision in the USA now. Students who go abroad and stay there keep in touch. I have had strong collaborations with some of them. We keep writing papers together.'

With regard to the second objective, we observe that because of the motivation of the students and scientists to return to India, once they have completed their term abroad, they have a strong perception of the importance of maintaining personal and professional relations throughout their academic and scientific path in order to be able to position themselves professionally in the face of the opportunities that they may be offered there in the future. Skilled Indians abroad strategically invest their time and resources in creating networks and connections which could turn out to be important for their future return. One young assistant lecturer at IIT Delhi referred to this by saying: 'When I was in Germany contacts were made through emails with my previous professors in India and they provided me with professional advice about where should I apply. They were all guiding me to follow opportunities.'

Preparing for return is important since, as the empirical evidence on return migration has shown, it facilitates the ability to mobilise resources and stimulates the possibilities of the return to the country of origin being successful (Cassarino 2004; Sabates-Wheeler et al. 2009). As argued by Portes et al. (1999), transnational links in the form of collaborations, knowledge transfer and the transfer of other resources facilitate the migrants' reintegration into the society of the country of origin upon their return.

Group mobilisation and structures in the form of networks and associations are considered to be necessary conditions for the promotion of the diasporas' collective transnationalism and for increasing the potential impact and durability of their actions over time (Saxenian 2006). We observe that skilled Indians in Europe do not usually participate in migrants' organisations or diaspora associations which could boost the scale and impact of their actions to transfer knowledge. There are different reasons for this. The expansion of globalisation has made it easy for Indian migrants to feel close to their home country without having to meet up with other fellow nationals, as was the case in the past. Also, the temporary nature of their residence in the countries of destination in Europe, a lack of time and a lack of individual interest to get involved in community activities, together with the notion that their commitment to organisations or associations of this kind is going to prevent them from experiencing the culture of the country of destination are all factors that influence their reluctance to participate in organised communitarian activities aimed at their home country.

A doctoral student at the University of Lausanne referred to the diversity of the initiatives of Indians in Switzerland in the following manner:

> There are collective efforts as a 'we', the Indian diaspora, feel we should contribute there. (But) I think individually it is very diverse; it depends on the person. There are many individual initiatives; people do things and contribute to their family, their village, their neighbourhood or other things like that.

The observation of the testimonies of skilled Indians in Europe indicate that they deliver access to social and professional contacts as well as scientific and institutional connections with India and these open up cooperation opportunities for the local scientific community. Furthermore, through their collaborations, they seek to assist the development of science in their home country, reinforcing the educational system and strengthening its international scientific position. Assisting Indian students and young researchers (mostly those who cannot afford to go abroad), taking advantage of their own international networks and exposure for their research endeavours is another way that skilled Indians in Europe can contribute. Nevertheless, we see that knowledge transfer though transnational collaborations remains at an individual level for the most part and it lacks any collective associative type of organisation or network, and therefore, the efficiency to create and impact the sustainability of this type of actions is not ensured overtime. Other country case studies have shown how the members of the diaspora make an abundance of social capital available (Bourdieu 1986) by implementing collective action. This comes from the contacts, social and professional relationships and scientific and institutional links that are built. However, it should be pointed out that the availability of resources linked to these connections does not in itself ensure their positive impact. As Bruggeman (2008) pointed out, cohesion, social support and a favourable environment all play a role in determining that the creation of contacts and social networks generate benefits.

6.3 Motivation of the Diaspora to Contribute to the Country of Origin

The affective capital of migrants is understood as both a feeling of attachment to the home country and as a desire to participate in its progress (Tejada and Bolay 2010). Skilled Indians abroad attach importance to India's regional and national development, and they feel their overseas exposure can benefit India in one way or another. In specific terms, Indian scientists, students and skilled professionals who are active in the academic and research sector feel an attachment to India through their scientific and academic activity and they think that the best way to contribute is by addressing themes and questions in areas that are significant for India's development and by getting involved in research projects that link Indian institutions. A researcher based in the Netherlands said: 'I am currently researching renewable energy development in India. All my research here has been focused on development issues in India.'

In their pursuit to promote the transfer of knowledge, skilled Indians in Europe contribute through different types of collaborations through which they hope to be able to create benefits for Indian researchers and scientists as well as for the local society. A postdoctoral researcher at EPFL in Lausanne referred to this when she explained: 'The best way to help people in India is by working with people there. You make progress because you have the technology edge here and you get things done with people there, providing them with employment, and improving access to the high facilities that we have here.'

The affective capital of the Indian diaspora is also channelled through the provision of information about opportunities for training scholarships and internships at foreign institutions. Indians see this as a way of boosting the local critical mass and contributing to a strengthening of the country's scientific presence in the world. Skilled Indians also appreciate the complementarity of these collaborations, from which they also benefit. One researcher in biomedicine at the University of Lausanne explained:

> Facilities here might be easier to get to than in India, whereas India has manpower resources and raw materials. In immunology, you would never get the type of background, patient and samples that you get there over here. So I think that trying to set up mutually beneficial collaborations would be a great way to engage with India.

Our research also brought to light the plans of skilled Indians in Europe to return to the home country as part of their aspirations to contribute to the development of India. Imagining the possibility of contributing through their return is especially clear in the testimonies of students and young researchers who feel a commitment to transfer the knowledge they have acquired abroad to their community by going back there and helping to build capacities and improve education and research systems in India. An associate professor at IIT Delhi who returned to India after doing a doctorate in Switzerland said: 'I went abroad to learn something

useful, something meaningful and I wanted to implement those things in India, and that is one main reason that I wanted to come back.'

The observations of the testimonies of the skilled Indians in Europe show that there is a high level of motivation to aid home country development, and migrants make specific efforts to implement individual knowledge transfer actions. We can see that institutional mechanisms for cooperation and transnational collaborations together with high development aspirations help to channel the knowledge and other resources of skilled Indians abroad. However, further research is necessary in order to examine the concrete level of impact generated in the Indian context and to see whether the local society does actually benefit from these practices.

7 Conclusions

As we have attempted to demonstrate, there is a strong link between social and economic development and globalisation, and for old and emerging economies alike, this process is greater and more complex than opening up new markets. It is also characterised by the expansion of new technologies that ease the transfer and exchange of information, and by an acceleration of international migration. Against the backdrop of this more open economy, emerging and developing countries are acquiring new positions. In this reorganisation of the world, knowledge and education—which UN institutions see as two key elements of growth and development—will be two fundamental criteria of success. If all the layers of the education system are considered as important for the global progress being pursued by national governments, international institutions place their main emphasis on elementary education and the completion of primary schooling, knowing that we still have more than 700 million illiterate people in the world today. Even if the MDGs are not achieved by 2015 (as planned in 2000), advances have been made and the efforts have to be pursued. They form the basis of a more consistent involvement by emerging and development countries in scientific and technological production. While knowledge-based economies are the engine of innovation and economic growth and will increasingly continue to become so, they may also represent a new barrier between world countries and regions.

We have shown here that investment in higher education, research and innovation represents a huge expense and requires a series of efforts between states, international bodies and the private sector. However, even though the share that public budgets devote to R&D is increasing and the number of researchers in the world has also risen sharply, benefitting developing and emerging countries mostly, there is a need to avoid new forms of marginalisation so that least advanced countries with only 0.5 % of the total number of world researchers, limited scientific strengths and a low level of education will be able to follow this trend.

While arguing about the means that are conducive to disseminating the distribution of knowledge and broadening its content for the benefit of developing

countries, we placed researchers and scientists from the diaspora centre stage. Despite the intensification of international cooperation between developed and developing countries, there are still many unresolved issues about the effects on scientific mobility and the transfer of knowledge from the diaspora for the benefit of the home countries. Yet, the position held by scientists and students from the South living in the North and their transnational actions offers new dimensions for cooperation between developed and developing countries. In this chapter, we seek to contribute to the reflection on scientific cooperation between the North and the South, and taking India as a case in point, we set out to get a better understanding of some of the factors that influence the transfer of knowledge from skilled Indians based in Europe to their home country.

The analysis presented here looks at three interrelated determinants that channel the transfer of knowledge between Europe and India: institutional mechanisms for cooperation; diaspora transnational collaborations; and the aspirations of skilled Indians abroad towards the development of India. We have shown that institutional cooperation strategies in science and technology between Europe and India have inspired various types of measures promoting bilateral collaboration, such as scientific and academic exchanges in areas that are of priority for the two signatory countries. We found that while return to the home country is considered as part of the mobility process of Indian scientists in such structures, this does not necessarily occur due in practice to a combination of personal reasons and structural contextual factors. More often than not, Indian institutions do not have either the mechanisms or the adequate conditions to lure them back.

In terms of transnational cooperation, it becomes evident that the linkages of the Indian scientific diaspora with the scientific and professional community in India are mostly oriented towards two objectives: promoting collaboration and preparing an eventual return. Through their links with the home country, skilled Indians abroad provide the local community in India with access to social and professional contacts and with the scientific and institutional connections they have acquired and strengthened during their overseas exposure, and this influences the propensity to launch new cooperation opportunities. However, the availability of resources linked to these connections does not in itself ensure their positive impact. Furthermore, this type of knowledge transfer remains mostly at the individual level and lacks an associative type of organisation or network which has been shown to be necessary to ensure the durability of the cooperation and the impact overtime. Finally, our research sheds light on the interest and aspirations of skilled Indians abroad to contribute to the progress of India. While skilled Indians' motivation towards home country development is high and they also deploy efforts to implement knowledge transfer actions, further research is needed in order to verify the level of correspondence between transnational cooperation actions and the actual impact generated in the Indian context.

Our findings point to an interrelation between the three determinants that channel knowledge transfer and they let us anticipate a trend whereby scientific diasporas become carriers of knowledge for their countries of origin in the South and promoters of alternative research agendas in the host countries of the North.

Nevertheless, the ability to reap the potential benefits of skilled migration and increase the scientific and knowledge capabilities of the home countries varies according to both the structural context and local environments and the resources that skilled migrants count on. While this option cannot obviously be simply interpreted as a result of a North–South division, it is true that it is influenced by important cross-cutting global disparities. An important task that lies ahead is to promote a fuller understanding of the decisive factors that enable concrete benefits for the local society in developing countries as a consequence of the transfer of the knowledge of the scientific diaspora, considering the multiple dimensions of international migration and the complexity of global challenges.

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