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Scientific research standards and policies: scientific mobility in America

Políticas y normas de investigación científica: movilidad científica en America

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Content

ABSTRACT:
Science is international by nature. Scientific exchange of researchers and international mobility is important in quality of research output and hence its relevance and efficiency in solving general everyday societal life problems (Marcio L. Rodrigues, Leonardo Nimrichter, Radames J. B. Cordero, 2016). This paper discuss the scientific research policies and standards then narrows down to one of the major developing trends in the latter, scientific mobility in America.
Keywords Standards, Policies, Mobility, Research.

RESUMEN:
La ciencia es internacional por naturaleza. El intercambio científico de investigadores y la movilidad internacional es importante en la calidad de la producción de la investigación por lo tanto relevante y eficiente en la solución de los problemas generales de la vida cotidiana de la sociedad (Marcio L. Rodrigues, Leonardo Nimrichter, Radames J. B. Cordero, 2016). Este artículo discute las políticas y normas de investigación científica y para concluir una de las principales tendencias, la movilidad científica en América.
Palabras clave Normas, Políticas, Movilidad, Investigación

1. Introduction

Although not considered to be formal laws within society, standards still work to promote a great deal of scientific research control. They are statements that regulate conduct. The cultural phenomenon, that is the norm, is the prescriber of acceptable behavior in specific instances (John, 2016). Ranging in variations depending on culture, race, religion, and geographical location, it is the foundation of the terms, some know acceptable, as not to injure others, the golden rule, and to keep promises that have been pledged. Without them, there would be experimentations without consensus, common ground, or restrictions (Korku Ayenyo, et al., 2015). Even though the societal laws and a state's legislation is not intended to control but regulate the research standards, the society, which is involved in a large part, and the law are inherently linked and one dictates the other.

The language used in some legislation is controlling and dictating for what should or should not be accepted. The language surrounding these laws conveys the message that such acts are supposedly immoral and should be condemned, even though there is no actual victim in these consenting relationships. This applies in the research community. As research is done on the people for their benefit, there are rules guidelines and standards that aim at ensuring that both parties are protected from harm, both physical and emotional, as a result of the research proceedings.

For example, bioethical thinking, initiated against well known cases of disregard to human dignity and rights in research involving humans, became institutionalized in the Europe and USA in the form of standards, regulations and corporate bodies, such as committees and commissions entrusted with their interpretation and application. This is as a result of the fact that translation of research evidence into public policy, demands that researchers be aware of their role in the globalized scientific community and interacts with their peers internationally at a comparable level of competency.

On the other hand, policies are deliberate systems of principles that are set to guide decisions and achieve rational outcomes. Or rather, a policy is a statement of intent, and is implemented as a procedure or protocol. Policies are generally adopted by the Board of or senior governance body within the research community where as procedures or protocols would be developed and adopted by senior executive officers in the field's regulation body. Policies can assist in both *subjective* and *objective* decision making. Policies to assist in subjective decision making would usually assist senior management with decisions that must consider the relative merits of a number of factors before making decisions and as a result are often hard to objectively test e.g. work-life balance policy for those involved in research work assistance. In contrast policies to assist in objective decision making are usually operational in nature and can be objectively tested e.g. password policy.

Research policies provide a framework to ensure that the research programs in an institution or a region are relevant, necessary, efficient and effective. They are also tailored to create transparency and uniformity in research planning, implementing and monitoring research processes. The policies clearly maps out the processes of identifying and prioritizing the research needs and initiating research projects; procedure for preparation and approval of the research proposals; guidelines for identifying funding sources and modes of acquisition; mechanisms for project monitoring and control; dissemination of research results and evaluation of research effectiveness and impact.

Some of the major reasons for setting up research policies are to describe the factors such as relevance to national as well as international objectives for development, research project's necessity to bridge the knowledge gaps in the society that hinders technological advancements and to advance the utility of existing technology (Marcio L. Rodrigues, Leonardo Nimrichter, Radames J. B. Cordero, 2016). The policies also ensure that the objectives of the research project are successfully and objectively met with minimal use of resources available; this translates to the efficiency of the project design. To add on top, the policies also aid the effectiveness of research which is evaluated in terms of its potential to achieve the desired results in satisfying the national objectives as well as the adoption and application of research findings in solving problems in the society (John, 2016). The following section describes briefly on the fundamental hallmarks of a good research policy.

1.1. Content of research policies.

Generally policies are typically promulgated through official written documents. Policy documents often come with the endorsement or signature of the executive powers within the research community to legitimize the policy and demonstrate that it is considered in force (Nakamura, 1987). Such documents often have standard formats that are particular to the research community board of regulation issuing the policy. The policy documents usually contain certain standard components including:

- A purpose statement, outlining why the organization is issuing the policy, and what its desired effect or outcome of the policy should be.
- An applicability and scope statement, describing who the policy affects and which actions are impacted by the policy. The applicability and scope may expressly exclude certain people, organizations, or actions from the policy requirements. Applicability and scope is used to focus the policy on only the desired targets, and avoid unintended consequences where possible.
- An effective date which indicates when the policy comes into force. Retroactive policies are rare, but can be found.
- A responsibilities section, indicating which parties and organizations are responsible for carrying out individual policy statements. Many policies may require the establishment of some ongoing function or action. For example, a purchasing policy might specify that a purchasing office be created to process purchase requests, and that this office would be responsible for ongoing actions (Núñez, 2014). Responsibilities often include identification of any relevant oversight and/or governance structures.
- Policy statements indicating the specific regulations, requirements, or modifications to organizational behavior that the policy is creating. Policy statements are extremely diverse depending on the organization and intent, and may take almost any form (Núñez, 2015).

Some policies may contain additional sections, including:

- Background, indicating any reasons, history, and intent that led to the creation of the policy, which may be listed as motivating factors. This information is often quite valuable when policies must be evaluated or used in ambiguous situations, just as the intent of a law can be useful to a court when deciding a case that involves that law.
- Definitions, providing clear and unambiguous definitions for terms and concepts found in the policy document.

1.2. Scientific mobility.

Scientific mobility is an emerging trend in the research standards and policies which is encouraged by major regulation bodies in the scientific research societies (John, 2016). The mobility of scientists has been realized to be of great significance since it brings about circulation of knowledge and ideas which, in turn and when applied, results in some sort of transformation. This transformation of knowledge is often to adopt external knowledge to local specifications and usage. In so doing, it engenders a change in the host reservoir of knowledge and affects its knowledge profile in the long run. And hence, this brings change and modification within a locality.

Scientific mobility describes the growing movement of scientists and tertiary students of science around the world. Scientific mobility has, as a part of its function, enhanced scientific expansion and the formation of gravity centers in science (Korku Ayenyo, et al., 2015). Through the mobility of scientists, scientific traditions that are embodied in certain schools or departments expand to embrace other spatial sites of science and include them in their social spaces.

With the rise of the so-called ‘emerging’ economies, research and development are spreading their reach across the globe. Multinational firms are playing an important role in this process. By establishing research facilities in foreign countries, they are fostering knowledge transfer and the accrued mobility of research personnel. Importantly, this phenomenon is a two-way street. Multinational firms from Brazil, the Russian Federation, India, China and South Africa (the BRICS countries) are not only a magnet for foreign multinationals; these firms ‘born in the BRICS’ are also purchasing high-tech companies in North America and Europe and thereby acquiring skilled personnel and a portfolio of patents overnight.

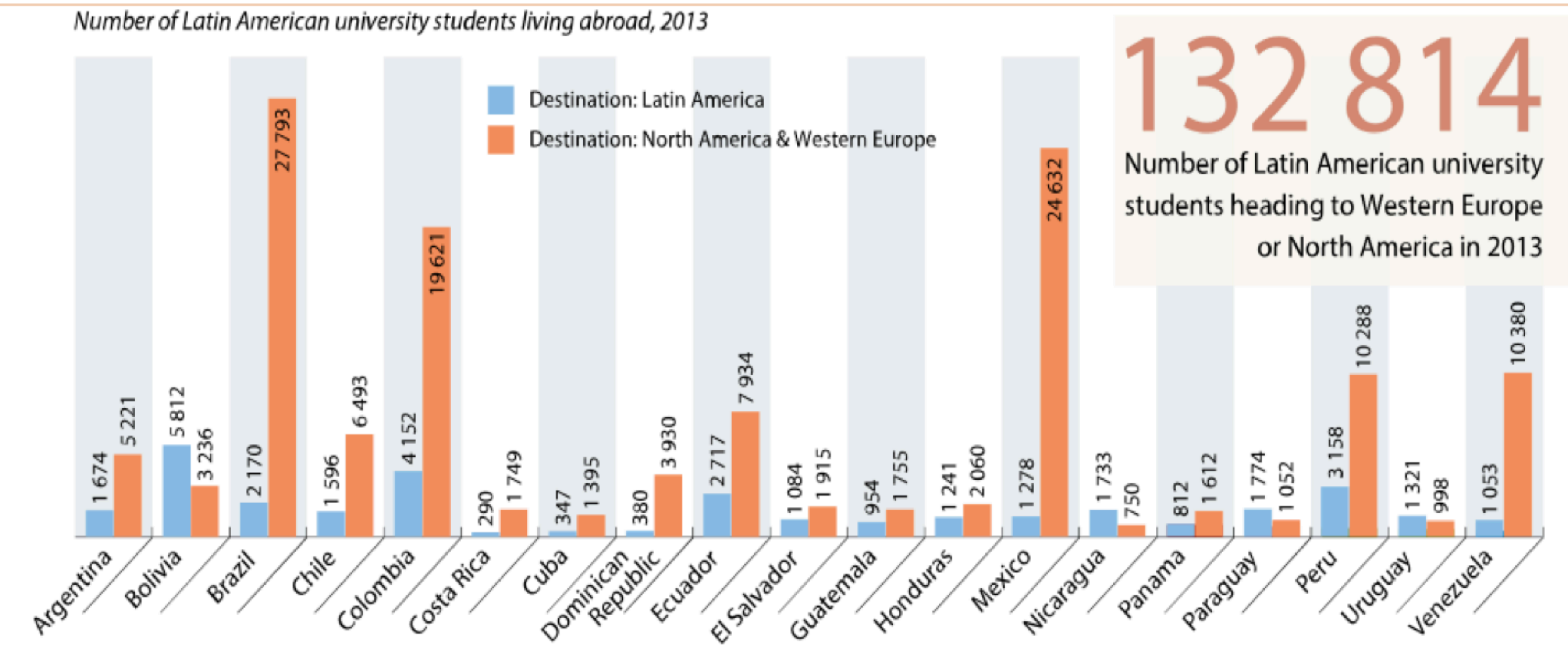
2. Research Findings

A statistical research on international post-doctoral student's mobility was carried out by the UNESCO Institute for statistics on a number of countries including America (Stewart Shannon, Stacy Springs, 2015) and the United Kingdom. The findings were as described below.

2.1. Long-term growth of tertiary-level international students worldwide, 1975–2013.

The recognition of qualifications and studies is one of the principal instruments that contributes to fostering the mobility of persons between countries of Latin America, and that can help in universities and countries collaborations on the continent. The number of international students rose by 46% between 2005 and 2013, from 2.8 million to 4.1 million, according to the UNESCO Institute for Statistics. Many governments are accompanying this movement out of a desire to develop a knowledge economy or maintain their international competitiveness. The United States of America, United Kingdom and France hosted the largest contingents of international doctoral students in science and engineering in 2012 (Stewart Shannon, Stacy Springs, 2015). The United States alone accounts for half of these students (49%), followed by the United Kingdom (9%) and France (7%), Australia (5%), Canada and Germany (4%), Switzerland, Japan and Malaysia (3%). The United States also stands out for the small share of its doctoral students who choose to study abroad, just 1.7%, compared to 12.3% of French PhD students and 18.0% of Canadians [4]. These countries may be the most attractive destinations for institutions in the region among the nationals of each country for a first Latin American exchange compared to other options that cannot be entirely excluded, but that are in the end more costly than exchange among countries of the region.

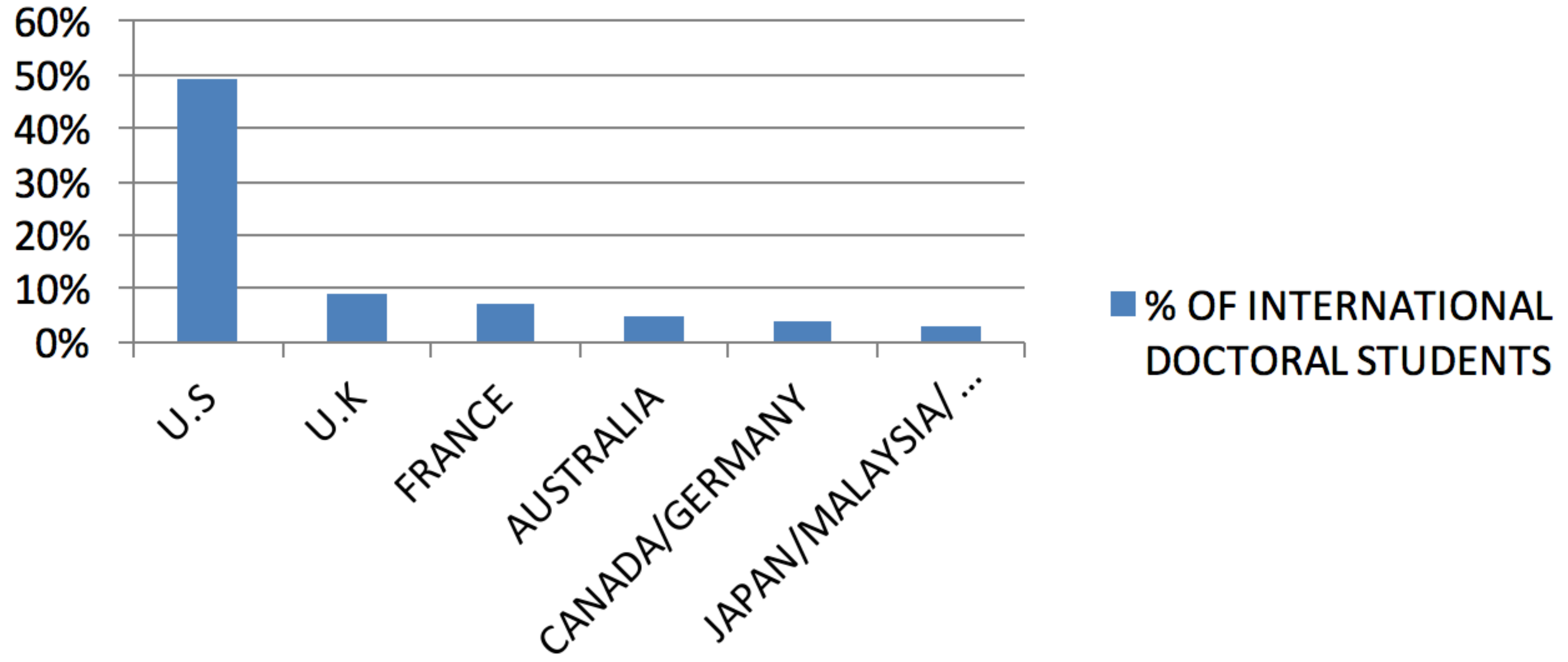
The institutional poles of knowledge production on scientific mobility, in all cases, are a few institutions, for example seven in Brazil. The interests of the researchers are varied, but always-strong lines of inquiry concern the scientific mobility. In Argentina, Brazil and Mexico, researchers generate the knowledge about internationalization. In Chile and Panama, part of the knowledge emanates from official documents, just beginning to occupy space on the national research agenda. Until now, it has been essentially of interest to decision-makers and public policies were centrally aimed at increasing the number of PhDs trained outside and optimizing program management procedures.



Source: For higher education spending and students living abroad: UNESCO Institute for Statistics: for graduates; RICYT database, July 2015; for PhD students per million inhabitants, estimations based on data from the UNESCO Institute for Statistics and United Nations Statistics Division

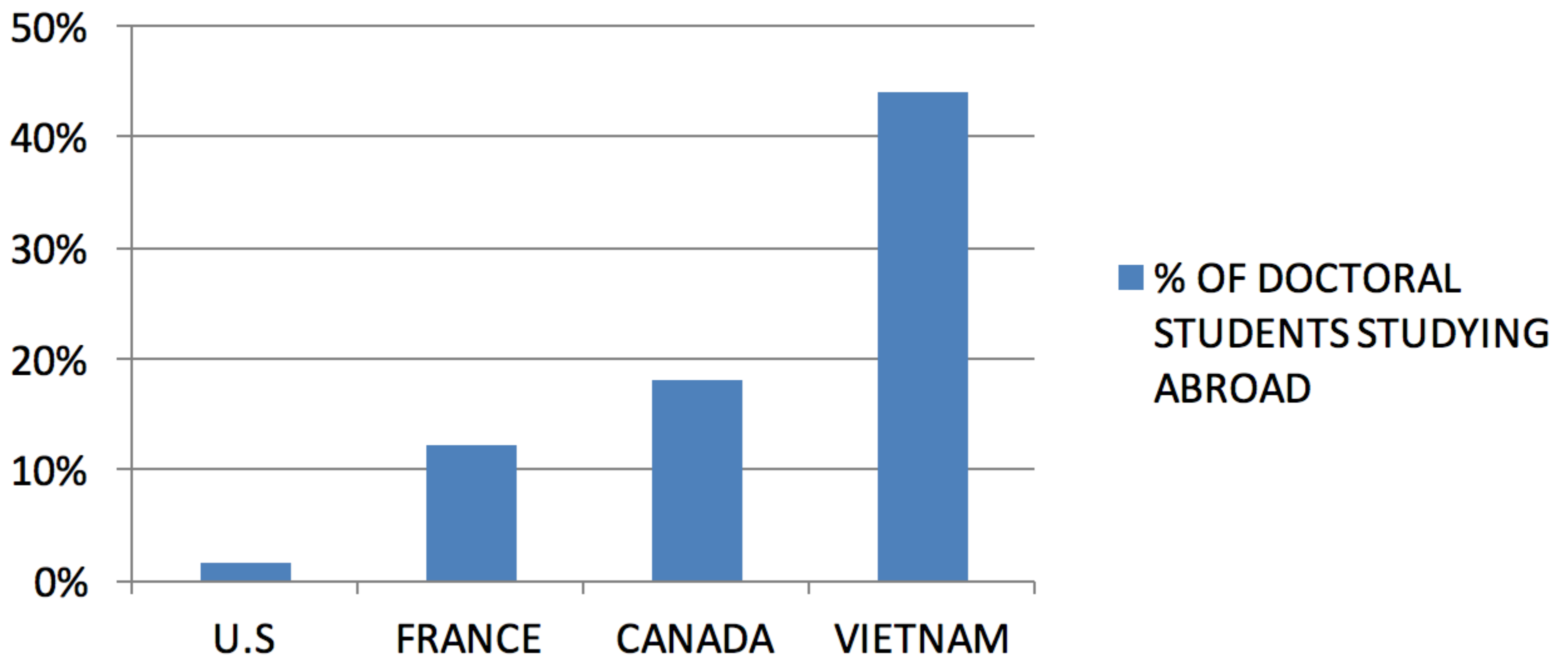
Picture 1. Students head for Western Europe and North America more than other Latin American countries, with the exception of those from Bolivia, Nicaragua, Paraguay and Uruguay, 2013.
Source UNESCO http://unesdoc.unesco.org/images/0023/002354/235406e.pdf

According to UNESCO data, the biggest destination for scientific mobility is North America and Western Europe, this trend is confirmed when we review data for international students in 2012.



Picture 2. Percent of international Doctoral Students in 2012.
Source UNESCO Science Report, data from UNESCO Institute for Statistics

As shown in the figure above, the United States alone accounts for half of these students (49%), followed by the United Kingdom (9%) and France (7%), Australia (5%), Canada and Germany (4%), Switzerland, Japan and Malaysia (3%).



Picture 3. Percent of international Doctoral Studying Abroad in 2012.
Source UNESCO Science Report, data from UNESCO Institute for Statistics

As shown above, The United States stands out for the small share of its doctoral students who choose to study abroad, just 1.7%, compared to 12.3% of French PhD students and 18.0% of Canadians.

2.2. Global distribution of international doctoral students

enrolled in science and engineering fields in 2012.

The great majority of mobile Latin Americans study outside the region (Lemarchand, 2015). There are four exceptions: Bolivia, Nicaragua, Paraguay and Uruguay. In 2013, 132 814 Latin American students were studying in Western Europe or North America, about four times more than in other Latin American countries. The proportion was highest in Brazil, Mexico and Venezuela. Some 2170 Brazilian university students were studying in other Latin American countries in 2013, compared to 27 793 in Western Europe or North America.

In Mexico, 1 278 were studying in Latin America and 24 632 in Western Europe and North America. The figures for Venezuela were 1 053 and 10 380 respectively. Many scientists and engineers have emigrated in the past decade, according to the President of the Venezuelan Academy of Physical, Mathematical and Natural Sciences. In 2013, the Mexican Council for Science and Technology and the Organization of American States created a joint program offering 500 scholarships up to 2018 for postgraduate education in science and engineering, in order to facilitate student exchanges within the Americas.

Brazil's Science without Borders program sent 70 000 undergraduate students abroad between 2011 and 2014. Researchers employed by private companies could also apply for specialized training abroad within this scheme. In parallel, the program sought to attract young foreign researchers interested in settling in Brazil or in establishing partnerships with Brazilian researchers in priority areas. The program was discontinued in late 2015, after the Brazilian economy entered recession.

In Latin America, the new Union of South American Nations has embraced the free movement of goods, services, capital and people around the subcontinent. Modeled on the European Union, it plans to establish a common parliament and currency for its 12 members. Within UNASUR, governments have been discussing the idea of standardizing university degrees in member countries to foster student mobility.

UNASUR members account for some of the most popular student destinations in Latin America, with Brazil attracting about 5000 students a year from the region and Argentina and Chile about 2000 each. Half the students at the Institute for Pure and Applied Mathematics in Rio de Janeiro, for instance, come from abroad, mainly from other Latin American countries – and the 50 teaching staff comes from 14 countries [5].

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3. Discussion

The data shows clearly a rise in the number of students enrolled away from their countries for research studies which depict a rise in knowledge transfer between regions involved (Hans de Wit, Irina Ferencz, Laura E. Rumbley, 2012). For instance Saudi Arabian students who enroll out of their country, move to the foreign regions to study after which they return home with the gathered knowledge to improve their society as well, they share their way of doing things in the host foreign country.

The same is observed in the research and innovation institutes. These organizations are starting to expand their bases of operation to foreign countries. By this, the researchers working in the institutions can be transferred to regions away from their home countries, enabling a mix up of researchers and scientists (John, 2016). This happens in both the private and public research centers. Or rather, there is a culture of on line mobility, were ideas and research findings are shared in on line platforms.

3.1. Work sharing as a form of scientific mobility in situ

The private and (semi-) public agents innovate but their different work cultures affect the way in which the knowledge generated is diffused (Marcio L. Rodrigues, Leonardo Nimrichter, Radames J. B. Cordero, 2016). Traditionally, scientists working in public institutions like universities have been motivated by the desire to establish a reputation that is dependent on openness. Their success depends on being first to report a discovery by publishing it in widely accessible journals, on other scientists acknowledging this discovery and building upon it in their own work (Marcio L. Rodrigues, Leonardo Nimrichter, Radames J. B. Cordero, 2016). This implies that making knowledge available to colleagues and the wider public is a key element of the work of academic scientists.

Scientists working in private firms, on the other hand, have a different motivation. Respecting their employer's interest calls for secrecy and the appropriation of knowledge rather than allowing it to circulate freely (Korku Ayenyo, et al., 2015). The marketplace being characterized by competition, a firm is obliged to appropriate the knowledge that it develops – in the form of goods, services and processes – to prevent competitors from imitating the discovery at a lesser cost (Lemarchand, 2015). Firms use a whole range of strategies to protect their knowledge, from patents and other intellectual property rights to secrecy. Although they will eventually make this knowledge available to the general public through the market, this protection of their knowledge limits its diffusion.

This trade-off between the right of firms to protect their knowledge and the public good is the basis of every system of intellectual property rights employed in the global economy. Public knowledge is not affected by this trade-off but much of the knowledge generated today involves contributions from both public and private actors (Korku Ayenyo, et al., 2015). This can affect the rate at which knowledge is diffused.

One obvious example is the influence of new knowledge on agricultural productivity. The so-called Green Revolution in the mid-20th century depended almost exclusively on research done by public laboratories and universities (Nakamura, 1987). This made the knowledge generated by the Green Revolution readily available for farmers worldwide and provided a great boost to agricultural productivity in many developing countries.

However, when the advent of genetic science and modern biotechnology in the late 20th century gave agricultural productivity another boost, the situation was very different because, by this time, private firms had come to play a leading role (Nakamura, 1987). They protected their knowledge, leading to a much stronger dependence of farmers and others on a handful of multinational firms that could act as monopolies. This has given rise to heated debates about the economic and ethical sides of private firms developing 'breakthrough' technologies but limiting the diffusion of these.

3.2. Private Science

Another difference between the 'culture' of public and private science and technology concerns the degree of mobility. Private science is increasingly mobile, public science is not. Here, we are not referring to individual researchers working in the public and private sectors, which tend to see mobility as a way of furthering their careers. Rather, we are referring to differences at institutional level.

Increasingly, firms are relocating their research laboratories abroad. Universities, by and large, remain much more immobile, with only a small minority setting up campuses abroad. Thus, the private sector potentially has a much bigger role to play than universities in spreading the 'resource balance' in science and technology around the world.

In 2013, the UNESCO Institute for Statistics launched its first international survey of innovation by manufacturing firms (UNESCO, 2013). For the first time, a database containing innovation-related indicators for 65 countries at different stages of development was made available to the public.

3.3 Review of Research Mobility Statistics in Latin America

Regarding research outcomes and research development, several indicators again show that universities in the region are not performing well. For example, research outputs are low in the whole region with only one exception: Brazil, a country which is positioned in 15th place in the world (SCImago Journal and Country Rank 19962014). Behind Brazil, we find Mexico (29th place), Argentina (32nd place), Chile (45th place) and Colombia (53rd place). Regarding the Science Citation Index 2011 (CINDA 2015), Chile leads the group with 431 citations followed by Uruguay (294) and Argentina (275). The countries of the region with the lowest citations are Honduras (16), El Salvador (15) and Guatemala (14). Most of the citations are in specialised areas of science such as agriculture, natural sciences, microbiology, ecology and environment. And most of the research is conducted in mega universities (20 per cent of research) (CINDA 2015).

Regarding the gross domestic expenditure on research and development as a percentage of the GDP (OECD 2015), Brazil is top of the list (1.1 per cent) followed some way behind by Argentina (0.585 per cent), Mexico (0.541 per cent), Chile (0.363 per cent) and Uruguay (0.23 per cent). All of these countries are far behind, for example, the US (2.806), Australia (2.128) and the UK (1.625).

Regarding human resources, there has been a rapid growth in the number of academics between 2000 and 2011. For example, in Argentina there has been an increase from 26,420 to 50,340, in Colombia from 4,011 to 8,675, and in Mexico from 22,228 to 46,125. The amount of researchers per 1,000 people (of an economically active population) in Latin America and the Caribbean is 1.1, while in the USA and Canada it is 9. Most of the researchers are concentrated in four countries Brazil (51.5 per cent), Argentina (18.5 per cent), Mexico (17 per cent) and Colombia (3.2 per cent). Finally, in relation to the number of academics with PhDs, we find low percentages across the region (for example, 8.7 per cent in Argentina; 9.7 per cent in Chile; 6.8 per cent in Colombia; 9.6 per cent in Mexico) (CINDA 2015).

4. Conclusions

The analysis of the literature on scientific mobility indicates that there has been substantive progress in the process over the last two decades. This one advances and runs through several lanes: reception in the local institutions of foreign students and sending of national students to study outside the country; Export of higher education services, especially through the installation of headquarters in third countries or the sale of distance education programs; Working arrangements with overseas institutions, for example for the purpose of exchanging pupils, teachers and researchers or for the undertaking of joint projects; Joint scientific publications between authors based in different countries.

The internationalization of scientific and technological research in Latin America has achieved some successes. During the 1960s and early 1970s, an initiative to develop scientific and technological capacity in Latin America helped open up programs for better scientific preparation and university development. Contributed to the creation of institutes and research corporations. Chilean researchers have been working in this field for the last fifty years. More than 6,000 Chileans are doing research, 2,000 of them very prominent. The number of publications in Chile rose from 754 in 1982 to 1,752 in 2000. However, between 1981 and 2000, 24,147 articles (0.16% of the total) were published, with 163,953 citations (0.09%). This is lower than Mexico, which concentrated 0.31% of all publications, and Argentina by 0.14%. The contribution of Chile is similar to Portugal and very far from countries like the United States, United Kingdom and Japan.

It is necessary to develop a strategy and an implementation plan to place Latin America as an international education destination. This requires a policy of attracting foreign students of excellence to carry out their postgraduate studies in Latin American countries. The postgraduate programs have a rather formal international scientific mobility. This is particularly important in the field of doctorates. However, the internationally established scientific mobility has not been able to verify its effectiveness at the student level and, at the level of teachers, the participation of international guests does not stand out. As a result, the definition of strategic actions is fundamental in order to attract high-level international students, promote the international mobility of the students of the program and encourage the participation of international teachers. Likewise, the collaboration of program academics with international professors through research is a developmental focus for the internationalization that needs to be fostered. It is also necessary to promote international cooperation as a mechanism for support and promotion of postgraduate in all fields, and in particular in those in the sciences and engineering, where the costs of implementation are high. Such cooperation can be replaced by links with entities in developed countries. It is also recommended that interinstitutional cooperation be promoted, both between national university networks and through alliances with prestigious entities in other countries, through the development of joint programs. In this exchange it is suggested to incorporate international internships for both doctoral and master's theses as well as for teachers of postgraduate programs, so as to guarantee their permanent updating.

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4. Source: UNESCO Science Report, data from UNESCO Institute for Statistics

5. Source: UNESCO Science Report: towards 2030, data from UNESCO Institute for Statistics

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