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Reaching development from innovation: a strategic look from Latin America

Alcanzando el desarrollo a partir de la innovación: una mirada estratégica desde América Latina

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Content

ABSTRACT:
This paper attempts to propose some strategies for Latin America countries in order to improve their innovation systems and through this reach the development of their countries and population. Some theories of development and innovation are analyzed, and some examples of innovative success in Latin America countries are exposed through which demonstrated that most of the innovation developed in Latin America, are incremental innovation.
Keywords: innovation, innovative strategies, development

RESUMEN:
En el artículo se proponen algunas estrategias que podrían adopter los países de América Latina en aras de fortalecer y mejorar sus sistemas de innovación y, a través de ello, alcanzar el desarrollo de sus países y de su población. Se analizan múltiples teorías sobre desarrollo e innovación, así como casos de éxito a través de la innovación en países de América Latina. A través de estos casos se comprueba que la mayoría de las innovaciones desarrolladas en América Latina son incrementales.
Palabras clave: innovación, estrategias innovativas, desarrollo

1. Introduction

The reflection on strategies for economic growth in Latin America has been characterized in recent decades by the Schumpeterian notion of innovation (Schumpeter, 1934). This notion has also come to dominate the policy arena for Science and Technology (S & T). In this case, its relevance lies in the distinction between two processes often intertwined but different, which at the same time can occur independently. I refer, on the one hand, to the process of "invention"- or, more precisely, the generation of new knowledge, the development of a new idea or an act of creation -, and, on the other hand, the innovation process in the strict sense, i.e. the practical implementation of new forms of doing things, which refers to the commercialization of the invention (Hitt, Hoskisson, & Nixon, 1993; Ahuja & Lampert, 2001).

For the Economic Commission for Latin America and the Caribbean (ECLAC), innovation is a central element in the development strategy, defined as a dynamic process of interaction linking agents who work guided by market incentives (such as companies) and other institutions (such as public research centers and academic institutions) that act according to rules and strategies that respond to other mechanisms and incentive schemes. The systematic linkages and interaction between actors as well as economic and institutional infrastructure that each country is able to develop, determine their ability to capture the momentum that gives knowledge production and brings into a virtuous circle of growth. (Rodriguez & Alvarado, 2008)

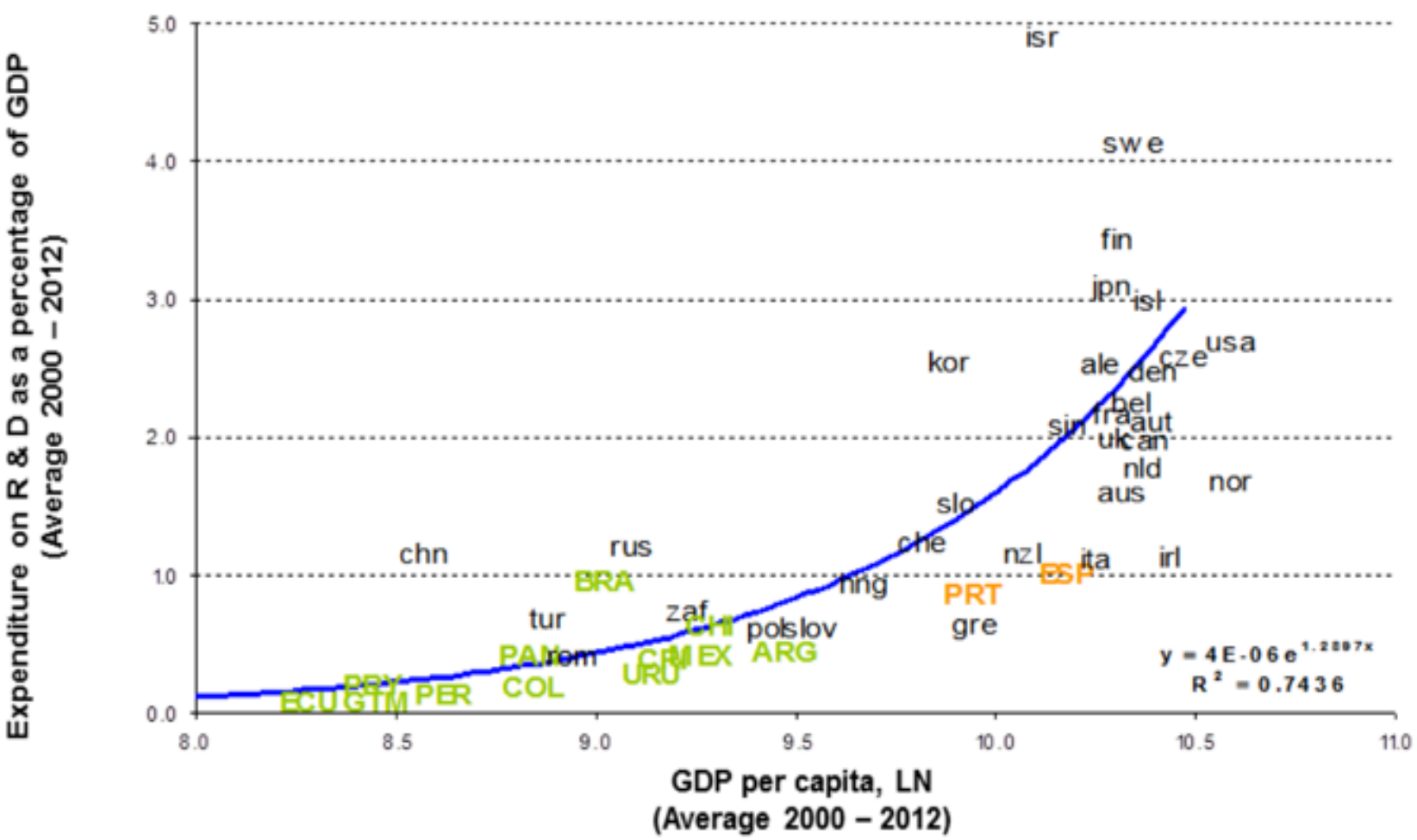
Investment in research and development (R & D) is one of the main indicators of technological and innovative effort of a country. It is important to note that there are several ways to measure the innovative effort of a country (or company), and that innovation in many cases involves activities that go beyond investing in R & D (such as organizational innovations or in business models), but spending on R & D is a valid indicator to measure a country's innovative effort. (OsloManual, 2005)

A very high correlation is presented globally between R&D and the level of per capita income in the country economies. This relationship is neither deterministic nor linear, and is mediated by a number of other variables such as human resources, institutions (universities and research centers) and productive specialization, among others. However there is worldwide clear evidence of the existence of a high positive correlation between innovative efforts and per capita income (Braconier, 2000; Acemoglu, Aghion, & Zilibotti, 2006), the last one is an indicator of development in countries (UNESCO, 2002).

Graph 1 summarizes the above discussion; it is generally observed that economies with higher per capita incomes are higher performing innovative efforts. All the technological frontier countries are in the upper-right quadrant of the graph, including the United States, Canada and the Nordic countries, among others. In the case of the Iberoamerican countries, a clear distinction between Spain and Portugal which are in an intermediate position, and the countries of Latin America, occupying all the lower left quadrant of the graph, showing levels of Gross Domestic Product (GDP) per capita among the lowest in the sample and research and development expenditure that does not exceed 0.5% of GDP, with the exception of Brazil, which invests nearly 1% of GDP in R & D.

In other words, there is a lag in the innovative effort of Latin America countries (expenditure on R & D, researchers, funding sectors of effort). This means that there is a low innovation capacity in the countries of Latin America.

Graph 1
GDP per capita and spending on research and development
2000-2012, several countries



Source: Data for this graph was obtained from ECLAC (2012)

Due to the situation of Latin America countries about innovation efforts and country development exposed before, the aim of this paper is to analyze what strategies can be used in order to encourage innovation and development in Latin America countries through the analysis of the relationship between a Latin-American innovation theory such as Sábato Triangle (Sábato & Natalio, 1968) and other theories such as Schumpeter's theories of development (1934; 1975), and the ideas of Teece about who profiting from technological innovation (Teece, 1986).

1.1. Theoretical Background

In 1968, the argentine Jorge Sábato, concerned about the future development of the Latin America countries, created a theory based on the idea that Latin American countries should be active participants in the world's scientific and technological development. In order to become an active participant, he considered necessary the existence of (at least) three vertices of a figure he called Sábato’s Triangle in each country of Latin America.

According to Sábato and Natalio (1968) the triangle must consist of the following vertices: (1) scientific and technological infrastructure: composed by the educational system, laboratories and research institutes, and economic and financial resources necessary for its operation. (2) Government: that mobilizes resources towards the vertices of the productive structure and scientific and technological infrastructure through legislative and administrative processes. (3) Productive structure: composed by all productive sectors that provides goods and services demanded by the society.

Sábato (1967) defines the main objective of the production structure, public or private entrepreneurship, according to Schumpeter's ideas, believing that the role of the production structure is to reform or revolutionize the production system, exploiting an invention, or an untried technique to produce a new good, or the production of an old merchandise by a new method, that allows an industry reorganization. (Schumpeter, 1975)

The existence of this triangle between government, technological infrastructure, and production structure was also validated by several authors in the U.S. (Woytinsky, 1977; Galbraith, 1967), not only from the standpoint of the analysis of the existence of the vertices, but also the existence of the relationships between each of them, which Galbraith (1967) called techno - structure.

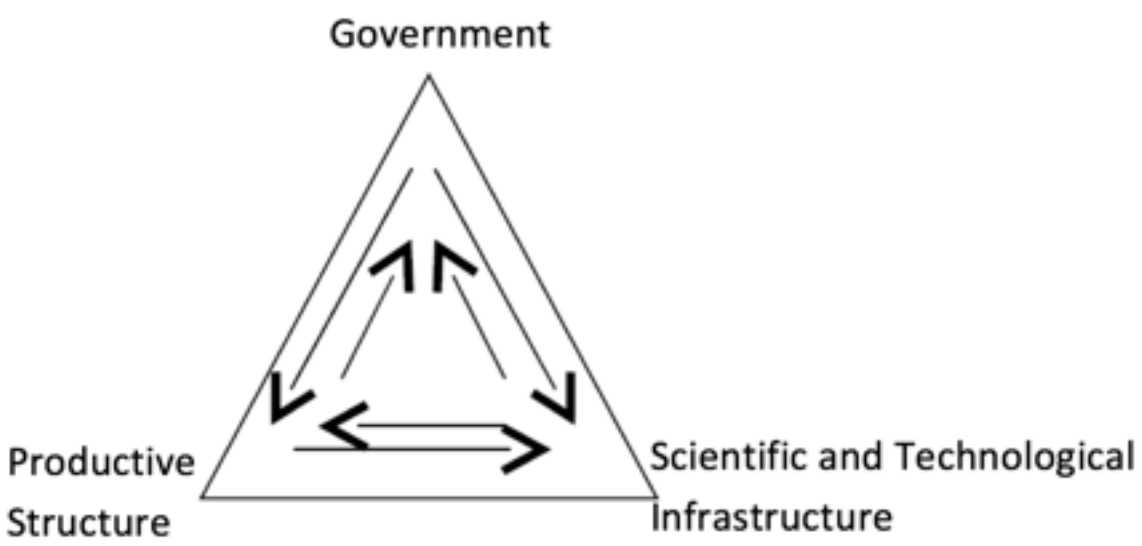
Figure 1, shows a triangle of reciprocal relationships between the three vertices mentioned before. There are relationships in the vertical direction (government - technological infrastructure, and government - production structure). It is important to mention that in Latin America countries the technological infrastructure vertice depends on the action of the government in regard to the allocation of resources, but also, according to Sábato, sometimes this relationship depends on government demands to the technological sector. An example of government demands to the technological sector in Ecuador occurred in 1982 when there was a great crisis in the banana sector, which represents the highest category of Ecuador's trade balance, after oil, because the plague black Sigatoka attacked the plantations in the country; due to this the government asked the technological sector to seek a solution and allocated special funds budget of the country for conducting this research. The technological sector of Ecuador was not prepared to meet this demand from the government and was forced to use these funds to hire foreign professionals in order to find the solution to the pest problem. The solution was found, and the invention of the pesticide previously used in Panama, was commercialized by the production structure of Ecuador, i.e. it became in innovation (Orlando, Sánchez, & Maldonado, 2001), but it is important to notice that the source of this innovation or the origin of this new creation was from outside the country, and the majority of the profits of the commercialization process of the pesticide went out the country.

Relationships between government and production structure usually occur through the technological sector as a mediator of this relationship, because is in the production structure where they are sold and produce inventions of the technological sector. Additionally, in many cases the research area belongs to the companies that constitute the production structure.

Horizontal relationships are more complex to establish, except in those cases where technological infrastructure belongs to the productive structure, reporting directly to the companies. In cases where technological infrastructure and the productive structure are different institutions, one of the most appropriate methods to establish communication channels through which demands are established between them is reciprocal human talent mobility from one vertex to another (Somaya, Williamson, & Lorinkova, 2008). Considering that the subjects in both vertices have creativity and business abilities, communication channels will be open, and interorganizational learning will be ensured (Phillips, 2002; Shaw, Duffy, Johnson, & Lockhart, 2005; Rosenkopf & Almeida, 2003; Campbell, Coff, & Kryscynski, 2012). However if it is noted that both qualities are absent in subjects of both vertex then we would face deaf dialogue between entrepreneurs and scientists who would become an obstacle, often without solution, in order to move towards the development of the countries, this happens frequently in Latin America countries. Employee mobility between firms also could help for the success of regional economic clusters through the agglomeration and localization of knowledge. (Saxenian, 1994; Almeida & Kogut, 1999)

By the other hand, the relationship between technological sector and production sector is of vital importance, because production sector has direct established communication channels with the market, and through this technological sector will be aware of the demands and needs of users in the market. According to Teece (1986) in weak appropriability regimes (what is happening in Latin America), the innovator need to be intimately coupled to the market so that user needs can fully impact designs.

Graph 2
SábatoTriangle



Source: (Sábato & Natalio, 1968)

With the representation of the triangle, we began to see the systemic nature of innovation, analyzed as the result of the interaction between different actors, in different areas, often induced by significant changes in the contexts in which the stakeholders move, in other words, innovation is seen as an interactive process, distributed, often emerged in response to new challenges. For innovation to work as a real system, it should be regulated by innovation policies at country level. (Freeman & Lundwall, 1988)

On the other hand, the conception of the triangle leads to the following statements: (1) the three vertices of the triangle must exist, which means that Government, Technological Sector (academia) and business sector should be involved effectively in the development of our countries in Latin America, (2) the three sides of the triangle must also exist, it means that the vertices should be effectively and cooperatively linked each other. But Sábato did not consider that the interactions between the vertices should be actually innovative, because although innovation is interactive, not all interactive interaction is innovative.

Many of the interactions that occur in the countries of Latin America have characteristics or consequences of routine, for example users supplied in the same way by the same producers, without significant changes occur (Linz & Stepan, 1996), this type of interactions that occur in Latin American countries have characteristics of familiarity traps which according to Ahuja and Lampert (2001) constrains the ability of our countries to create inventions. But it is rather the emergence of new players, or new opportunities, new challenges the elements that triggers the innovative potential of the interaction.

Based on the previous discussion, if the goal is to propose strategies that promote the development of Latin American countries based on innovation, we not only have to be worried about the existence of components of each vertex and interactions among them, but also their impact on innovation. We could have a perfect Sábato triangle without its transformation in a relevant process of innovations, although most likely would be reflected in a significant increase in the production and technical progress (Schumpeter, 1934).

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2. Methodology

For this work a qualitative research methodology have been used, consisting of case analysis. Cases of innovation were selected in Chile and Brazil, which are two of the countries with the highest levels of innovation in Latin America; some cases of Mexico and Perú were also included because they constitute examples of incremental innovations; and help to show the importance of complementary assets, and competitiveness. Ecuador was also included because this is the country in which the authors reside.

2.1. Case discussion

During the 80's, Chile was able to grow at a rapid rate thanks to a market-oriented economy, a strategy of international openness, an institutional policy and an orderly macroeconomics. In this scheme, the competitive advantage of Chile was the export of natural resource-intensive products, competing primarily through lower costs (Tokman &

Zahle, 2004). Then in the 90's there was a slowing of Chilean economy, which motivates to develop studies that showed that countries that exploit the natural resources intensively tend to grow less in the long run than those that develop technologically, unless that strengthen advantages relative to such resources through innovation. Consistently, the new growth theories postulate that the most effective way that countries have to develop in the long term, is through increased productivity generated from technological change and innovation. (Tokman & Zahle, 2004)

Based on that, Chile's government created the National Innovation System (SIN), which suggests that technological innovation is the product of a mixture of highly dynamic markets and business, with subsidies and government regulations, and the collaboration between universities and companies technological centers (Monsalves, 2002), i.e. raises a close relationship between institutions through good practices or relationships. The development of public policy has resulted in an increase in the last decade of the investment in R&D that in 2010 reached 0.44% of GDP (RICYT, 2010), which is still low but added to the efficiency government, business efficiency and economic performance areas where the country is a leader have resulted in the high level of competitiveness of the Chilean economy.

Moreover, Sábato put emphasis on government as a mobilizer of resources through production and technological vertices through legislative and administrative processes, though not emphasized the need for laws to protect and encourage innovation, neither the aspect of competitiveness, although they emphasized the importance of profits from innovation. In this sense it is necessary to complement Sabato's theory (1968) with Teece's theory (1986) when shown the importance of a country's legal system to predicting who will profit as consequence of innovations.

Teece (1986) referred to this issue as appropiability regimes and predicted that in weak appropiability regimes (as in the case of Latin American countries) analysis of complementary assets (specialized, co-specialized or generic), and the relative position of competitors or imitators was vital for proper decision-making. So the strategies that will be proposed should aim at the strengthening of the legal system, not only from the point of view of intellectual property and patents, but also to protect the alliances that exist between innovators and producers of complementary assets, mainly those that are specialized assets or co-specialized assets.

Another central approach of Schumpeter's theory also found in Sabato's theory is the privileging of the technological push over the pull of demand, which is, of course, a consequence of its emphasis on radical technical innovation and the resulting storm of creative destruction that are the basis of his vision of capitalist development (Schumpeter, 1975). Thus, like most Latin American countries have based their innovation policies in the ideas of Schumpeter, it has become difficult to meet the goals of innovation in our countries because even when breakthrough inventions represent rare, valuable, and potentially inimitable sources of competitive advantage (Barney, 1991), in developing countries prevails incremental technical change, adaptive and diffusive (Crespi & Tacsir, 2012; Hegde & Shapira, 2007). Today there is widespread consensus that the accumulation of small innovations minor changes can have big impact on the product or process. Incremental technical change in developing countries plays a role as important as the radical (Hall & Maffioli, 2008).

Examples of incremental innovations, the importance of complementary assets, and competitiveness in Latin America countries are shown through cases of Brazil, Mexico and Peru.

Competitiveness is a field of knowledge in which the facts and policies shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people (Adreani, 2008). If we analyze the case of soybeans with respect to the development of the competitiveness we can see that its production has experienced one of the fastest and sustained growing in the last years. Soy is used as an intermediate food, as feed for animals, oil for human consumption, other uses in the food industry, and more recently as a biofuel. In the 90s began the expansion of this crop that reached double its growth rate, and earnings of 77% (Adreani, 2008). One of the

fastest growing countries respect to the exploitation of soy production is Brazil with an increase in production of 38.2 million tons per year with respect to 1996, this increase is largely due to the development of agricultural policies generated by the government and implementation of process of research and development that resulted in soy grain changes making them more resilient and productive. This innovation brings Brazil to produce 61.3 million tons for 2008. (Dufey, 2006)

As we saw earlier, due to the demand of the national government, researchers from Brazil created a stronger soybean and this increased production of soy in this country. Given the excess production of this natural resource and motivated by the Kyoto Protocol for the protection of the environment by reducing the emission of greenhouse gases, the Brazilian government ask researchers to create biofuel, which has Brazil led to become one of the most important producers and consumers of biofuel worldwide (Dufey, 2006). This is a clear example of incremental innovation and innovative relationship between the three vertices of the Sábato triangle. It is an incremental innovation because researchers create the biofuel based on existing knowledge and resources within a country, meaning that this innovation was also competence-enhancing (Tushman & Anderson, 1986).

In 2010, Peru had the third highest mortality rate in Latin America (20 deaths per 1000) after Haiti and Bolivia; in that year, only 7% of Peruvians had access to private health systems and 30% of the rest had no access to any health system. Thinking about this problem, a group of Peruvian doctors wondered how they could help these poor people in Peru in a quick, cost effective, and professional way.

These doctors created a hospital in a very different fashion, (1) they set up the facility in the shells of 23 old buses that were waiting to be disposed off by the city administration, they equip them with water, electricity, drainage, air conditioning, and medical equipment; so they created the hospital in just four months instead four years that it would take in South America. The hospital has all needed facilities to perform a high quality health service. (2) The founding team do not invested in equipment, but they invited doctors to buy equipment that they could own, use, and maintain; doctors who agreed, became investors in the hospital. (3) They created a hospital that can easily move its parts to where the demand is, so they obtained a differentiation aspect from usual hospitals that offer services from fixed locations. They also create differentiation in service delivery with charges of no more than 3 dollars, which most Peruvians can pay (Ruelas, 2011). This hospital constitutes an example of competitive social innovation that could help our Latin American nations to reach development.

Another example of innovations to suit the need for Latin American countries is the one developed in Mexico by the largest cement company in the country, CEMEX. In 2008, the company conducted an analysis of the environment because it was proposed to increase their sales. During the study, researchers noted that about 50% of money that migrants sent to their families in Mexico, was used for the construction of their homes, so they decided to innovate in the commercialization process of cement through the creation CEMEX cooperative at international level, where migrants could deposit money and send remittances to their families and this money was transformed into building materials and delivered to the homes of their families in a maximum time of one hour. To do this, CEMEX divided the country in quadrants, and created logistics systems for each quadrant, which guaranteed the immediate delivery of materials and total customer satisfaction (migrants and families of migrants) (CEMEX, 2008).

This example also demonstrates the importance of analyzing customer needs and be ready to meet them when necessary. It also shows the importance of complementary assets (in this case commercialization assets) in countries where innovation occurs in the process and not necessarily on the products, as Teece (1986) mentioned.

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3. Results

Based on the previous analysis, some strategies are proposed below these lines in order to promote innovation and development in Latin American countries:

3.1. Proposed strategies for Latin American countries

Countries should create innovation policies that protect and promote innovative competition, this is the case that occurred in Colombia, which adopted the Cepaline model (ECLAC, 2013), they sought the development and competitiveness of its domestic industry, protecting their early years with laws and no pay of fees until strengthen it, and then forcing it to be competitive with the signing of Free Trade (FTAA) as in the case of the free trade agreement between Colombia and the United States. Innovation policies and appropiability regimes must be clearly defined for each industry (Teece, 1986).

It is necessary create a system of grants to enhance the training of scientists and entrepreneurs so that the dialogue between these two sectors start to flow and be a quality dialogue that promotes innovation, these processes have been implemented in countries like Brazil and Ecuador mainly focused on the development and preparation of scientists and researchers in the best worldwide universities. Furthermore, the two countries have programs to attract scientists from all over the world, Ecuador currently has the Prometheus program (SENESCYT, 2013) and the Science Without Borders program in Brazil (Brazil, 2013)

Strengthen the legal system regarding to Intellectual Property and Patents, most Latin American countries have historically maintained a low level of legislation regarding Intellectual Property (weak appropiability system), but in the last decade with the signing of free trade agreements (FTAs) between Latin American countries like Mexico, Chile and Colombia and developed countries like the U.S. and Canada, Intellectual Property has acquired particular importance in the process of globalization and the new knowledge economy. With the adoption of the Agreement on Trade-Related Intellectual Property Rights, Intellectual Property have been fully incorporated into the multilateral trading system producing a break in the historical development of Intellectual Property in Latin America by introducing, among others, the concept of minimum standards of protection (Roffe & Santa Cruz, 2006). Even when Teece (1986) expressed that patents are especially ineffective at protecting process innovations, it could be a beginning from Latin America, where a very weak appropiability system is present.

Intellectual Strengthening related to the protection of transfer partnerships of complementary assets (especially specialized and co-specialized assets). In the case of imported innovations, i.e. from out of country borders which are produced with resources that belong to Latin American countries, the law should ensure that part of the profits obtained from innovation stay in the country.

Create incentives for research through taxes reduction or refund of taxes to innovative firms, these processes are carried out in countries such as Ecuador in which firms that implement advanced technologies or environmentally friendly technologies are stimulated with a tax reduction. Besides, countries can create competitive grants to encourage the development of research and innovation. In countries such as Chile, 60% of research is funded by the state.

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4. Conclusions

The analysis presented in this document has been realized in countries of Latin America where there is a need for policies and legal systems that promotes innovation in order to obtain development of the countries of the region. Even when they could be useful for other parts of the world, the proposed strategies have been created in order to be applied in Latin America countries.

It has shown the need to combine Sabato's theory (1968), with the theories of Schumpeter (1934; 1975) and Teece (1986) in order to display a set of actors that would develop innovative relationships, so all vertices could stay updated about the demands of the users, and the government needs, thereby promoting national competitiveness and participation in order to be active participants in the world's scientific and technological development.

Through the case studies, it has been shown that in Latin American countries there is a prevalence of incremental innovations in relation to radical innovations, so it may be better to promote the existence of these small incremental innovations, and once developed these,

start promoting and encouraging the radical innovations. What is a bit contrary to what Schumpeter (1934) proposed, which is an indication that the theories are adaptable to the needs of the countries, it is important to realize that concrete actions are needed to stimulate innovation, because through it Latin American countries will get the development and improvement of the economic indicators of its inhabitants.

Development is not only based on innovation, but in the combination of many factors, including: legal system, production system, market, health, employment, education, etc. In this sense, education plays a fundamental role, as the preparation of the members of the productive sector and members of the technology sector; because it will ensure the establishment of an intelligent dialogue, rather than mediocre dialogues that occur between these two important sectors due to lack of knowledge.

In other words, learning processes are necessary, since the technologies have tacit elements and their basic principles are not always clearly understood. Technological change at the level of the firm should be seen, then, as a continuous process of absorption or creation of knowledge, partly determined by external inputs and partly by past accumulation of skills and knowledge. Precisely, the concept of technological learning refers to any process that strengthens the capacity to generate and manage technical change.

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