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TESIS:

CHINA Y MÉXICO: DOS REALIDADES EN LA CONSTRUCCIÓN DE UN SISTEMA NACIONAL DE INNOVACIÓN

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TABLE OF CONTENTS

FIGURES AND TABLES

INTRODUCTION

Considering land and GDP, China is the largest country in the Eastern Hemisphere and Mexico is the fifth largest nation by land, and the fourth by GDP in the Western Hemisphere. China's GDP has been growing since at least one decade ago; it basically started imitating technology from developed countries, and manufacturing goods. Nowadays Chinese Government has put more emphasis in developing its own technology. Mexico's has grown steadily although not exponentially. Its financial situation is stable, with a controlled inflation. The manufacturer sector locally known as "maquiladora" has been the engine of this growth. The last three decades have been "extraordinary thirty years" in history of both countries. However these two countries have implemented individually reform and opening up policies, have experienced radical changes in the political, economic, social, and diplomatic fields, and have achieved notable successes in the social economy. Further, both countries have become members of international groups such as, G20. Have increased their presence in International Monetary Fund, and are key countries in world decisions. These changes and their results have generated new contexts and dynamics of sustainable development, both countries are important keys in the new globalization era.

Mexico has been a historical partner of the United States, because of the geographical situation; however, Mexico has been displaced by China as the main trading partner of United States, which is clearly observed in textiles and apparel, where Mexico has lost significant market shares. This result is due to lack of competitiveness in different sectors.

Although Mexico has signed the North American Free Trade Agreement (NAFTA) along with United States and Canada, the impact of China has not ceased.

Mexico and China could be excellent trade partners, for that more talks are necessary. Moreover, the exchange between them is very asymmetrical: the China's participation in Mexico's total exports does not reach even 1%, while China is the second largest exporter to Mexico.

Mexico accumulates trade deficits increased with China. Among export products Mexico to China include manufacturing, copper and iron ore. Overall, the capacity exports from these countries to China is concentrated in a number very much reduced products, although these are of medium technology sectors high. Mexican companies in China are still very few firms such as Bimbo, Cemex, Gruma and Nemak have presence in China and small food chains. Grupo Bimbo has a plant in Beijing, China, Nemak, which is a subsidiary of ALFA, has two plants in China, one to manufacture engine blocks and one for aluminum heads. Gruma has two food factories in China and Cemex entered the Chinese market in 2007, by buying two cement plants. China has more presence in Mexico, and increasingly in communication and technology sector, such as Huawei, Lenovo, ZTE, Oppo, Foxconn and Alibaba. China has signed 10 free trade agreements (FTA) with 24 countries; and Mexico has 11 FTAs with 46 countries. But Mexico and China have never signed a FTA.

Education is a key element for innovation to develop, a nation without a proper education level will definitely lag behind leading innovative countries, investment in education brings back the benefits in the long term, The PISA assessment test is elaborated by The Organization for Economic Cooperation and Development (OECD), this test is now

used as an assessment tool in many regions around the world. It was implemented in 43 countries and economies in the first assessment, 41 in the second assessment (2003), 57 in the third assessment (2006) and 75 in the fourth assessment, So far, 65 countries and economies have participated in PISA 2012.

In addition to OECD member countries, the survey has been or is being conducted in: East, South and Southeast Asia: Himachal Pradesh-India, Hong Kong-China, Indonesia, Macao-China, Malaysia, Shanghai-China, Singapore, Chinese Taipei, Tamil Nadu-India, Thailand and Viet Nam. Central, Mediterranean and Eastern Europe, and Central Asia: Albania, Azerbaijan, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, the former Yugoslav Republic of Macedonia, Malta, Moldova, Montenegro, Romania, the Russian Federation and Serbia. The Middle East: Jordan, Qatar and the United Arab Emirates. Central and South America: Argentina, Brazil, Colombia, Costa Rica, Netherlands-Antilles, Panama, Peru, Trinidad and Tobago, Uruguay and Miranda-Venezuela. Africa: Mauritius and Tunisia.

In 2012, Mexico was in place 52 of 65 countries that participated in the test in 2012, which means a breakthrough, because in 2003 placed in 37th place of 41 countries surveyed. In 2012, Shanghai, China placed first in math skills obtaining 613 points, followed by Singapore with 573, and Hong Kong, with 561. Education policy is definitely an important tool for governments to create a National Innovation System (NIS), which is a network of institutions in the public and private sectors, where their activities and interactions initiate, import, modify and diffuse new technologies.

Both countries have included the necessity of improve their innovation indexes in order to increase the general standard of living, through policies and cooperation. The idea

of NIS, to some extent has expanded due to globalization, the world has experienced a series of changes, particularly since the first revolution, with the first power loom in 1784, at that time Mexico and China weren't as globalized and interconnected as they are now, and this first revolution mostly impacted developed countries. In the second industrial revolution some 100 years after the first, the People´s Republic of China hasn´t emerged yet, and Mexico was having the first constitution, one revolution will come to innovate its agricultural sector some year later.

The third industrial revolution involved the use of electronics and IT systems that further automate production, around 1969, in this scenario the PRC was recently settled down, while Mexico was passing through one of the best economical episode in history.

The 4th Industrial Revolution is related to the automation industry in the eighteenth century, the division of labor and mass production of the early twentieth century, and the technological revolution of the late twentieth century, now we are talking about the digitization of production systems that greatly impact on businesses and the way in which the economy affects people, society and country.

The Internet represents a change in the production process to a centralized intelligent manufacturing process, thanks to technological advances. This has the ability to connect everything to a network that can receive information from many sources to be stored, transferred, analyzed, personal or automated without human intervention. Problems can be solved and decisions can be taken from data analysis, maintaining consistent quality and reducing the risk of human error. Innovation is now connected worldwide, and governments need to adapt their NIS to this new reality, China and Mexico weren't

considered in the earlier revolution, but in the new scenario China and Mexico along with other developing countries play a big role in world innovation.

This thesis aims to explore the dynamics in the creation of two different National Innovation Systems (NIS), and discuss the elements and environments regarding the innovation in China and Mexico. For that matter the thesis is compounded by 5 chapters, the first chapter refers to introduction. The second is the theoretical framework, which comprehends the development of the concept of NIS, as well as their forms of development and risks, some of the most relevant authors and theories are addressed. Resulting from the relative importance of its limited capacity to address some specific market or economic situations, developing countries have to figure out a way to obtain resources. Lack of resources (development of scientific and technological facilities, skilled personnel) need to be faced with creativity, The development and maintenance of advanced scientific and technological infrastructure has long suffered from low priority and limited sources of funding in developing countries.

The third chapter is intended to give a better understanding in the creation of NIS in China and Mexico, as well as offering a wide background in innovation. This chapters makes a historical analysis of the conditions of both countries regarding innovation. We review the structure of NIS in China and Mexico, and analyze the differences between this two nations, such as interconnection between dependencies.

The fourth chapter is Methods and Data, which explains the process of building the NIS in Mexico and China, using a series of variables and indicators. All indicators are described and explained. We use these key indicators to identify potential improvements in policies. Outcome indicators measure the broader results achieved through the policies.

These indicators can exist at various levels: population, agency, education, environment for innovation etc.

And finally the last chapter is analysis and discussions, where after the literature review and study of all indicators, we analyze the data and interpret it in order to offer some conclusions regarding the creation of NIS in China and Mexico.

CHAPTER I

CONCEPTUAL FRAMEWORK

Countries increase their investment in human capital training, either within the country or abroad. The literature on the National Innovation System (NIS) emphasizes the importance of strong links between various institutions in improving innovation performance and national competitiveness.

It emphasizes linking the government, because it can increase the transfer rate of progress of academic research to industry through policies such as tax incentives, grants, exemptions etc. and promote the application of these advances in the research of domestic enterprises to improve national economic performance. The NIS can be an active strategy, whether the relationship is strengthened and the transfer of technology is improved and accelerated. Many, if not most of these initiatives focus on transfer encoding property rights to individual inventions, and rarely address the larger matrix of the relationship between industry and university covering a wide range of activities. The creation of the NIS differs from the conditions that each country has, there are several factors that may influence its development. NIS can develop in a variety of scenarios, such as laissez-faire when government has minimum inference in decisions regarding innovations, and market demand/supply has a strong decision, or an environment where decision are almost totally made by government. In the current world, experience not only in innovation but in in other topics of economics, politics society etc., has shown that either system has its own flaws. For example in 2008 crisis, a lack of US government intervention made the crisis worst, causing an unprecedented damage in world economy. Mexico and China are two countries with different political, economic and cultural background, but this work is intended to find

their correct and incorrect policies through a historical analysis of the conditions presented in both countries, through indicators that the literature on innovation considers applicable, in order for both countries to better understand the creation of a successful NIS, which is beyond a political system. Why did China advance in innovation field while Mexico presents stagnation?, What was the scenario in which the NIS were created in China and Mexico? , What was the role of government in creating the NIS in China and Mexico?

Justification of Research

The scientific and technological knowledge and the ability to innovate are elements, which contribute to increasing the productivity of nations and their standard of living. International experience shows that developing countries relies increasingly on its ability to generate, absorb and transfer knowledge, because that way goods and services with higher added value that enrich its development capabilities to create and raise a nation's position in a global environment increasingly interconnected and competitive day (CONACyT, 2014).

That is why the NIS in industrial economies seems increasingly interdependent; this phenomenon of interdependence was strengthened after 1945, when cross-border flows of capital, goods, people and knowledge showed rapid growth.

Derived from this interdependence, NIS can be seen in two very different contexts, one is where the government does not intervene, thus, institutional, public, private and academic domains, operating in market conditions or also known as laissez faire societies. The second context is where the government intervenes through policies that stimulate innovation, and here the domains are increasingly intertwined with a spiral pattern of linkages emerging at various stages of the innovation process. Mexico and China have

characteristics of these two contexts, for this reason it is relevant to know the situation in which the NIS is created.

China and Mexico both developing countries with different historical background and geographical situations, are experiencing a different process of creation of NIS. To study the process of building the NIS in Mexico and China, we have a series of variables and indicators, which according to institutions such as the OECD are involved in innovation processes; we also conduct a literature review to identify potential areas for research, to compare previous findings.

Objectives

- **To examine the historical process of NIS in China and Mexico**

  I intend to perform a literature review of the most influential authors regarding innovation and NIS such as Freeman, Lundvall, Schumpeter, in order to understand the current scenario, it's always necessary to know the conditions in the past, such as political system, social situation and economic environment.

- **To identify the changes and reforms in innovation in China and Mexico**

  China and Mexico have recently undergone some key reforms in terms of energy, education among others, some especial areas have appeared, and changes in politics have determined the flow of technology. Some particular reforms aimed to develop new strategic regions.

- **To generate information that can be useful in policies that contributes to building a national innovation system in China and Mexico.**

  I intend to collect data regarding innovation and compare it, after the comparison some useful results will let me understand how China and Mexico develop their NIS and relate their success or failure to their data.

- **To provide a better understanding of the role of governments in the innovation-driven economy of China and Mexico.**

  As a result of this study some conclusions will let us understand the role of governments in two different scenarios (China and Mexico).

Hypothesis

The analysis of the experiences in building a NIS from other countries allows knowing the successes and implementing policies, which makes possible to identify best practices and derive useful lessons for the design of our innovation policy country.

Scope and limitations

This research explores the experiences in building a national innovation system of two developing countries with historical, social and economic differences such as China and Mexico, in order to take advantage of all that is redeemable for improving Mexican innovation policy. The selection of these two countries is due to the widely known improvement of China in the field of innovation, as well as the favorable economic performance in recent decades.

Meanwhile for Mexico innovation is a priority, it is relevant to build and consolidate a NIS that enables people to produce goods with high added value from scientific and technological knowledge.

While this thesis can provide relevant information on some useful elements, it should be recognized that each experience is unique and that each country builds its alternatives based on their own economic, political and social conditions. However, it was considered useful to recognize the accomplishments of other developing countries that are international leaders in the implementation of innovation policies in different sectors, to compare with what was done in Mexico. Consequently, this paper simply intends to formulate general criteria to help improve our policies based on international best practices.

Materials and methods

To achieve the above objectives a documentary research was conducted, describing the topic, analysis of the information gathered, and drawing conclusions, this means the deductive method. Public information from different national and international institutions was used in addition to literature review of authors who have previously addressed the issue.

CHAPTER II

THEORETICAL FRAMEWORK

Innovation cannot be seen as an individual phenomenon, but as a complex system, when a person comes out with a new invention or an improvement, we usually call it innovation, which according to the Cambridge Academic Content Dictionary, innovation can be defined as “A new idea or method, or the use of new ideas and methods”, when we include all innovations developed in a country we now have a national innovation.

Systemic approaches are giving new insight into innovative and economic performance in the OECD countries. Technology-related analysis has traditionally focused on inputs (such as research expenditures) and outputs (such as patents). But the interactions among the actors involved in technology development are as important as investments in research and development.

And they are keys to translating the inputs into outputs. The study of national innovation systems directs attention to the linkages or web of interaction within the overall innovation system. An understanding of these systems can help policy makers develop approaches for enhancing innovative performance in the knowledge-based economies of today. The smooth operation of innovation systems depends on the fluidity of knowledge flows – among enterprises, universities and research institutions. Either tacit knowledge, or know-how exchanged through informal channels, and codified knowledge, or information codified in publications, patents and other sources, are important. The mechanisms for knowledge flows include joint industry research, public/private sector partnerships, technology diffusion and movement of personnel.

Defining National Innovation System

The idea of NIS was developed by Swedish economist B. Lundvall, who was based on the concept of Frederich List national production system, and put the emphasis on the relationships between users and producers within the national economy. However, NIS is a concept that was developed in parallel in different locations in Europe and the United States during the 80's. This term had already been working for some time. NIS can be defined as the follow:

".. It is a network of institutions in the public and private sectors, where their activities and interactions initiate, import, modify and diffuse new technologies" (Freeman, 1987 on: Ortiz, 2013, p.56); that is, by gathering all activities and institution nation-wide, we have a complete NIS, which interacts with all members of a society. It is important to note that innovation as well as other processes needs human intervention, in this case is called entrepreneur, a word that was first used by economist Joseph Schumpeter.

“Schumpeter attributes the principal role in this type of development to the entrepreneur. Entrepreneurial actions are the main mechanism in the process of economic development and the disturbance of the economic system is impossible without them.” (Croitoru, 2012, p.141); that is an entrepreneur is needed to know the processes and used the knowledge to take advantage of all factors and develop something innovative.

“The ability and initiative of entrepreneurs (who might or might not themselves be inventors but more usually would not be) created new opportunities for profits, which in turn attracted a “swarm” of imitators and improvers to exploit the new opening with a wave of new investment, generating boom conditions.” (Freeman, 1997, p.19, 20); the innovation

process could be as complex as other process, Freeman argued that when an entrepreneur starts a new process, soon others will come and develop another process based on the entrepreneur. But the concept of National Innovation System (NIS) differs from the traditional concept of innovation.

Entrepreneurs are the mean to develop innovation, through the design of methods and models, also putting in practice different ways to solve problems; they also have the imagination to work with opportunities. Entrepreneurs not only develop ideas from scratch, but also transform existing ideas into new forms.

Innovation is a system. At that time, it was not clear whether innovation comes from government policies, or industries or even universities. NIS have interactions with several institutions in an economy, scholars in a new idea “triple helix” worked this term. The Triple Helix model, states that the main institutions have first been defined as university, industry, and government. However, these institutional carriers of an innovation system can be expected to entertain a dually layered network: one layer of institutional relations in which they constrain each other’s behavior, and another layer of functional relations in which they shape each other’s expectations. For example, the function of university-industry relations can be performed by different institutional arrangements such as transfer offices, spin-off companies, licensing agreements, etc. The institutional relations provide us with network data, but the functions in a knowledge-based economy are to be analyzed in terms of the transformative dynamics. The knowledge base of an economy can be considered as a specific configuration in the structure of expectations, which feeds back as a transformation mechanism on the institutional arrangements.

The development of all these theories made innovation process clearer, people around the world started to hear about this term. In spite of these achievements, during this period the concept of innovation was still unknown for most of the countries, it was mostly developed or industrialized countries that study this term. For that reason most of the authors and scholars discussing innovation can be found in Europe, North America and Japan.

When the term innovation was related to science and technology, it was clear that these terms should be related to governments, since governments create policies to develop science and technology. By this time some scholars around the developed world were developing the term National Innovation System (NIS).

The idea of NIS was developed by Swedish economist B. Lundvall, who was based on the concept of Frederich List national production system, and put the emphasis on the relationships between users and producers within the national economy. However, NIS is a concept that was developed in parallel in different locations in Europe and the United States during the 80's. This term had already been working for some time.

List argues that the Smith way of seeing economics was irresponsible, since he assumes "a state of things which has yet to come in-to existence." They assume "the existence of a universal union and a state of perpetual peace. However List argues that free trade is beneficial to some nations in some circumstances and believes that leaders of nations must focus on the long-term welfare of the nation.

According to Friedrich List, it was necessary to “protect” infant industries; this was an idea that opposed Adam Smith’s opinion.

List's infant industry argument is based on the following principles. First, countries go through five stages in their development: (i) the savage stage; (ii) the pastoral stage; (iii) the agricultural stage; (iv) the agricultural and manufacturing stage; and (v) the agricultural, manufacturing and commercial [services] stage. Second, to progress, countries ought to industrialize, i.e. go from stage (iii) to stages (iv) and (v). Third, such transitions cannot take place automatically through the "natural course of things", i.e. through market forces. Hence, to do so, infant industry protection becomes necessary for countries, which are at stage (iii) if other countries are at different stages of development, i.e. "some have outdistanced others in manufactures". Fourth, protection should be temporary, i.e. confined to the infant stage and should be gradually removed as the industry matures. Finally, protection should be confined to the manufacturing sector; agriculture should not be protected, even though productivity growth in this sector is important for development. (Mehdi, 2000, pp. 4,5)

During the 80's another scholar went further in the construction of the term NIS, according to Christopher Freeman (1987-1988) NIS forms a "network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies". These institutions include not only those who are directly involved in research and development, but also "the way they are managed and organized the available resources, both in companies and at national level.

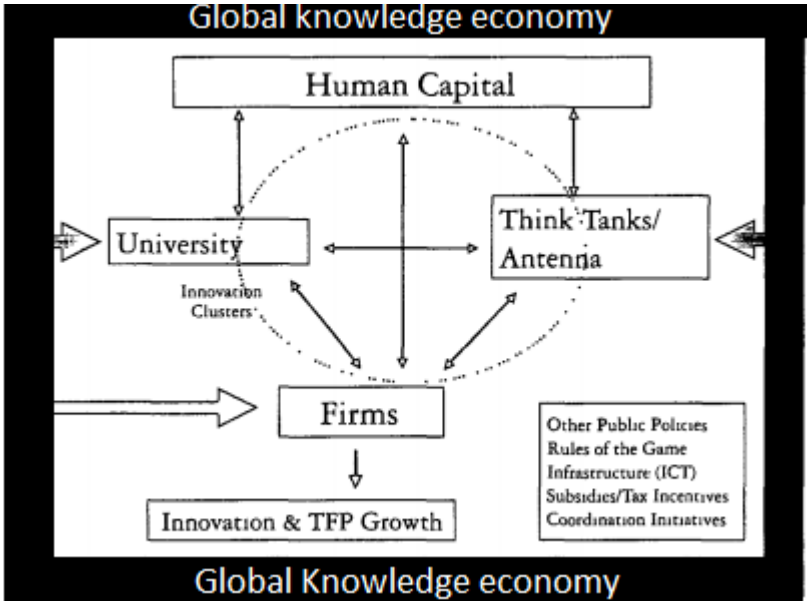
NIS as one that, at least partially, forms part of the functions of government policy at national level; formal state regulation and informal coordination, funding for the R+D (Research and Development), as a result of all this stock of knowledge that can help develop the homogeneity and linkages between national innovation actors.

In National Innovation Systems (NIS) the linkage of actors involved are key in improving technology performance, as we have seen before, it was a term defined in Europe and United States, therefore the earlier examples comes from those areas.

The conceptual approach of a NIS emerged as one of the dominant strands of research from the field of innovation studies. Although the idea of innovation as an activity is not new, the study of innovations began to emerge as a separate field, differentiating itself from economics, in the 1960s.

The next figure taken from De Ferranti 2003, sketches a simple NIS capturing the ideal interaction of these various institutions and, where applicable, the human capital employed in them. In theory, the networks of public institutions and private firms interacting in a concerted way to generate and adopt technologies form the mechanisms through which nations learn.

Figure 0-1 Global knowledge economy



Source: De Ferranti et al. (2003)

NIS have shown that innovation although brings several benefits to economy it also involves risks of these market and nonmarket institutions.

The Micro-level and Macro-level risks of NIS

Innovation is an uncertain process. The speed of change in international markets and science and technology, along with the greater diversity and specialization of knowledge, create uncertain and rapidly changing environments for firms. In stable environments it may be sufficient for firms to engage in stable and exclusive relationships with a small number of partners.

Both macro-level risk and micro-level risk lead to the uncertainty. NIS can lead to financial risk found in stocks and funds, to political risk found in different countries, and to the impact of economic or financial variables on political risk.

Macro risk can also refer to types of economic factors, which influence the volatility over time of investments, assets, portfolios, and the intrinsic value of companies. If not implemented properly innovation process can be extremely expensive for a country, especially to developing countries.

Micro-level risk can be found in enterprises, institutions and companies, according to Gao 2010, government support and cooperation among actors respectively decreases the macro-level and micro-level risk of innovation. Government (policy and funds), helps to reduce the macro-level risk. It also overcomes the micro-level risk by the institutions and organizational forms that bolster cooperation.

The globalization of economies is making countries' innovation systems more interdependent. Trade in technology is growing, as are international alliances among firms and cross-border purchases of patents and licenses. Investment in foreign research facilities

is also on the rise, particularly by firms based in smaller countries. In this environment, the competitiveness of firms depends more and more on their ability to link to international innovation networks. However, globalization is not leading to a homogenization of national innovation patterns. Countries still differ greatly owing to differing starting points, technological and industrial specialization, institutions, policies and attitudes to change. (OECD, 1999), therefore the main implication of the NIS concept involves creating a culture where the actors are continuously correlated, China and Mexico have made efforts to create a successful innovation cultures, and developing a successful NIS.

The NIS as model of development of countries

Economic growth relies more on innovation than before. Recent evidence from OECD and other sources suggests that this trend is continuing. Managing innovation policy is becoming more complex and depends more on governments' ability to find a strategic approach to harness the innovative potential of their respective economies. Further, these economies become more inter-linked through the process of globalization. (OECD, 2015)

Innovation has become a central topic in different fields, economics, engineering, medicine, and so on, it is also an important issue for enterprises and governments, and it represents a modern world, where comparative advantage of David Ricardo is no longer the key factor of development.

Some countries like Japan or Germany, both developed countries but with few raw materials, need to be innovating in every aspect of their economy, their production tend to be more cost-intensive than countries rich in raw material such as Mexico or Brazil.

According to "The Global Innovation Index 2014" elaborated by Cornell University, INSEAD, and the World Intellectual Property Organization, in many respects, the global

innovation landscape is more active and inclusive than ever: In addition to higher levels of expenditures on innovation, we also see signs that the number and geographical spread of students, researchers, and entrepreneurs are rising.

Countries around the world are in a constant race to become an innovative nation, as innovation indexes show. Efforts are made in public and private sectors, those efforts are stronger in developed nations than in developing nations, due to the fact that innovation efforts are sometime exclusively related to money expenditure, and amongst other factors, Research and Development (R&D) stands out of the rest.

Research and Development investments

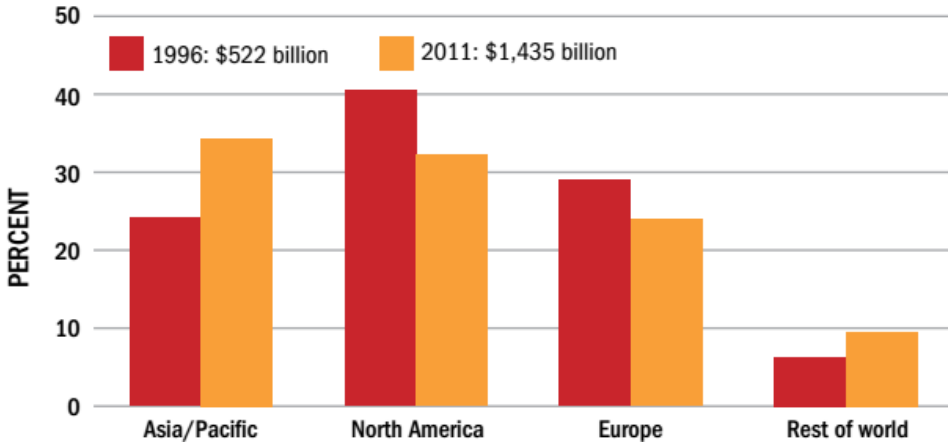
Investment in R&D is not the only factor that affects the rate of and capacity for innovation. Public policies, but there is no doubt of its important role, another factors include monetary policy, tax policy, standards, procurement, regulatory policy, the availability of a skilled technical workforce, and market access

As empirical evidence and analysis began to accumulate about industrial R&D and about innovation, both in Japan and in the United States and Europe, it became increasingly evident that the success of innovations, their rate of diffusion and the associated productivity gains depended on a wide variety of other influences as well as formal R&D. In particular, incremental innovations came from production engineers, from technicians and from the shop floor. They were strongly related to different forms of work organization. Furthermore, many improvements to products and to services came from interaction with the market and with related firms, such as sub-contractors, suppliers of materials and services. Formal R&D was usually decisive in its contribution to radical innovations but it

was no longer possible to ignore the many other contributions to, and influences upon the process of technical change at the level of firms and industries (Freeman, 1997 p.302)

Total National Investment in R&D includes investments by the Federal Government, states, colleges and universities, and the business and non-profit sectors. The United States as well as other developed nation show the highest rate of R&D expenditure, According to "The Science and Engineering Indicators Digest 2014" which is the latest available, global R&D expenditures are highly concentrated in three regions: Asia, North America, and Europe. The seven countries with the largest R&D expenditures together accounted for nearly three-fourths of total global R&D in 2011. The United States remains the largest R&D performer and accounted for almost one-third of worldwide R&D total in 2011. China is now the second largest R&D performing nation, accounting for about 15% of the worldwide total.

Figure 0-2 Regional share of worldwide R&D expenditure: 1996 and 2011

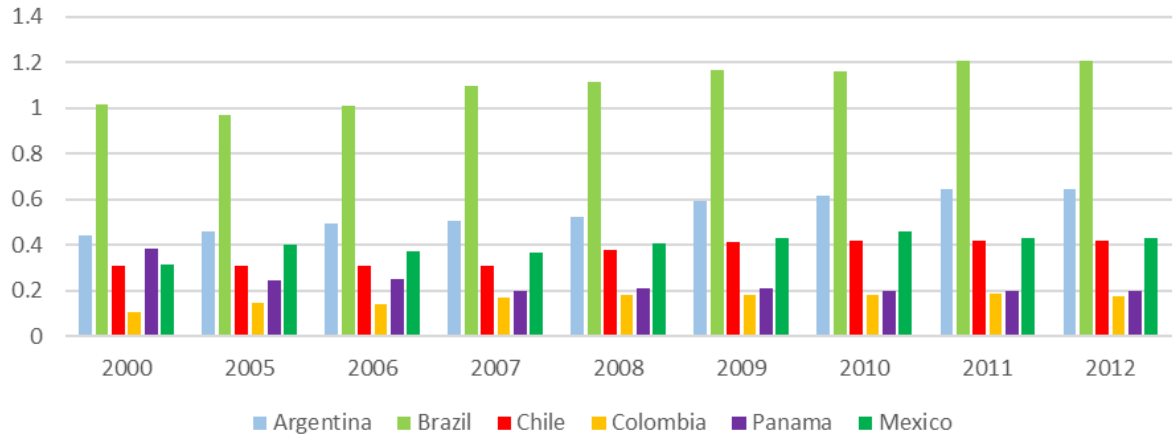


Source: SEI 2014, Global Pattern of expenditures, chapter 4.

Asian countries have led the growth in worldwide R&D expenditures over the past decade, with China accounting for about one-fourth of the total global growth.

The Latin America and the Caribbean region, by contrast puts much less effort into development research, as a result of the low share of private R&D, since that type of R&D is generally done by the private sector. Brazil, Argentina and Mexico were among the largest spenders on development research. The rest of the LAC countries lagged far behind, with an important recently exception of Chile.

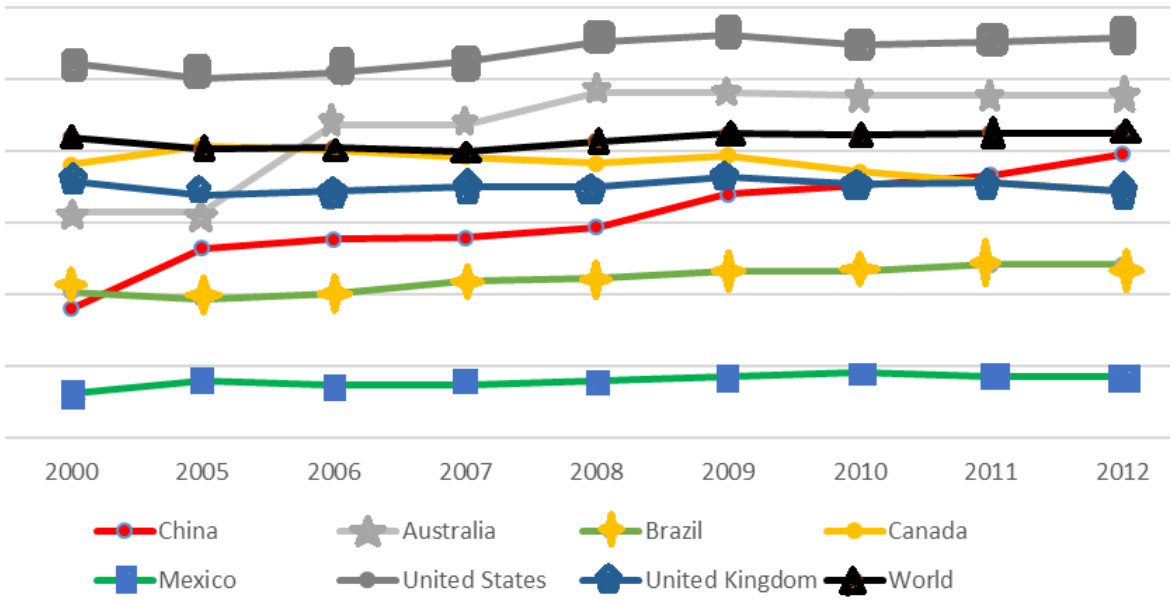
Figure 0-3 R&D expenditure (%of GDP) in Latin-American region



Source: Own elaboration with data from World Bank, 2015

Mexico had a relatively stable performance with an insignificant increase. China had one of the best performances in R&D. Innovation strategies focusing on R&D are evidently generating economic growth. On average, companies manufacturing piece goods invest about 6% of their turnover in R&D. however companies with poor R&D quota of less than 2 percent barely set any growth impulses.

Figure 0-4 R&D expenditure (% of GDP)



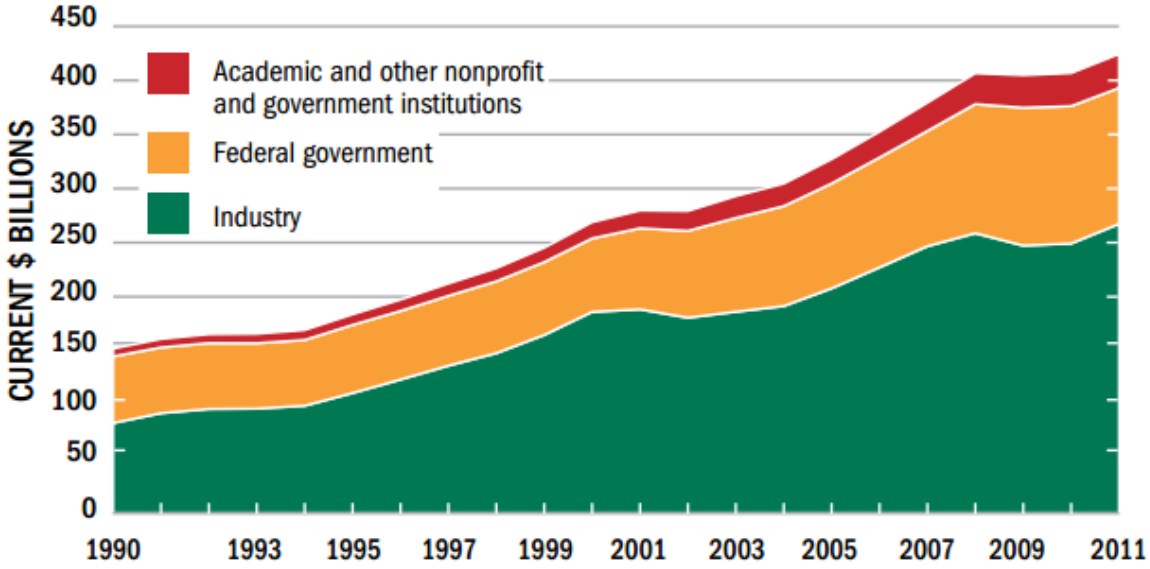
Source: Own elaboration with data from World Banka Database, 2015.

Given this critical time in our Nation's economic trajectory, careful consideration of our portfolio of innovation policies—including R&D investment practices and public policy—is needed to foster national prosperity and to increase national access to the global economy.

Type of R&D structures

The structure of R&D funds by source in the U.S. has gone through three phases from government-dominance type to industry-dominance type since the 1960s. The same trend happened in many other developed countries.

Figure 0-5 U.S. E&D expenditure, by source of funds: 1990-2011



Source: SEI 2014

The structure of R&D by source in China eleven years ago still was a government driven type, however, nowadays belongs to an industry driven type. In contrast, the structure of R&D in Mexico is a predominance of government investment. In Mexico, except for state-owned companies, such as Pemex and the electrical utility company, the government does not provide research and development funds or incentives for R&D in firms. The research and development effort is centered in federal and state research projects (primarily in agricultural and medical research), and in the public universities about 40 percent of all public university R&D is at the National University of Mexico (UNAM). One-third of all the researchers registered in the late 1980s -by the national system of researchers (SNI) worked at UNAM.

For technology transfer to succeed and firms absorb external knowledge, investment in R&D is a key determinant. Investment in R&D has a twofold advantage for firms. In addition to generating new ideas, investment in R&D also has a direct effect on the creation of absorptive capacities. R&D competences are fundamental for the development of new competencies and skills needed to search out, acquire and adapt existing technology. In other words, investment in innovation is a key driver of productivity catching-up.

Therefore it is crucial to assess what firms are doing in terms of innovation and R&D. Are they concerned about innovation as a part of their competitive strategy? Have they devoted resources to R&D? Do they have the capacity to transfer and adapt technology that could make them more productive? What kind of innovation is occurring and what kind of technology is being incorporated? (IDB, 2010, P.44)

Building an innovation culture

Who is responsible for having an innovation culture? Although government has an important role in promoting innovation through policies, regulation exemptions etc., it is not the only one. Innovation also requires overcoming the inability of many firms to cope with technical progress and incorporating new knowledge and technology, as well as universities and scientific centers to develop and promote new knowledge creating an adequate environment for students or human capital.

The main actors in innovation processes (firms, public and private research organizations, and government and other public institutions), have to enhance interactions. These actors are influenced by a variety of factors that exhibit some degree of country specificity: the financial system and corporate governance, legal and regulatory frameworks,

the level of education and skills, the degree of personnel mobility, labor relations, prevailing management practices, etc. The variable role of government is partly reflected in the levels and structures of public R&D financing. AS we have seen before, in developing countries, government R&D expenditure accounts for a higher share of total R&D than in more advanced economies. These countries often still need to build a scientific and technological infrastructure and their business sectors tend to have only weak technological capabilities.

Governments should also address the specific factors that restrain the number of technology-based start-ups and reduce their growth potential. The scientific content of innovation is increasing and the scientific roots of innovation are diversifying and changing in relative importance. Universities and research centers have an impact on innovation culture. Innovation has several actors it is indeed a systemic phenomenon that cannot be isolated.

At the other end of the spectrum are countries in which the business sector provides the bulk of R&D funding. Countries also differ in the orientation of publicly funded R&D. For instance, despite a common trend away from the "traditional" missions of the post-war period (defense, energy) and towards new societal demands, such as ageing populations, the environment and competitiveness, the defense cluster still plays an important role in some countries, notably France, Sweden, the United Kingdom and the United States. The variable role of the higher education sector (universities, etc.) serves as an indication of the relationship between the science system and the rest of the innovation system. The share of expenditure on R&D in the higher education sector (HERD) financed by government is

declining in the majority of OECD countries, but remains very high in some (e.g. Austria). In others, the enterprise sector is a significant financial contributor to universities.

Successful NIS

At the end measuring the success of a NIS is difficult and complex, each scholar probably would have a different point of view, our literature review shows that factors like, social, political and economic environment are key elements for achieving this success. These elements together with a Triple Helix system (Government, Industry and University system) are the central node of a system of innovation. Encouraging innovation can be synthesized into five main types: technology transfer, collaboration and conflict moderation, collaborative leadership, substitution, and networking. The overall function of Triple Helix systems of knowledge and innovation generation, diffusion and use is realized through a set of activities in the Knowledge, Innovation and Consensus Spaces. According to David and Foray (1995), innovation capability had to be seen less in terms of the ability to discover new technological principles, and more in terms of the ability to exploit systematically the effects produced by new combinations and uses of components in the existing stock of knowledge. The concept of NIS has led to several forms of division, one of them is division into platforms and regions, and recently China has put more emphasis in innovation platform rather than innovation system. Compared with the concept of "innovation system, "innovation platform places more emphasis on the infrastructure of innovation and can be seen as an early stage to form a completed NIS.

National Innovation Platforms

National Innovation Platform (NIP), forms new relationships (interaction and cooperation) among different actors and encourages these actors to engage in innovation process based

on the crucial and generic demand of industry by policy. In other words, NIP-program affects the components of NIS, i.e. both actors and institutional set-ups. If NIP is implemented felicitously, it is reasonable to make an optimistic forecast that the resulting NIS will form stronger domestic links and interactions among knowledge producers, users and the government.

Innovation itself was characterized by defragmentation; it was necessary to have a deal between many ministries, education centers, financial groups, etc. If a nation faced a specific problem issue i.e. agricultural sophistication, ministries in charged had to be involved as well as top government ministries (financial, monetary, fiscal ministries). The Netherlands first established the mission of its own innovation platform in 2003, that was aim to create conditions and connections, as well as to develop a vision to boost innovation. African nations have look forward to implement innovation platforms, but have struggled to accomplish the goals due to lack of actor's coordination, developed and developing economies face different situations. As the case of China and Mexico reflects a number of differences stand out. First, the R&D intensity of these economies is relatively low, often close to 1% of GDP (China spends 2.08% as percentage of GDP, Mexico spends 0.4%), while the share of researchers in the labor force is also quite low, and these countries provide a relatively limited contribution to scientific activity. The low R&D intensity is due to low government and private spending on R&D, although the public sector tends to play a larger role in total R&D expenditure than the private sector, as the country still needs to develop its national science and technology base and the private sector is often relatively weak in technological terms. The economic structure of these countries is often more geared towards low- and medium-technology industries, and this contributes to relatively

low private R&D spending. Second, these countries' innovative activity, as measured by an index of technological strength, also tends to be quite low compared to higher-income economies. Their technology balance of payments often shows a negative balance, which indicates that they are highly dependent on technology imports.

Table 0-1 Technology balance of payments of China and Mexico from 2010 to 2013 (Millions of Dollars)

	China				Mexico			
	Received	Payment			Received	Payment		
2013	886,670,295	21,033,078,371	-20,146,408,076	4%	2,295,003,000	1,474,686,000	820,317,000	61%
2012	1,044,102,041	17,748,983,437	-16,704,881,396	6%	95,626,260	1,120,228,140	-1,024,601,880	8%
2011	743,301,698	14,706,108,691	-13,962,806,993	5%	96,535,890	774,463,200	-677,927,310	11%
2010	830,483,814	13,039,546,459	-12,209,062,645	6%	88,006,650	658,295,850	-570,289,200	12%

Source: Own elaboration with data from World Bank, 2015.

As the transfer and adoption of technology plays a very large role in these countries, their NIS system has a strong focus on technology transfer, adoption and diffusion.

The speed of change in international markets and science and technology, along with the greater diversity and specialization of knowledge, create uncertain and rapidly changing environments for firms. In stable environments it may be sufficient for firms to engage in stable and exclusive relationships with a small number of partners.

NIS often contributes to the development of a stronger economic environment, NIP's are recently taking a part in some nations, China is one of those, we will study the NIP deeply in the next chapter.

CHAPTER III

CHINA'S AND MEXICO'S NIS

This chapter aims to give a better understanding regarding the historical conditions that contributed to create a NIS in China and Mexico. China is currently the world's second largest economic power; it is also one of five permanent members of the United Nations Security Council, and the only Communist Party-led authoritarian state in the G-20 grouping of major economies. Its cultural roots date back to thousands of years. China is a vast country covering a largest portion of the Asian continent. Politically, the Chinese Communist Party (CCP or Party) has been in power in China for more than six decades, a record of longevity that rivals and could one day surpass that of the Communist Party of the Soviet Union. The CCP assumed power in 1949 by means of a civil war victory over the forces of Chiang Kai-shek's Nationalists, who moved the seat of their Republic of China government to the island of Taiwan. The Communists named their new regime the People's Republic of China (PRC). (Lawrence, 2012, p.5). After the entrance of communism China started to gradually improve in term of economy development. However innovation was not a relevant issue in the early of the People´s Republic of China.

Mexico is the second largest economy in Latin America, after Brazil. Mexico in recent decades has been labeled as an open market economy, it puts emphasis in exports, and in 2015 Mexico was the largest exporter in Latin America and world´s tenth exporter. Mexico is a culturally diverse country, and its history dates back to prehispanic cultures such as Aztecs, Mayans etc. Mexico has a strong economic relation with the United States, both countries are united by history, several disputes and agreements have taken place in

this two neighboring countries. The relationship between the United States and Mexico is important to policymakers from both countries because of the mutual interest in a number of key issues affecting the two countries, such as bilateral trade, economic competitiveness, and border security. The economic relationship between the United States and Mexico is highly interdependent, with NAFTA playing a central role.

Background of People´s Republic of China

The creation of the People's Republic of China in 1949 was a turning point in Chinese history. After the World War II and the Civil War, the Communist party consolidated power and embarked on a comprehensive political, economic and social transformation. Following the Soviet experience, the Chinese communists planned to turn a backward agrarian economy into a modern industrial power through collectivization of agriculture, expropriation of "agricultural surplus", and a massive top-down industrial investment.

"The initial conditions in China 1950 were different from those in the Soviet Union. Imperial Russia was behind its Western counterparts, yet, it had been growing for several decades before the World War I. Stalin inherited a relatively developed industry and urbanized population. The Chinese economy before 1950 was a stagnating agrarian one. It had not experienced growth; moreover, its very institutions were built to preserve the status quo rather than to promote growth." (Cheremukhin, et al. 2015, p. 18).

"The Confucian political economy . . . was that of an agrarian empire and was directed above all to the maintenance of social stability through the guarantee of minimal standards of survival and the amelioration of unacceptable inequalities." (Richardson, 1999, p. 85 on Cheremukhin, et al. 2015, p. 18).

Overpopulation was becoming an increasing problem, large amount of people move from villages to cities, especially in coastal areas, in Beijing, Shanghai, Shenzhen, Guangzhou, etc. China is a centralized country but financial activity is partially spread in Shanghai and Shenzhen, each city has its own stock market. However the political power is in Beijing.

"After Mao's death in 1976, Deng Xiaopin rose to power and eventually managed to become a "paramount leader" of China. In December 1978, at the Third Plenum of the Central Committee, Deng consolidated his power and launched the course of reforms.
The dynamics of productivity growth and inter sectoral wedges in 1978-2011 are very different from those in 1952-78." (Cheremukhin et al. 2015, p. 29).

The third constitution of the People's Republic of China was adopted in 1978. In 1978, a new constitution was adopted. This new constitution attempted to restore some rule of law and mechanisms for economic planning. In regards to the latter, Hua Guofeng wanted a return to the Soviet-style economics of the mid-1950s. He drew up a ten-year plan which emphasized heavy industry, energy, and capital construction.

Deng Xiaopin returned to Beijing in 1978 and chaired the (11th) National Congress of the Communist Party of China. During Deng Xiaopin's era relations with the West improved markedly during Deng's term, although the People's Republic of China had gained a certain degree of recognition from the West in the late Mao era. In 1968, the government of Canadian Prime Minister Pierre Elliott Trudeau initiated negotiations with the People's Republic of China that led to the establishment of diplomatic relations between China and Canada on October 13, 1970. In 1971, Mexico decided to break formal diplomatic relations with the Republic of China (commonly known as Taiwan) after the

successful passing of Resolution 2758 at the United Nations recognizing the People's Republic of China as the only legitimate representative of China to the United Nations. In February 1972, the People's Republic of China and Mexico established diplomatic relations. After china's WTO entry, it advocates of liberalization in the last decade and to more than 70 countries unilaterally, no return to the lowering of tariffs. China since 1992, has autonomously reduce tariffs, to October 1, 1997, China's tariffs have been reduced substantially. Compared with 1992, the arithmetic average tariff rate went from 43.2% down to 17%, a decline of 60.6%.

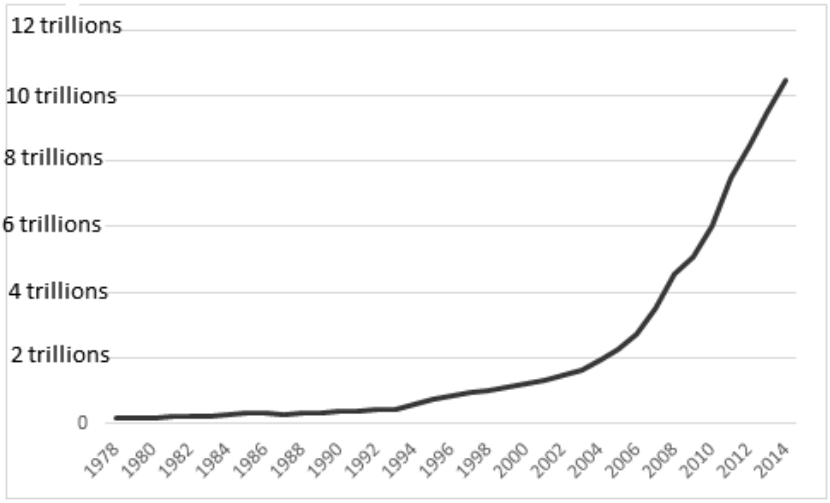
Thus, with the development of economic globalization, the interdependence of national economies, the strengthening of mutual penetration, and the liberalization of world trade has become the dominant trend. After all these years China has become a politically and economically superpower. Most of the world recognizes People's Republic of China as the legitimate power, the economic growth had have risen population out of poverty, and the continuation of the plans have made some structural changes.

Chinas economic overview

International Monetary Fund (IMF), World Bank (WB) and OECD consider China as a developing country among other institutions.

Since initiating market reforms in 1978, China has shifted from a centrally planned to a market based economy and experienced rapid economic and social development. GDP growth averaging about 10 percent a year has lifted more than 500 million people out of poverty. All Millennium Development Goals have been reached or are within reach.

Figure 0-1 China's GDP growth at market prices (current US$)



Source: Own elaboration with data from World Bank, 2016.

With a population of 1.3 billion, China recently became the second largest economy and is increasingly playing an important and influential role in the global economy.

Yet China remains a developing country (its per capita income is still a fraction of that in advanced countries) and its market reforms are incomplete. Official data shows that about 98.99 million people still lived below the national poverty line of RMB 2,300 per year at the end of 2012. With the second largest number of poor in the world after India, poverty reduction remains a fundamental challenge.

Rapid economic ascendance has brought on many challenges as well, including high inequality; rapid urbanization; challenges to environmental sustainability; and external imbalances. China also faces demographic pressures related to an aging population and the internal migration of labor.

Significant policy adjustments are required in order for China's growth to be sustainable. Experience shows that transitioning from middle-income to high-income status can be more difficult than moving up from low to middle income.

China's 12th Five-Year Plan (2011-2015) forcefully addresses these issues. It highlights the development of services and measures to address environmental and social imbalances, setting targets to reduce pollution, to increase energy efficiency, to improve access to education and healthcare, and to expand social protection. Its annual growth target of 7 percent signals the intention to focus on quality of life, rather than pace of growth. (IMF, 2015)

Back in 2010, China attempted to include the renminbi (RMB) or yuan in the Special Drawing Rights (SDR), which is a currency reserves basket containing the euro, yen, pound and US dollar. However the RMB didn't comply the requirements of the IMF. During that time some authors implied that China cannot be a reserve currency "…In spite of growing economic importance of China, since is already the second power in the world, its currency renminbi or yuan cannot be a transaction currency, not to mention a reserve currency" (Kozikowski, 2013, p.86). In spite of some critics, in November 30, 2015, the Executive Board of the International Monetary Fund (IMF) completed the regular five-yearly review of the basket of currencies that make up the Special Drawing Right (SDR). A key focus of the Board review was whether the RMB met the existing criteria to be included in the basket. The Board decided that the RMB met all existing criteria and, effective October 1, 2016 the RMB is determined to be a freely usable currency and will be included in the SDR basket as a fifth currency, along with the U.S. dollar, the euro, the Japanese yen and the British pound. Launching the new SDR basket on October 1, 2016

will provide sufficient lead-time for the Fund, its members and other SDR users to adjust to these changes.

Ms. Christine Lagarde, Managing Director of the IMF, stated:

"The Executive Board's decision to include the RMB in the SDR basket is an important milestone in the integration of the Chinese economy into the global financial system. It is also recognition of the progress that the Chinese authorities have made in the past years in reforming China's monetary and financial systems. The continuation and deepening of these efforts will bring about a more robust international monetary and financial system, which in turn will support the growth and stability of China and the global economy." (IMF, 2015).

The RMB will hold a 10.9 percent weighting in the Special Drawing Rights (SDR) basket, higher than the yen and sterling's 8 percent but well below the euro's 30.9 percent and the greenback's 42.9 percent.

This step of the RMB is signaling a significant leapfrog in China's rising geopolitical influence.

China's NIS process

For historical reasons, enterprises in China generally lack the awareness and capability of innovation. Since 1949 when the People's Republic of China was established technology development in China has been characterized by imitation rather than creation. Still after China's entry into WTO in 2001, most Chinese firms focus on developing manufacturing capability by utilizing low-cost labor force and exploiting resources while less attention is given to improvement of innovative capability. Many Chinese firms lack core technological

competences and in most high technology fields foreign firms dominate in terms of intellectual property rights. As a result, Chinese firms are at a disadvantage in the global competition. (Gao, 2010, P.1)

The first National Science and Technology Development Plan (STDP) defined the formation of the NIS during the period 1956 through 1967. China imported 156 heavy industry facilities from the Soviet Union and established 400 research institutes which mainly focused on reverse engineering. The National Science Conference in 1978 declared science and technology as the key among the four modernizations. In line with the "Reform and Opening Up" policies implemented after 1978, the doctrine of self-reliance was replaced by a strongly expanded orientation towards foreign technology. The transformation of the NIS was constructed as part of the overall transformation process from a planned to a market-driven economy.

China had a State Council of Science and Technology till 1998, when the Ministry of Science and Technology (MOST) was established. The State Science and Education Leading Group, headed by the Prime Minister, was established in the same year. There are nine members in the group – MOST, the Ministry of Education, the Ministry of Finance, the Ministry of Industry and Information Technology, the Ministry of Agriculture, the National Development and Reform Commission, Chinese Academy of Sciences, Chinese Academy of Engineering and the Natural Science Foundation Commission. All these ministries' organizations are directly connected with S&T development, besides the Ministry of Health and the Ministry of Environment Protection. Ensuring coordination among all these ministries and organizations has necessitated a large amount of work. Each of China's more than 30 provinces has its own Bureau of Science and Technology, Bureau

of Education and so on. So, for S&T administration, China has an inter-ministry system at the national level and province-level and county-level systems at local government levels.

Economic Planning

China has a clear economic development project in the long term. From the opening of its economy to the outside, it focused on the specialization of production, that is, in manufacturing and building one industry in specific locations, to energize the regional economy.

Since almost the beginning of the People's Republic of China economic policy was based on the address government industrial, agricultural, currency and trade policy with the assistance of the authorities and the Central Committee Communist Party. But over the past decades China realized that globalization was a real phenomenon, therefore started to get involved in international trade. In late 1978, State leaders tried to change economy - until then based on the Soviet model - a centralized planning market-oriented, under the guidance of the Communist Party.

The new Chinese centralized market oriented economy, tried to build a new society based on the formula OIIO (Observe, Imitate, Improve, Overtake), most of these investments are created by joint venture between foreign and Chinese companies - which was the legal concept adopted by The government at first. Since in such joint ventures was usually a clause Exchange Technology: technological know-how in exchange for all facilities to settle in the country and develop the market. China aims start innovating when it reaches the desired level of development. From Indeed, innovation has been the slogan of the Eleventh Five-Year Development Plan since 2006.

Joint ventures have been a successful to attract Foreign Direct Investment, and locate into regions in need. The development of regions therefore was an important issue in the agenda, since 1980, China established five special economic zones: Shenzhen, Zhuhai, Shantou, Xiamen and Hainan. In 1984 they opened outside 14 coastal cities: Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Shanghai, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang and Beihai and in 1985 opened the deltas Changjiang and Zhujiang, the southern Fujian peninsulas Liaodong and Shandong and Guangxi region. In 1990 he opened the Pu Dong New Area in Shanghai and a number of cities on the banks Changjiang River.

The specialization of the Special Economic Zones developed rapidly and successfully, bringing with it the expansion of model and develop additionally 15 free areas taxes (ZF), 54 areas of technical and economic development, 53 development zones of high and new technologies 1, 14 areas border economic cooperation zones and processing 15 for export.

Table 0-1 Chinese economic zones

Classification	Objective
Special Economic Zones (SEZ)	Develop an export economy in the manufacture industry intensive labor
Economic and Technological Development Zones (ETDZ)	Create an atmosphere of attraction for foreign investment, encouraging the assimilation of advanced technology

	and management expertise.
Free Trade Zones (FTZ)	Facilitate the intensive export of goods and products.
Hi-tech Development Zone (HDZ)	Attract and establish companies intensive high and new technology
Border Economic Cooperation Zones (BECZ)	Facilitate foreign trade activities in border areas.
Export Processing Zones (EPZ)	Encourage and strengthen the expansion of activities Foreign trade

Source: adapted from Lara, 2009

Chinese National Innovation Platform (NIP)

NIP is a new concept introduced by the Chinese government seen in the light of China's integration into the global competition. In October 2007, Jintao Hu, the National chairman of PRC, announced that China needs to enhance its capacity for independent innovation and become an innovative country in his report to the Seventeenth National Congress of the Communist Party of China. It is also emphasized that China will speed up forming a national innovation system and support basic research, research in frontier technology and technological research for public welfare. China will accelerate the process to establish a market-oriented system for technological innovation, in which enterprises play the leading

role and which combines the efforts of enterprises, universities and research institutes, and guide and support the concentration of factors of innovation in enterprises.

NIP is introduced for the purpose of supporting R&D for generic technology, improving innovative capability of enterprises, and forming cooperation and interaction among enterprises, universities, and research institutes. It is also an attempt to integrating the existent programs in regional and national levels.

Basis of NIP

According to Gao 2010, China already has some national and regional programs to support innovation before the concept of NIP is proposed.

(1) National S&T Infrastructure Platform

China's National S&T Infrastructure Platform is under construction to enhance the basic research from 2004. National lab, scientific equipment, technological information system, and scientific database are established and shared. Although the National S&T Infrastructure Platform focuses on basic research rather than application oriented research and thus not able to transfer technology directly to enterprises, it helps to concentrate the innovation resources and form an atmosphere of sharing.

(2) Innovation Relay Center

China‟s Innovation Relay Center is a technology transfer network for the purpose of accelerating the knowledge transfer from research to enterprises. It first collects information from enterprises, universities, and research institutes to know both the demand

and supply of knowledge. Then it publishes the information and helps to match the „demand" and „supply".

(3) National Key Technology R&D Program

China's National Key Technology R&D Program is led by the Ministry of Science and Technology and Ministry of Finance. It aims at solving the key technical problems, which are related to several regions or sectors and significant to the economic development. The Ministry of Science and Technology calls for proposals of research programs from the whole society, especially from enterprises and local governments. The proposals are then discussed by experts and approved as part of the final programs. Finally, the implementer of each program is identified.

The Ministry of Science and Technology assumes the responsibility to supervise the implementation of the programs. Programs are funded in different forms, including free financing, subsidized loans, repayable funding, and venture capital.

(4) Regional programs

Besides the national programs, local governments have also developed programs to support regional innovation. For example, many innovation platforms supported by local government have been developed. Some of these platforms also link to sectors and aim at driving the economic development of the whole region through enhancing the innovative capability of the specific sector. Unlike NIP, regional platforms integrate resources and provide services within the regional boundary, but not nation-wide.

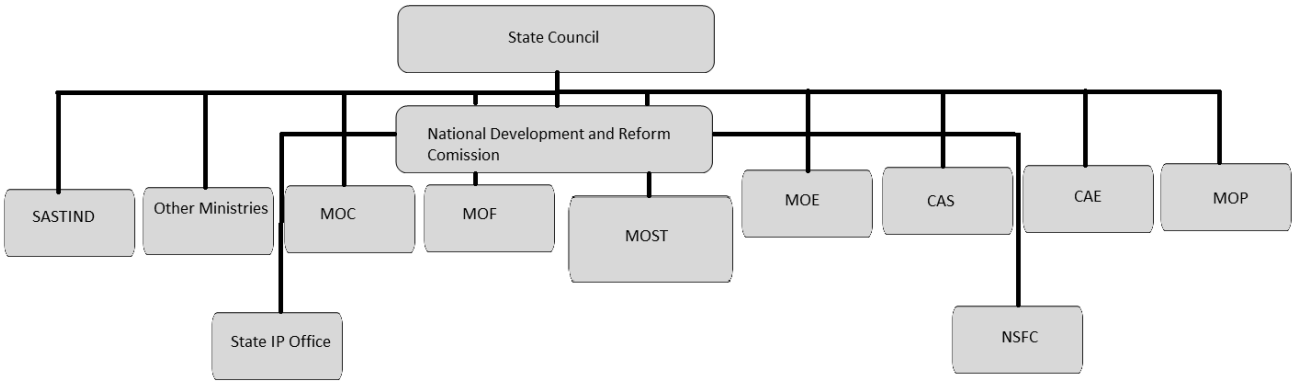
All the existent national and regional programs form the foundation of NIP. Integrating innovation resources provided by these programs can help to enhance effectiveness in supporting innovation and also reduce the cost of developing NIP.

Framework for analyzing NIP

The three pilot NIPs in China, i.e. national innovation platforms of textile industry, integrated circuit industry, and Tibetan pharmaceutical industry differ from each other in operational details.

NIPs may have different forms because they are built for different sectors. It is unrealistic to expect one-detailed instructions adapted to all China's NIPs. However, it is meaningful to look into the mechanism behind and explain how NIP accelerates the innovation process. In this study, we will develop the framework for analyzing the mechanism for NIP to promote innovation.

Figure 0-2 Chinese NIS structure



Source: own elaboration with data of OECD.

The Chinese current NIS structure has changed dramatically from the former centralized structure, based on the soviet model. Although current structure starts with a president of the People's Republic of China, several ministries make its vital decision. One important detail is that ministries are strongly related and linked together, therefore their cooperation, foster innovation. Below I briefly describe each element of the China's NIS.

State Council

In terms of governance the state council is the chief administrative authority of the People's Republic of China. It is chaired by the Premier and includes the heads of each governmental department and agency. Currently, the council has 35 members: the premier, one executive vice premier, three vice premiers, five state councilors (of whom two are also ministers), and 25 additional ministers and chairs of major agencies. In the politics of the People's Republic of China, the Central People's Government forms one of three interlocking branches of power, the others being the Communist Party of China and the People's Liberation Army. The State Council directly oversees the various subordinate People's Governments in the provinces, and in practice maintains membership with the top levels of the Communist Party of China.

National Development and Reform Commission (NDRC)

The NDRC is a macroeconomic management agency under the Chinese State Council, which has broad administrative and planning control over the Chinese economy. The candidate for the chairperson of the NDRC is nominated by the Premier of the People's

Republic of China and approved by the National People's Congress. Since March 2013 Xu Shaoshi has headed the Commission.

The NDRC's functions are to study and formulate policies for economic and social development, maintain the balance of economic development, and to guide restructuring of China's economic system. The NDRC has twenty-six functional departments, bureaus, offices with an authorized staff size of 890 civil servants.

State Administration for Science, Technology and Industry for National Defense (SASTIND)

Formerly known as (COSTIND), is a civilian ministry within the State Council of the People's Republic of China and is a subordinate agency of the Chinese Ministry of Industry and Information Technology and the superseding agency of the Commission for Science, Technology and Industry for National Defense (COSTIND). It was created by the Plan for Restructuring the State Council passed by the First Session of the Eleventh National People's Congress in 2008.

Collaborations in terms of innovation

The ministry of Commerce (MOC) and The Ministry of Finance (MOF) together provide tax reliefs to exports of high tech products, and preferential treatment of FDI in high tech sectors

The Ministry of Science and Technology (MOST) formulates strategies, priority areas, policies, laws and regulations for S&T, promotes the building of the national innovation system, conducts research on major S&T issues related to economic and social development, guides reforms of the S&T system, formulates policies to strengthen basic research, high-tech development and industrialization, designs and implements programs to

fund basic and applied research, to induce firms to innovate, to create science parks, incubators, etc., develops measures to increase S&T investments, allocates human resources in S&T and encourages S&T talents, promotes international S&T cooperation and exchanges.

The collaboration between The Ministry of Education (MOE) and The Ministry of Science and Technology (MOST) provides support to university-related R&D, science parks and human resource development.

The MOE, The Chinese Academy of Sciences (CAS), and The Ministry of Personnel (MOP) Attracts overseas Chinese Scholars, manages post-doc programs.

Background of the United Mexican States

On September 16, 1810, an independent Mexico was established. During the first years Mexico struggle to control the new territories, agricultures was one of the most important issues in the new governments, since it was necessary for all the activities. After agricultural activities Mexico went to a revolution, so the people can control their lands. Several decades after, oil became another important issue, until March 18, 1938 when President Lazaro Cardenas called for an expropriation of all oil reserves, facilities, and foreign oil companies in Mexico. This changed the economy and political structure of Mexico, since oil became the only and most important resource; it is still a relevant source of income for Mexico.

In the early 1970s, industrial policy diversified its objectives to include export promotion and the strengthening of international competitiveness, the development of capital goods industries, regional decentralization of industrial activities, and foreign investment regulation.

The new priorities were reflected in a number of policy reforms. Export promotion policies included the establishment in 1971 of export subsidies called Certificados de Devolucíon de Impuestos (CEDIS), and of tariff rebates on imported inputs of exporting firms, the expansion of short-term export credits provided by FOMEX (Fondo para el fomento de las exportaciones de productos manufacturados), the creation in 1972 of FONEI (Fondo de equipamiento industrial) for the financing of export-oriented investments, and the formation in 1970 of IMCE (Instituto Mexicano de Comercio Exterior) to strengthen export promotion efforts and facilitate access to international markets. From 1977 to 1981, a number of trade reforms replaced import licenses with tariffs with the aim of reducing the anti-export bias of the protection regime and increasing industrial efficiency. (Ros, 1993, P. 6)

Until the early 1980s, Mexico had strong protectionist economic policies with high trade barriers in several key industries, including the computer and automotive industries. After the 1982 Mexican debt crisis, Mexico's trade policy began to change. The Mexican government took a series of steps toward unilateral trade liberalization to attract foreign investment and make the country more competitive in non-oil exports. In the late 1980s, Mexico proposed negotiations for a free trade agreement with the United States.

Since 1983, Mexico's economic development model began to experience a transition from import substitution to export-oriented economy, with an active implementation of open economic policies. In 1988 President Salinas came to power, to make drastic economic reforms in trade, such as tariffs reduction, import licenses narrow range, eliminating non-tariff barriers and other measures, investment, including opening up

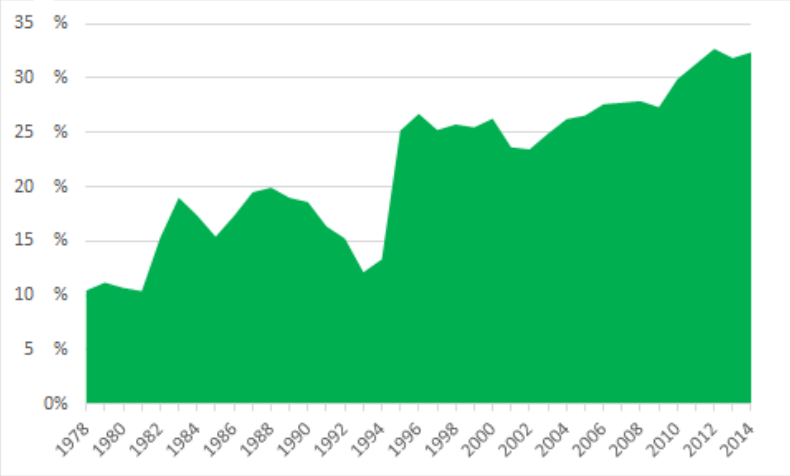
financial services, tourism, real estate, automobile manufacturing and other sectors, attracted a lot of foreign capital inflows.

The United States starting with Canada, a country with relatively close level of economic development, conformed the first attempt of North American Free Trade Agreement, some years later Mexico would be included, to continue to push southward, and ultimately achieve the purposes of economic integration of the Americas region.

In January 1994 members from the United States, Canada and Mexico signed the North American Free Trade Agreement (NAFTA), which is the world's first integration group including developed and developing countries. As mutually adjacent geographically, the United States, Canada and Mexico in terms of language, social customs and values are quite close, the three countries have convenient transportation, and have long formed a deep interdependence, economic and trade exchanges with each other more closely.

NAFTA had a great impact on Mexican economy after its implementation, Mexican exports doubled, especially to United States.

Figure 0-3Mexican net exports as share of GDP from 1978 to 2014



Source: World Bank, 2016

Mexico's strong economic ties to the United States after implementation of the North American Free Trade Agreement (NAFTA) have deepened the dependency of the Mexican economy on U.S. economic conditions.

"Mexico's reliance on the United States as an export market and the relative importance of exports to its overall economic performance make it highly susceptible to fluctuations in the U.S. economy. Exports equaled 26% of Mexico's GDP in 2009, a significant percentage, and 80% of Mexico's exports are destined for the United States. The United States is, by far, Mexico's most important partner in trade and investment, while Mexico is the United States' third-largest trade partner after China and Canada. After oil and gas, most of Mexico's exports are manufactured goods." (Villareal, 2010 , P.2)

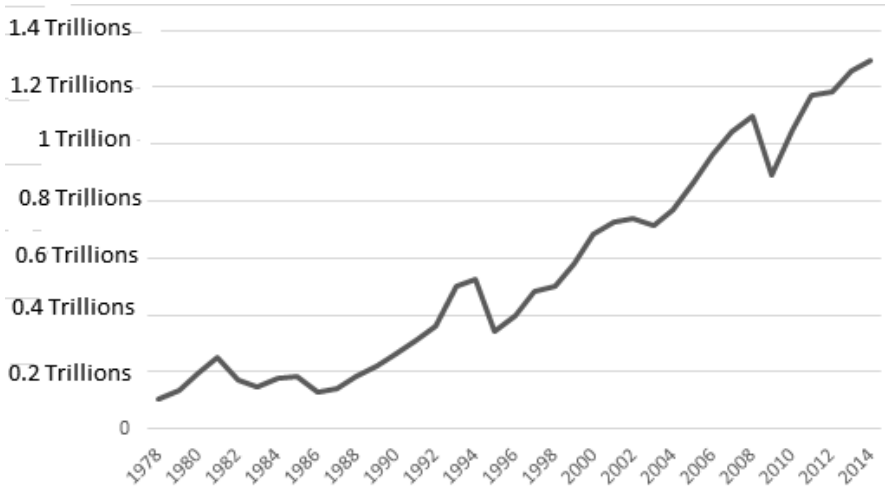
The Mexican economy suffered a financial crisis in 1995 that resulted from a number of complex financial, economic, and political factors. In response, the government abandoned its previous fixed exchange rate policy and adopted a floating exchange rate regime.11 Mexico's currency plunged by around 50% within six months as a result, sending the country into a deep recession.

The Peso steadily depreciated through the end of the 1990s, which led to greater exports and helped the country's exporting industries but sharply raised import prices and lowered its terms of trade. The change in the Mexican economy to an export-based economy may have helped to soften the impact of the currency devaluation. However, the peso devaluation resulted in a decline in real income, hurting the poorest segments of the population and also the newly emerging middle class. After the 1994 devaluation, the government took several steps to restructure the economy and lessen the impact of the currency crisis among the more disadvantaged sectors of the economy.

"The goal was to create conditions for economic activity so that the economy could adjust in the shortest time possible. The United States and the International Monetary Fund assisted the Mexican government by putting together an emergency financial support package consisting of loans of up to $50 billion, with most of the money coming from the U.S. Treasury. Mexico put forth efforts to demonstrate its commitment to fulfill all of its financial obligations without a default on its debt by adopting tight monetary and fiscal policies to reduce inflation and absorb some of the costs of the banking sector crisis. The austerity plan included an increase in the value-added tax, budget cuts, increases in electricity and gasoline prices to decrease demand and government subsidies, and tighter monetary policy." (Villareal, 2010, P.4)

In 1994, Mexico joined the OECD; its admission was recognition that the country was on the road of success. The sovereign default in 1982 precipitated a currency collapse and sharpened contraction of GDP. (Hanson, 2012, P.2.)

Figure 0-4Mexico's GDP growth at market prices (current US$)



Source: World Bank, 2016

Industrialization and urbanization were the most remarkable phenomena that characterized Mexican twentieth century. Although had begun incipiently since the nineteenth century and the first decade of the twentieth had a major expansion still under the Porfirian regime, was until after 1940 when the Mexican industry really took off and with it began accelerating urbanization, achieving a significant change in the distribution of population in the country in a relatively short period.

Much of the population growth is explained by the generalization in most of the national territory of different medical advances that could be available at low cost, from antibiotics to vaccines.

In 2012 Mexico entered the TPP, for which required the vote of all members, USA was the last vote achieved. For Mexico, to join the TPP would involve greater integration and diversification its economic relationship with the Asia-Pacific region, although Mexico happens to be the oldest Latin American member of the APEC forum has failed to finish the process, partly because the national agenda focuses on other regions such as North America.

The Trans-Pacific Strategic Economic Partnership (TPP) is the result of agreements promoted during the Asia-Pacific Economic Cooperation Forum (APEC) because the latter does not achieve an Asia-Pacific regional integration especially on tariffs, intellectual property rights and quality standards. Mexico joined APEC in 1993 being the first Latin American country to do so.

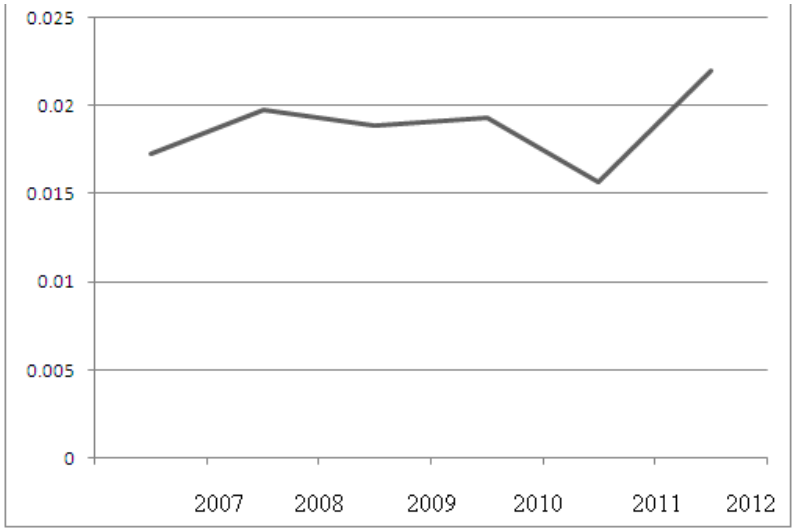
Despite the efforts and the speech delivered by the Federal Government, Mexico has never left the North American Free Trade Agreement (NAFTA), in fact, even though Mexico is being recognized as a country that leans to the free trade, out of the 5 countries

from the Americas members of the TPP (Canada, Chile, United States, Mexico and Peru) Mexico is the less integrated into the Asia-Pacific region.

Mexico is the country in the Americas that shows less trade integration with the Asia-Pacific region. The data also apply to other regions except North America, which is central to the international agenda in Mexico. This despite the six calderonista years 2006-2012 that emphasized the TPP, but there was still a little improvement in the integration of Mexico with Asia-Pacific region. As shown in figure 3-5.

Until 2012 the results have been satisfactory. Mexico continues to be the American country member of the TPP less commercially integrated to the Asia-Pacific region, but the effort put by the Government through the National Development Plan 2006-2012 (PND) increased integration.

Figure 0-5Performance of Mexico's exports to the Asia-Pacific region from 2007 to 2012



Source: own elaboration with data from INEGI 2015.

In the PND 2013-2018 the Asia-Pacific region, also appears as a priority.

"The Asia Pacific region represents an important opportunity. The economic dynamism that have shown the countries of Asia and Oceania demand a greater presence. As part of the consultation process for the preparation of this National Development Plan, it notes that in the "Forum Mexico with Global Responsibility" was special emphasis on the need for the nation to strengthen its diplomatic presence in the region. The case of China is a clear example of this. Mexico has the challenge of bringing relations with that country towards a new paradigm of cooperation and dialogue, allowing new schemes promoting understanding and exchange. On the other hand, the limited relationship with other countries in the region mentioned, offers business opportunities to enhance trade with Asia and attract tourism to the country. "

Implications of Mexico to the future income of China

In the beginning of what we now know as TPP, Brunei, Peru, Australia and Vietnam, discussed ways to negotiate and increase transpacific trade, now it includes a dozen nations. The US involvement dates back to 2008. The President George W. Bush was finishing his term. Susan Schwab, the US Trade Representative, was concerned about the decline in imports from the Pacific region of the United States, and saw the TPP as a way to ensure the continuation of US exports there. The issue was trade, not China, and President Obama formalized the US participation in TPP shortly after taking office in early 2009.

The possibility for China to join the TPP was unthinkable only a year ago. However, it is now receiving serious consideration following the announcement in May 2013 Minister of China, who considered joining the TPP 'on the basis of equality and mutual benefit. "- A marked change from his position earlier rejection Reconsideration of China is

not surprising arises from Japan's participation in TPP, which has led to a debate within China on the best way to respond.

The three major free trade agreements negotiated in the Asia-Pacific region are the Free Trade Area of East Asia and the Comprehensive Economic Partnership for East Asia, on the one hand, and the TPP on the other, and differentiate between them in which the first two are integrated exclusively by Asian countries and China is one of its drivers and the United States is not part, nor could it be.

For Mexico China has become more than a larger trading partner but a competitor in the US market, over the years both countries have changed their export capacity, its products have diversified. China has diversified its market and surprisingly for the rest of everyone. After its entry to the World Trade Organization (WTO) in late nineties, even though the United States is a distant country has become one of the most important destinations of Chinese products.

Mexico and China competed a few years ago with manufacturing products in international markets such as automotive, machinery, electronics goods industry as well as parts of aircraft and other aviation branch over. There are also processed foods and resources from the agricultural sector, among many others.

In the 90s it was thought that Mexico's participation in NAFTA would appeal to China to take advantage of the platform of the Mexican market to enhance its access to the other two markets in North America, particularly the US. The reality showed that China not only penetrated the northern market without relying on the platform offered, but that market shifted to various Mexican manufacturing exports. That obviously naive notion is still wielded today.

However, due to the policies implemented by the government, China is now an exporter of goods with high commercial value, betting on technology and science. Therefore, the WTO ranks China as the second country with export capacity and representing almost 12% of world exports, meanwhile Mexico represents almost 3% of world trade.

Mexico's NIS Process

In Mexico the main innovation actor is still the government by creating laws, making reforms and somehow interconnecting education system, private and public sectors. FDI has played a major role in innovation process, the "maquiladoras", and some kind of assembly companies started in Mexico as a way of attracting FDI.

"Mexico NIS has most agents that other successful countries have. But their actions and interactions are different in intensity levels and contribute to further characterize it as a developing NIS. The most relevant actors are government organizations and institutions, public centers and research institutes, institutions of higher education, enterprises, intermediary institutions and financial institutions." (Dutrenit, 2010 P.64).

One important example in Mexico's industry is the "maquiladora" which begins in Mexico around 1970, it took several years to really have the importance as today. The event that increased the importance was the signing of NAFTA. Since then this sector has speeded up industrialization in Mexico, especially in northern states, such as Chihuahua, Baja California, Sonora, Tamaulipas and Nuevo Leon.

"Mexico increased FDI after NAFTA, but has failed to promote technology transfer. The empirical studies on Mexico generally find fairly low levels of innovative activity

since NAFTA and find limited evidence that intellectual property reforms stimulated innovation." (Park, 2011, P.6)

Historically, social valuation of science, technology and innovation (STI) activities has been rather low in Mexico. Arguably technical change based on systematic domestic STI efforts has seldom been identified as a relevant driver for the improved performance of the Mexican economy. In addition, positive influences from the overall macroeconomic environment would be limited too; notably the conditions of competition remain insufficient. In spite of the economic reforms, the high degrees of monopoly powers derived from unequal market structures and weak enforcement of regulations continue to determine the existence of markets with strong asymmetries of supply and access to information. These conditions prevent, in a continuous base, the innovation processes. (Dutrenit, 2008 P.1)

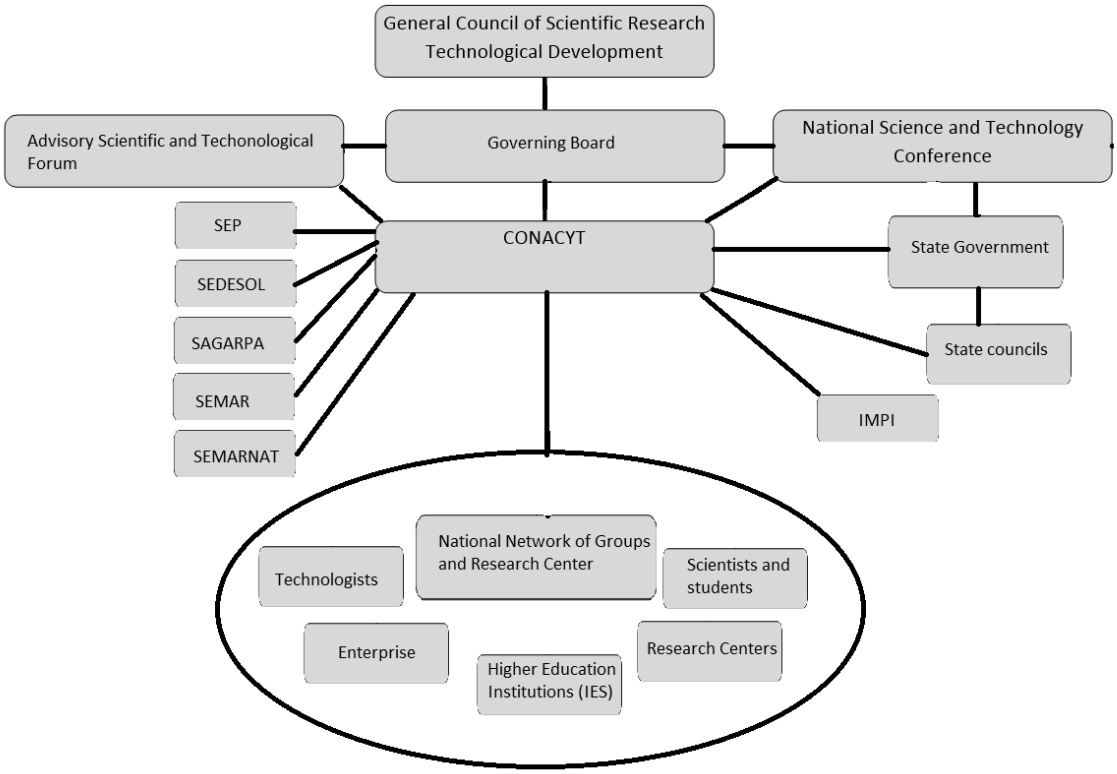
Mexico registered first steps on development during the Porfiriato (1876-1880 and 1884-1911), in which relations were established to attract foreign investment and technology; that was the first time Mexico intended to officially receive investment in infrastructure, mostly the implementation of rail and creating pathways communication between distant cities, achieved rapid economic growth; the consolidation and modernization of ports he managed to put the country first as an important point.

During 1900 and after Mexico experienced a centralized demographic phenomenon, must of the rural population moved to urban areas such as Mexico City, Guadalajara and Monterrey.

Mexico is facing same problems as other developing countries such as China, and that is migration from rural to urban areas. Basically rural people are looking for better

income and better jobs. Therefore these urban zones became a center for materials and logistics that attracted knowledge, FDI, and innovative people. The largest number and prestigious universities in Mexico are located in these three zones.

Figure 0-6 Mexican NIS structure



Source: Own elaboration

General Council of scientific research and technological development (CGICDTI)

The Council was established as the highest body of political and sectoral coordination, chaired by the federal government. In addition, it was envisaged that would consist of: Nine ministers; Conacyt holder; the coordinator of the Advisory Forum; President of the Mexican Academy of Sciences; a representative of the National Conference; three representatives of the productive sector; two representatives of the scientific and

technological sector, invited by the President of the Republic; a representative of the Public Research Centers; and another of ANUIES.

Functions

Technological Development and Innovation (CDTI CGI), responsible for regulating the grants the Federal Government is obliged to grant to promote, strengthen and develop scientific, technological research and innovation activities.

Governing Board

In accordance with Section 4 of the Organic Law of the National Council of Science and Technology and 9 of the Organic Statute of Conacyt, its administration rests with the Director General and the Board of Governors, same as, based on Article 5 of the Organic Law of CONACYT and 10 of the Organic Statute, consists of 13 members who shall be:

A representative of the Secretariat of Finance and Public Credit;

A representative of the Ministry of Economy;

A representative of the Ministry of Education;

A representative of the Secretariat of Environment and Natural Resources;

A representative of the Ministry of Energy;

A representative of the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food, and

A representative of the Ministry of Health.

The Secretary General of the Anuies;

A member of the Scientific and Technological Consultative Forum;

Two researchers acting preferably the top two levels of the National System of Researchers, and;

Two representatives of the productive sector, which will be proposed by the Director General of CONACYT.

In addition, the Governing Board has a Secretary and a Deputy Secretary, as well as a monitoring body, composed of a Public Statutory Auditor and Alternate.

The Advisory Scientific and Technological Forum

It is the autonomous body of permanent consultation of the Federal Executive, the General Council for Scientific Research, Technological Development and Innovation (CGICDTI) and the Governing Board of the National Council of Science and Technology (CONACYT). The National Science, Technology and Innovation (CTI) has been strengthened by the general law on the subject by including three instances of coordination and consultation: the General Council for Scientific Research, Technological Development and Innovation (CGICDTI); the National Conference on Science, Technology and Innovation and the Scientific and Technological Consultative Forum, A.C. (FCCyT).

Since its inception in 2002, the Consultative Forum has also worked with the Legislature, through the coordinated work with the committees of Science and Technology of the Senate and House of Representatives, and others responsible for issues such as education, competitiveness, budget and public administration. State advises Congress on updating their regulatory frameworks in the field.

Functions

According to the Law on Science and Technology, the Advisory Forum has assigned the following main functions:

Serve as an autonomous body and permanent advisor to the Executive, the General Council, the Governing Board of CONACYT and the Legislature (federal and state). The

effect, promote the expression of scientific, academic, technological and productive sector, for formulating policy proposals and programs of scientific research, technological development and innovation community.

Being an organ of expression and communication of system users of CTI, it aims to foster dialogue between the members of the National Research and legislators, federal and state authorities and entrepreneurs, in order to strengthen partnerships between academia, government and business.

Communicate and disseminate the CTI. The Forum uses different means of direct, mass communication over the Internet.

National Conference on Science, Technology and Innovation (SNCTI)

It is one of the instances that contribute to the governance of National Science in the country, in the framework of the Law on Science and Technology and is made by CONACYT and the representatives of the State Governments in science, technology and innovation. This representation lies with the CEOs of councils and state science agencies in each state.

The National Conference allows for coordination, communication and permanent link between its members; it aims to promote action to support related activities based on science, technology and innovation, development and participating in the definition of policies and programs in this area. It allows endorse the federal pact by adding wills and agreements 32 states plus the Federal Government, using the CONACYT.

Collaborations

CONACYT and SEP (Ministry of Education) conform applied and basic research centers, since 2002 there is a mutual fund.

CONACYT and IMPI (Mexican Institute of Industrial Property) use the planned IMPI/CONACYT Fund to foster the systematic creation of, or affiliation to, technology licensing and transfer offices in public research institutions, including HEIs, in order to promote the diffusion of research results.

CONACYT and SEDESOL (Secretariat of Social Development), since 2005 there is a mutual fund, they use this collaboration to foster social development.

CONACYT and SAGARPA (Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food), since 2003 there is mutual fund, that contributes in the research of agricultural problems, through biotechnology and other sciences.

CONACYT and SEMAR (Secretariat of the Navy), since 2003, contributes to foster technological advances regarding security.

CONACYT and SEMARNAT (Secretariat of Environment and Natural Resources), these collaborations contribute to find solutions for environmental pollution, conservation of forest.

CHAPTER IV

METHODS AND DATA

The variables chosen for the analysis were taken from public sources, based on information of institutions such as OECD, IMF, and WB. I came to conclusion that seven components enclose the innovation process. These components are: Human capital development, Research infrastructure, Economic environment, Social environment, Information technologies and communications, Human resource trainers and innovative trainers.

To study the process of building the NIS in Mexico and China, we use a series of variables and indicators, which according to institutions such as the OECD are involved in innovation processes:

Table 0-1 Variables and indicators

Component	Indicator	Source of data Mexico	Source of data China
1. Human capital development	Undergrauate Students per 10,000 inhabitants	SEP	Ministry of Education
	Graduate students per 10,000 inhabitants.	SEP	Ministry of Education
2. Research infrastructure	Universities for every 10,000 inhabitants	CONACyT	Ministry of education

	Universities in world rankings	Webometrics (Spain)	Webometrics (Spain)
3. Economic Environment	Technological balance of payments	World Bank	World Bank
4. Social environment	Average level of education	UNESCO	UNESCO
	Literacy rate	UNESCO	UNESCO
5. Information technologies and communications	Rate of houses with internet access	INEGI	China's bureau of statistics
6. Human Resoure trainers	Researcher by 10,000 inhabitants	World Bank	World Bank
7. Innovative productivity	Patents applied in USPTO and EPO (patents per million labor force)	USPTO and EPO	USPTO and EPO

Source: own elaboration

Description of components and indicators

Human capital development

The development of human capital can be defined as the increase in the production capacity of the work achieved with improvements in the capabilities of workers; these enhanced capabilities are acquired through training, education and experience.

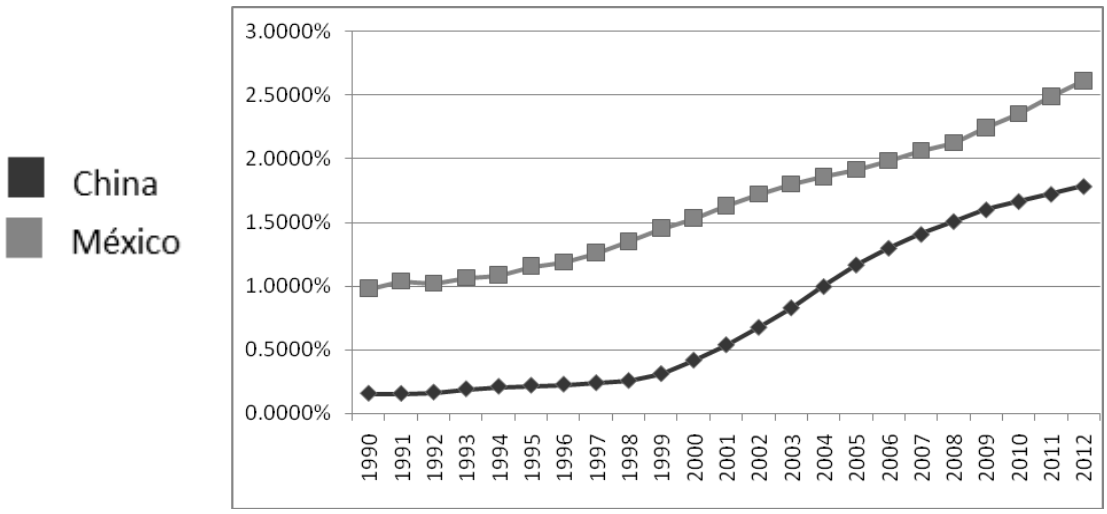
The number of university can indicate the level of human capital is preparing for the generational shift, and the number of graduate students indicates a higher level.

a. Undergrauate Students per 10,000 inhabitants

For this paper we understand college students in the case of Mexico the students of higher education, excluding higher secondary education, and technical level.

In the case of China, they are taken into account students in higher education without the section of adult education. Figure 12 shows the progress seen in the enrollment of Mexican and Chinese students in universities for every 10,000 inhabitants, both of 1990-2012.

Figure 0-1 Enrollment of Mexican and Chinese students in universities for every 10,000 inhabitants 1990-2012

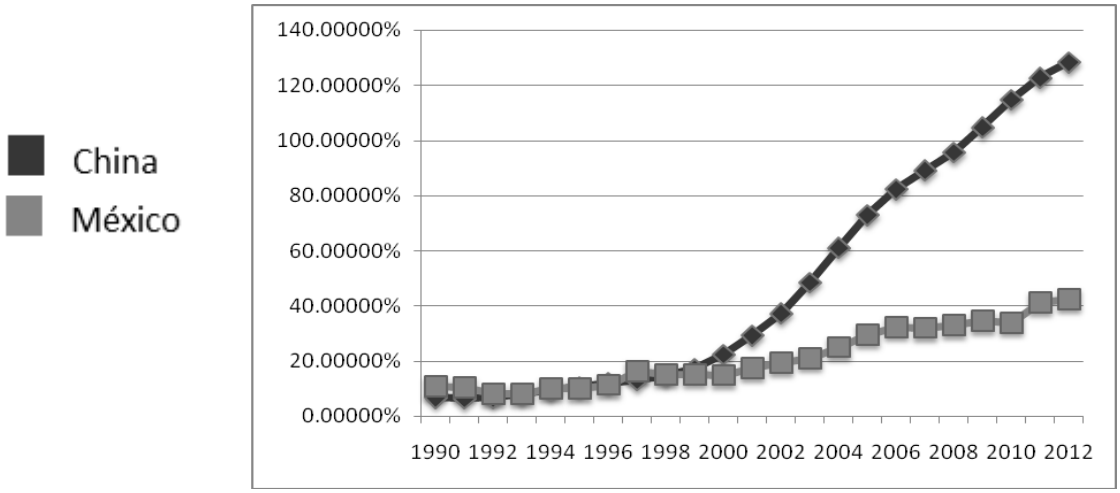


Source: Own elaboration with data from Secretaría de educación Pública (Mexico), Minsitry of education (China)

b. ***Graduate students per 10,000 inhabitants***

China has encouraged access to postgraduate studies through scholarships and student support policies in access to employment. Mexico in turn presents a major advance in undergraduate students, but very low in graduate students.

Figure 0-2 Enrollment of Mexican and Chinese students in postgraduate studies for every 10,000 inhabitants 1990-2012



Source: Own elaboration with data from Secretaría de educación Pública (Mexico), Minsitry of education (China)

In 1995, the Chinese government launched the Project 211. The title refers to the aim of building up 100 top level HEIs and key disciplines in the 21st century. This initiative is built into the ninth Five-Year Plan.

Research infrastructure

a. Universities for every 10,000 inhabitants

In Mexico there are more universities per 10,000 inhabitants 0.07 than in China 0.02 with data from 2013.

b. Universities in world rankings

According to the Ranking Web (Webometrics) of Universities which provides the most complete and updated classification of higher education institutions around the world and

based on the Lab Cybermetrics (Higher Council for Scientific Research, CSIC, Spain), in the total of public and private universities in China and Mexico, China has 5 universities in the top 100 best universities, while Mexico has only one, the Autonomous University of Mexico which is a Federal University.

Table 0-2 Number of Chinese and Mexican universities in world rankings

Country	Top 100	Top 200	Top 500	Top 1000	TOTAL
China	**5**	**11**	**40**	**114**	**2555**
Mexico	**1**	**1**	**1**	**7**	**949**

Source: Webometrics, 2015

And regarding the Top 1000 universities, China has 114 representing a 4.5% of its universities, and Mexico in turn has 7 universities representing 0.80% of its universities

The evaluation of higher education is a difficult issue to address for its wide dimensions. The situation is further complicated when it comes to assess internationally. Talk of the international or global evaluation, citing global university rankings, and in this context, the most important rankings are the Academic Ranking World Universities, Times Higher Education and Quacquarelli Sydmonds. The information emitted by these rankings among its applications priority decision-making. They are cited among governments, entrepreneurs, students, and society as a whole, hence the importance of knowing the use and usefulness of information they produce. (Hernandez, et al., 2015 P.40)

According to collected data, Chinas has increase its presence in international education rankings, and the quality of universities has also increased, every country has its own measure, China and Mexico have their own methods and steps to follow.

However it is important to note that "…although Mexican universities are young compared to other world class universities, it is important to note that the ideal state of prestige and quality of universities always have ultimate aim insertion in the international context. In this case the measured from the university rankings. As for the international rankings, ARWU, THES and QS, are the references that are used between employers, governments and society. Hence the importance of reaching a quality assessment, since the information resulting from these rankings is taken as reference for decision-making. (Hernandez, et al., 2015, p.40).

China is often seen as one of the most practiced setting up research centers for regional economic development strategy, and research centers are technological and industrial parks, which symbolize the strong desire to grow and develop China in an internationally competitive through national and regional economic development based on science significant investments nationwide.

The latest 5-year plan shows how China stresses economic development through technological progress, and large parks and research centers are created to reach this goal. China has 54 industrial and technology parks designed to be the basis of industrial parks and innovative growth. Aggressive intervention of national and local governments to create large-scale farms is a China policy.

One example is the development of the Zhangjiang High-Tech (ZHT) Park industrial park. Starting almost from scratch, the Chinese government ordered and

encouragement more than 30 research institutions do computer research centers of multinational companies. About 200 medium-sized companies in the field of biotechnology joined them.

Outside ZHT, the Shanghai Jiao Tong University, Fudan University contributed with 8,600 scientists and researchers. It also promotes the return of Chinese researchers that left the nation.

The government made policy changes in those returning to the country such as lower income taxes, assistance with housing costs, among others. At the end of 2004, there were 253 researchers and scientists who returned to China and specifically to ZHT Park. (Wessner, 2009). Also the Chinese government is a major investor and financial support for businesses involved in the ZHT Park.

For their part in Mexico, the state of Nuevo Leon has an area of 175 acres located in a research park established in the city of Monterrey, which produces 11 percent of manufactured products in Mexico, equivalent to USD $ 12.1 billion, a significant pattern with the development of industrial parks in China is that the city of Monterrey just like Shanghai has a large number of institutions of higher quality education, including 93 universities that teach skills necessary to carry out the necessary research to industrial parks. Tecnologico de Monterrey and Monterrey University are two of the most prestigious universities in Latin America, and the University of Nuevo Leon is one of the best universities located in Mexico.

Monterrey Industrial Park, is also strongly supported by the Federal Government, which amounts to $ 100 million in infrastructure and $ 150 million in buildings and equipment. (Wessner, 2009)

Quality universities in the area are a factor, which determines the creation of parks, and research centers, which are generating innovation in the country. Both cities are among the most generate innovation.

Economic environment

Technological balance of payments.

Technological balance of payments (TBP) is defined as a subdivision of the overall balance of payments, and record the transactions of intangibles related to trade in technological knowledge among agents from different countries. This concept does not include the transfer of technology embodied in goods, such as capital goods and high technology goods. The OECD's methodology for compiling TBP is contained in its manual Proposed Standard Method of Compiling and Interpreting Technology Balance of Payments Data (1990).

China's technological balance of payments has been constantly negative, this situation is similar to the one shown in Mexico, with one clearly exception in 2013, when the balance in Mexico was influenced by the purchase by the Belgian company Anheuser-Busch InBev of Mexican brewer Grupo Modelo by 20 thousand 100 million dollars in cash in a transaction that increased the income received but so atypical.

Whether a Technological Balance of Payment is negative or positive should not necessarily be interpreted in the same manner as a conventional balanceof-payments surplus or deficit, according to which a surplus represents advantages and a deficit represents disadvantages. In the case of technology, imports may reflect a country's efforts to bolster the vigor of its industrial system and achieve a higher position in the international

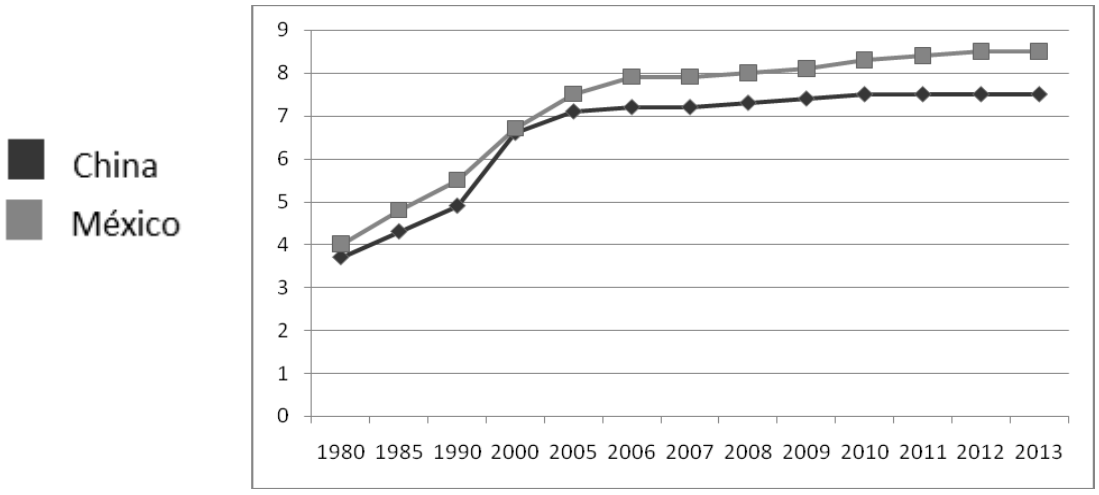
division of labor, while a TBP deficit need not necessarily be considered undesirable. The observable relations of technological interdependency between countries suggest that a country that does not import technology probably does not develop or export advanced technology. Japan and South Korea have systematically imported technology, and this imported technology has always played a highly active role in the design and assembly of their industrial and technological systems (Amsden, 1989; Kim, 1997).

Social environment

a. Average level of education

The average level of education enables us to know the level of education of a population.

Table 0-3Average level of education in China and Mexico 1980-2013



Source: Own elaboration with data from UN, 2015.

This index shows a very similar pattern in both countries regarding the level of education, it is interesting to note that Mexico has slightly more years of schooling than China, although China has a slightly higher rate of literacy, as we shall see later.

In China today, the education system functions as a primary institutional body to instill values and skills for the masses of Chinese citizens. Chinese education includes six years of primary school, three years of lower middle school, three years of high school and four years of college. Schools have been established in the rural and urban sectors of the nation. While urban schools are fully funded by the state,

For its part the education system in Mexico according to the General Law of Education is comprised have: primary, secondary and higher.

Basic education type comprises three levels: preschool, primary, and secondary, preschool education consists of three levels, starting from the age of three.

Primary education is taught in six grades for children six years until young age of fifteen and his conclusion, which is evidenced by an official certificate. Secondary education is provided in three grades and their conclusion is credited with official certificate.

The higher average includes high school and technical education, and higher education last type is made up of three levels, the superior technical, undergraduate and graduate.

The historical roots of illiteracy are ancestral and derived from a socio-economic, political and cultural structure traditionally based on inequality and unfair distribution of wealth, which is embodied in a generalized state of extreme poverty, misery and marginalization throughout the country. As a result of the foregoing, in Mexico there are 5.3 million illiterate. According to the Census of Population and Housing 2010, 6 out of 8

100 men and 100 women aged 15 and over cannot read or write, which exceeds the limits of a strictly educational backwardness to influence an ominous issue social order.

What is a literate person? The answer is not as simple as it might seem at first glance. The concept of literacy has evolved over time, as society has undergone profound changes.

Still difficult to agree on what we mean by literacy. In the 1950s, it was considered illiterate person who simply did not know decode the signs needed to read and write. Thus, a definition of UNESCO in 1958 stated that:

"A person is literate who can read and write with understanding a short simple statement that relates to their daily lives."

According to the following table 4-4, China has achieved 100% literacy to 2010 data, which seemed incredible to mid-twentieth century, Mexico for its part has also taken a step forward but the rate of increase is still higher in China.

Table 0-4 Literacy rate in China and Mexico 1980-2010 %

	1980	1990	2000	2010
China	89	94	99	100
México	92	95	97	98

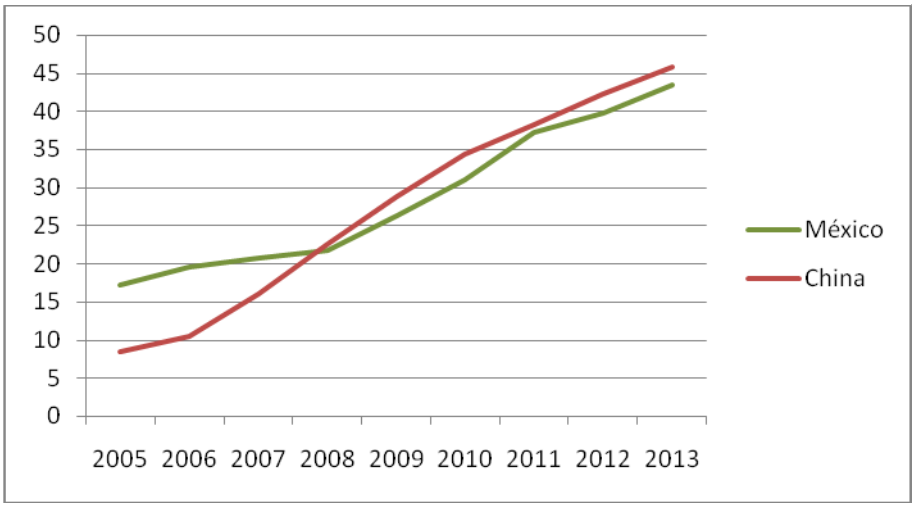
Source: Own elaboration with data from World Bank 2015

Information technology and communications

a. Internet users per 100 inhabitants

Before 2008, Mexico and China were widely separated in the number of Internet users. World Bank data we see that in 2004 China had 9 Internet users per 100 inhabitants, while Mexico and had 17 users, the gap was closing over time to the point that by 2009 China already exceeded the number Internet users, and the difference has virtually remained until 2013.

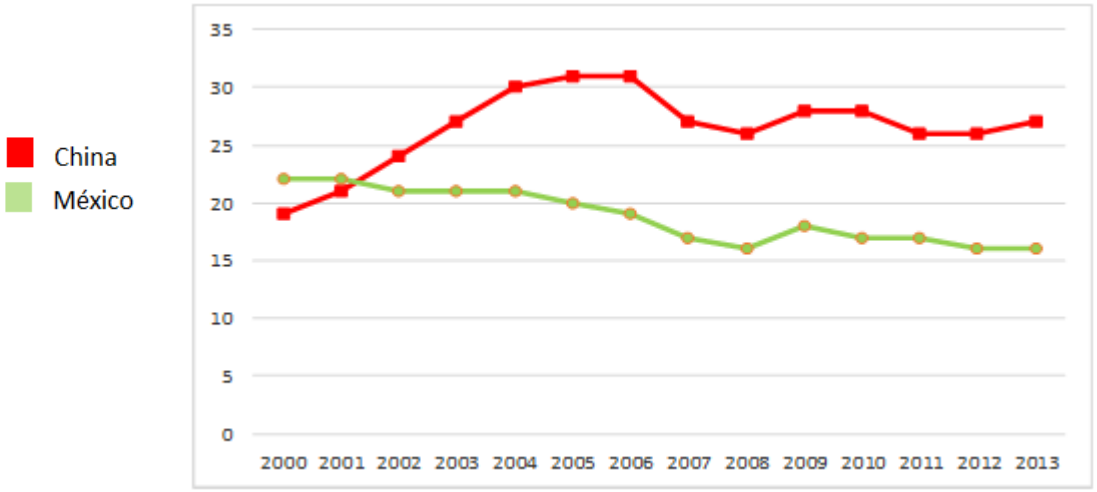
Figure 0-3 Internet users by 100 inhabitants



Source: Own elaboration with data from World Bank 2015

b. Human resources trainers

Figure 0-4 Researchers in R&D (per 1 million inhabitants) in China and Mexico



Source: Own elaboration with data from World Bank 2015

In Mexico there is a figure called National System of Researchers (SNI), Presidential Agreement published in the Official Gazette on July 26, 1984, to recognize the work of people dedicated to producing scientific knowledge and technology, created The National Research System. The award is given through peer assessment and is to grant the appointment of National Enquirer. It has played a very positive role in the constitution and development of a community of qualified researchers, who are selected, promoted and rewarded with non-taxable complements to their remuneration according to criteria based on the volume and excellence of their scientific production. Without this system, centrally managed by CONACYT and financed on its budget, the level of excellence of Mexico's research activities and the number and diversity of internationally recognized researchers

would not be what they are presently. Incentives are granted whose amount varies with the assigned level.

Today, this unusual system both insures against brain drain and presents a longer-term risk. While its role in developing a high-quality research base and ensuring the attractiveness of research careers should be preserved, reforms are needed to address the nature of the evaluation criteria used, the management and funding of the system, and the dangers of an ageing research community. In the longer term, the reform process could lead to the adoption by research institutions of remuneration patterns based on nationally defined standards.

First, the criteria of excellence should not be restricted to scientific publications but should include contributions to research-based innovation developed either in research institutions or in collaboration with the private sector.50 There are welcome initiatives in that direction. More credit might be given to research work carried out in international teams or networks, and the links between collective research and individual rewards could be reconsidered.

Second, financial rewards in the form of a non-taxable complement to remuneration should eventually become part of researchers' regular salary once they have been confirmed at the same SNI level over a certain period. This is obviously a delicate issue with important budgetary consequences in terms of pension provisions and would require changes in labor laws governing public servants as they apply to SNI members. It would change the salary scales of researchers in public research institutions and help deal with the pension issues that contribute to the ageing of the researcher community. It would also be in line with a desirable reform that would give researchers teaching responsibilities beyond

those related to the training of postgraduates. While the obstacles are quite daunting and such changes would be difficult to implement in the short to medium term, there is no a priori reason why Mexico's practices should be so different from those of other countries with a strong scientific base.

Third, while selection procedures might continue to be centrally managed to avoid moral hazards, evaluation committees should increasingly include members of the international scientific community. The increased costs should be compensated by reducing the frequency of evaluations relating to promotion to higher SNI levels. The inclusion of expatriate Mexican scientists in evaluation panels is a good move in this respect (OECD, 2008)

Innovative Productivity

The innovative productivity includes all those variables that are traditionally considered fruits of inventions and / or innovations. The first relates to the patents applied for every 1,000,000 inhabitants and the second is the scientific production per 10,000 inhabitants of the entity.

This refers to knowledge creation, which are the result of inventive and innovative activities: patents. The scientific production in turn is measured by the number of articles in peer-reviewed journals; and the number of items (H) they have received.

"The system of intellectual property rights is multifaceted and ranges from copyrights, trademarks, and design patents to utility patents for technical inventions." (Schmoch et al., 2006, p.89).

According to Schmoch et al. (2006), A patent application must meet at least three criteria: novelty, inventiveness and industrial applicability.

Novelty

An invention is new if it is not included in the state of the technology, has been published, exploited or patented before the filing or the Andean or ordinary priority is claimed. This is commonly known as "originality requirement"

The novelty is not lost if the invention is disclosed within the year preceding the application for an act of bad faith or exposure officially recognized in any of the member countries of the Cartagena Agreement (in the case of Colombia) or published to academic or research purposes.

Inventiveness

When the invention may be used in any industry, thus, the prerequisite to patent the invention is to have any practical application.

It is necessary to secure a patent by filing a patent application. The patent application contains, usually, the title of the invention, and an indication of its technical field. A patent application does not automatically give the applicant a temporary right against infringement. A patent must be licensed to be effective and enforceable against infringement.

This study uses no patents applied for and granted patent, because the patent applications are published before, and reflect the technological competitiveness of a more appropriate way. Office data trademarks and patents in the United States or USPTO for its acronym in English is used, and the European Patent Office or EPO for its acronym in English.

For this study did not take into account the Patent Office of Japan or JPO in English, because since the second half of the 90s does not have a database that allows us to perform our analysis.

Table 4-4 shows the total number of patents applied by both countries in USPTO and EPO, the intensity of patents (patents per million labor force) and the growth rate with reference to the previous year.

Table 0-4 Total number of patents applied by Chinese residents in USPTO and EPO 2004-2013

	Labor force	Total	Intensity (patents for every 1 million of labor force)	Growth rate
2004	752,711,357	2,105	3	
2005	758,612,921	2,690	4	4
2006	763,693,185	4,498	6	5
2007	768,074,459	5,036	7	7
2008	770,992,463	5,956	8	8
2009	773,686,144	8,508	11	9
2010	774,172,295	10,217	13	12
2011	782,422,530	13,087	17	14
2012	787,632,272	17,005	22	18
2013	793,307,655	19,149	24	23

Source: Own elaboration with data from USPTO, EPO, World Bank

Table 0-5 Total number of patents applied by Mexican residents in USPTO and EPO 2004-2013

	Labor force	Total	Intensity (patents for every 1 million of labor force)	Growth rate
2004	44,117,855	203	5	
2005	44,845,642	208	5	6
2006	46,367,100	265	6	6
2007	47,400,119	271	6	7
2008	48,549,880	335	7	7
2009	48,606,636	286	6	8
2010	50,387,831	366	7	7
2011	50,716,876	376	7	8
2012	52,847,521	419	8	8
2013	53,895,633	414	8	9

Source: Own elaboration with data from USPTO, EPO, World Bank

Mexico and China currently have a performance very similar in all the indicators studied, it is interesting and slightly exceeds undergraduates Mexico to China, but the Asian country exceeds Mexico by a wide margin in graduate students. The Asian country also beats Mexico in patent applications, and universities in global rankings.

CHAPTER V

ANALYSIS AND DISCUSSIONS

From the fieldwork and from the carrying out of the literature review have come out some interesting points regarding NIS creation in China and Mexico.

Table 0-1 Comparison of NIS' creation in China and Mexico

	China	Mexico
1	Economic planning with continuity and long term.	Sexennial or immediate economic planning.
2	Emphasizes on postgraduate education	Emphasizes on undergraduate education
3	Interested in international education rankings	Interested in national education rankings
4	Opening for the share of FDI in almost all sectors.	Favored FDI in specific sectors and products
5	Reform processes are fast and take place immediately	Reforms process are long and agents involved, frequently oppose.
6	FDI focused on technology transfer and science development	FDI focused on Manufacture sectors (maquiladoras), absence of technology transfer

Source: Own elaboration

Economic planning

In current economy, planning economy cannot be seen as foreign system, planning economy system can be beneficial for both the developed and underdeveloped countries for the developed countries to maintain or accelerate growth already achieved and for underdeveloped countries to overcome poverty and to raise the standard of living.

Planning is a continuous activity, with the study of flexible and alternative plans, where "Participation by the public is part of the trend of modernization and democratization" of the country. Firms, cooperatives and other economic organs prepare their plans independently, for their own purposes: their own management bodies approve them. The economic units set out from their own possibilities, the conditions and requirements of the market. They take into consideration the effect of indirect economic plans, as well as the direct decisions of the national economic plan. (Tobar-Arbulu, 1987, p. 246).

The planning system has a key role to play in achieving a vibrant economy. It seeks to promote sustainable economic development through supportive planning policies, land for development, identifying and protecting development opportunities and integrating employment generation with essential supporting provision in terms of housing and infrastructure.

China is currently in its thirteenth plan (2016–2020), President Xi Jinping has taken several measures to stimulate economy and promote growth, and the current plan is focused in 5 areas:

Innovation: Move up in the value chain by abandoning old heavy industry and building up bases of modern information-intensive infrastructure

Balancing: Bridge the welfare gaps between countryside and cities by distributing and managing resources more efficiently

Greening: Develop environmental technology industry, as well as ecological living and ecological culture

Opening up: Deeper participation in supranational power structures, more international co-operation

Sharing: Encourage people of China to share the fruits of economic growth, so to bridge the existing welfare gaps.

Mexico has tried to develop a planning economy system through the “Plan Nacional de Desarrollo” (National Development Plan), on May 17, 2013, President Enrique Peña Nieto presented at the National Palace, the National Development Plan 2013-2018, three days after being published in the Official Gazette. The mechanisms of participation in the Plan were: Public Consultation on the Internet, citizen proposals in physical and electronic windows, consultation forums and roundtables. Mexico is also putting emphasis on innovation and sustainable development.

Education and development

First of all it is important to note that education is a basic right of humanity, as expressed in chapter 26 of the Universal Declaration of Human Rights adopted by the United Nations General Assembly on 10 December 1948. This chapter says:

"Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available... Access to higher education shall be equal for all on the basis of merit. Education shall be directed to the full

development of human personality and strengthening of respect for human rights and fundamental freedoms. To promote understanding, tolerance and friendship among all nations and all ethnic or religious groups, and promote the development of the activities of the United Nations peacekeeping [...]. "

Educated population serves as a mean to increase technology and development. Education not only helps the intellectual development of a country, but to poverty reduction, increase in HDI, decrease in corruption level etc. as men, women and families raise their standard of living. A country is economically better when its population increases their job opportunities and quality of life. Cultural tolerances, technological increase, improved health of the people are some areas that also are benefited by education.

Fundamental education is a right as UN states, Mexico and China are both countries that guarantee compulsory elementary and secondary education to all their citizen, but in this paper it is noted the undergraduate and postgraduate studies have actually more impact on innovation than fundamental education. And between those two levels, postgraduates' studies relate more to innovation and have more emphasis on China than Mexico.

According to US Current Population Surveys and Labor Force Surveys in Britain, it turns out that there is a stronger connection between increases in the relative demand for postgraduates and measures of technological change than for college-only graduates. Analysis of changes in employment shares and changes in computer usage in 215 US industries and 51 British industries shows that, for both countries, there is only a positive correlation for postgraduates. That shifts in labor demand towards postgraduates seem to be (at least in part) driven by technological change is also supported by cross-country patterns

of changing labor demand and technology. As education changes its patterns, so does the population. A well-educated population will tend to increase innovation in all fields.

As we have seen previously, China has increased the number of postgraduate students especially since 2000. Before this year China and Mexico basically had the same behavior in Postgraduate student's number, but in 2012 Mexico has 4.24 postgraduate students for every 10,000 persons, while China has 12.84 postgraduate students for every 10,000 persons.

International education Ranking

The evaluation of higher education is a difficult issue to address for its wide dimensions. The situation is further complicated when it comes to assess internationally. Talk of the international or global evaluation, citing global university rankings, and in this context, the most important rankings are the Academic Ranking World Universities, Times Higher Education and Quacquarelli Sydmonds. The information emitted by these rankings among its applications priority decision-making. They are cited among governments, entrepreneurs, students, and society as a whole, hence the importance of knowing the use and usefulness of information they produce. (Hernandez, et al., 2015 P.40)

According to collected data, Chinas has increase its presence in international education rankings, and the quality of universities has also increased, every country has its own measure, China and Mexico have their own methods and steps to follow.

However it is important to note that "…although Mexican universities are young compared to other world class universities, it is important to note that the ideal state of prestige and quality of universities always have ultimate aim insertion in the international context. In this case the measured from the university rankings. As for the international

rankings, ARWU, THES and QS, are the references that are used between employers, governments and society. Hence the importance of reaching a quality assessment, since the information resulting from these rankings is taken as reference for decision-making. (Hernandez, et al., 2015 P.40).

According to World Economic Forum (WEF) which is an annual report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index. Back in 2007 China were close enough in competitiveness. But recently the gap has been growing.

Table 0-2 Global Competitiveness Index

	China	Mexico
2015	28	57
2014	28	61
2013	29	55
2012	29	53
2011	26	58
2010	27	66
2009	29	60
2008	30	60
2007	54	58

Source: WEF, 2016

According to WEF, Mexico's ranking has remained broadly stable. The country shows a somewhat uneven performance over the various pillars of the GCI, with relatively good scores on health and primary education, goods market efficiency, and selected components of technological readiness, e.g. FDI and technology transfer, no doubt reflecting the close

links of the Mexican market to the United States in the context of NAFTA. However, this is offset by the same institutional weaknesses as are prevalent in the rest of Latin America.

Mexico in 2016 progresses four places to 57th, despite some deterioration of the institutional environment, thanks to improvements in the efficiency of financial markets (up 17 places to 46th), business sophistication (up eight places to 50th), and fostering innovation (59th). The country's competitiveness also benefits from an efficient goods market with enhanced, albeit low, level of competition (99th) and a large market (11th)—Mexico is the second largest country in the region. These results signal that recent reforms are bearing fruit, but challenges remain. Despite some improvement in the labor market (up seven places to 114th), rigidities are still a problem, as are weak public (115th) and private (78th) institutions—which reflect the fact that corruption is considered the most problematic factor for doing business.

And China's overall performance has barely budged in the past six years. Faced with rising production costs, an aging population, and diminishing returns on the massive capital investments of the past three decades, China must now evolve to a model where productivity gains are generated through innovation and demand through domestic consumption. Box 4 details the performance of China in the GCI and highlights the priority areas on which it must focus to meet the challenges ahead.

In 2016 WEF pillar of innovation placed China in the 31st position, above Italy and below Indonesia, while Mexico placed 59, above Turkey and below Macedonia.

Foreign Direct Investment

As countries develop and approach industrialized nation status, inward FDI contributes to their further integration into the global economy by engendering and boosting foreign trade

flows (the link between openness to trade and investment is illustrated by Figure 2). Apparently, several factors are at play. They include the development and strengthening of international networks of related enterprises and an increasing importance of foreign subsidiaries in MNEs' strategies for distribution, sales and marketing. In both cases, this leads to an important policy conclusion, namely that a developing country's ability to attract FDI is influenced significantly by the entrant's subsequent access to engage in importing and exporting activities.

This, in turn, implies that would-be host countries should consider a policy of openness to international trade as central in their strategies to benefit from FDI, and that, by restricting imports from developing countries, home countries effectively curtail these countries' ability to attract foreign direct investment. Host countries could consider a strategy of attracting FDI through raising the size of the relevant market by pursuing policies of regional trade liberalization.

Host countries' ability to use FDI as a means to increase exports in the short and medium term depends on the context. The clearest examples of FDI boosting exports are found where inward investment helps host countries that had been financially constrained make use either of their resource endowment (e.g. foreign investment in mineral extraction) or their geographical location (e.g. investment in some transition economies). Targeted measures to harness the benefits of FDI for integrating host economies more closely into international trade flows, notably by establishing export-processing zones (EPZs), have attracted increasing attention. In many cases they have contributed to a raising of imports as well as exports of developing countries. However, it is not clear whether the benefits to the domestic economy justify drawbacks such as the cost to the public purse of maintaining

EPZs or the risks of creating an uneven playing field between domestic and foreign enterprises and of triggering international bidding wars and integration. (OECD, 2002)

Most of the western countries had an important effect on FDI during the recent 2008 crisis, in 2007, an entry of 30 thousand 069 million dollars were registered, but in 2008 the total invested was only 26 thousand 948 million dollars, for the year 2009 15 thousand 575 million dollars, and the 2010 were obtained 19 thousand 626 million dollars. In addition to this, there has been an effect negative reference to devalue the peso the dollar. (Noriega et al., 2007, p.337). The Mexican recovery started in 2010, and in 2014 reached 22 thousand million dollars, although was a good recovery was still far from 2007 numbers.

Mexico and China confront similar challenges, both countries have to face globalization, while there are unique aspects and elements determined by environment, culture and history, both countries have several similarities and common elements. Mexico can learn from other countries that are totally market-oriented like the United States or partially market oriented like China.

Reform Process

China is unrecognizable in today's economy. Since 1978 China has undergone a series of reforms that have changed the nation not only economically but socially. China joined WTO in 2001, since then China continues being an important actor in current world.

Under the open-door policy foreign trade and foreign investment are encouraged. China's economy was essentially a closed economy before the economic reform. In 1978, the total volume of its foreign trade, or the sum of the values of its exports and imports, amounted to only 7 percent of its national income. Deng Xiaoping's open-door policy encouraged the opening of China to foreign imports and the promotion of exports. By 1987,

the volume of foreign trade increased to 25 percent and by 1998 to 37 percent of gross domestic product. A number of institutional reforms were introduced in the administration of foreign trade, beginning with strict control for the purpose of providing exports to pay for the imports required under central planning. The provinces were given autonomy to promote exports. Trading companies were established in cooperation with industrial enterprises manufacturing products for export to facilitate decentralization of trading activities. These companies were responsible for their own profit and loss. (Chow, 2011, P.131); In china Deng Xiaopin tried to ease out communism regime and implemented some new reform that eventually will contribute to the development of China.

Success in China's economic reform was measured partly by its rapid economic growth in real GDP in the order of about 9.5 percent annually in the two decades after 1978. In the meantime there were significant changes in economic institutions as described above. The following factors account for the success. Note that economic growth was important for carrying out further economic reform. Without growth, reform would not and could not have proceeded because the reformers would have lost confidence and the support of Communist Party members and the Chinese people. The first two factors stated below account for the rapid growth once the basic elements of a market economy were introduced. By basic elements I mean the freedom and opportunity to make money on the part of Chinese citizens by hard working and ingenuity, with rewards dependent on ability and effort, and economic success dependent on superior performance under a somewhat competitive environment. (Chow, 2011, p.141)

State monopolies have been important issues in Mexico's agenda, the reforms in recent years tend to minimized or in some case eliminate their effects. In 2013 new industry

structures in oil, natural gas, and electricity were established. Even though Mexico will still control and have the ownership of key sectors like hydrocarbons and the Federal Power, competition will definitely bring some benefits.

Finance Mechanism

Financial mechanism in developing countries is still difficult to obtain, for an entrepreneur or small business to be successful is important to have access to loans.

"Improving the access of small enterprises to financial services is beneficial not only to the national economy and small enterprises, but also to the lenders. Research shows that as small businesses develop, the economy flourishes and employment grows, income distribution improves, and poverty is reduced." (Yuan and Cai 2010 on Asian Development Bank, 2014, P.17).

"Information required by most commercial banks is "hard information", while information on operations generated by SMEs mainly take the form of "soft information". Information asymmetry may also occur if soft information is not communicated accurately, which is obviously related to the misguided notion that there is no cost advantage of collecting and processing such information." (Asian Development Bank, 2014, P.17).

China Development Bank (CDB) has pioneered in small-enterprise lending in the PRC and invested large amounts of capital, technology, and manpower.

CONCLUSIONS

After the completion of this thesis it seems clear to me that the development of NIS needs to be based on 3 key elements:

Politics

A country with an unstable political environment such as corruption, lack of confidence, weak law enforcement etc., will struggle to attract FDI; will fail also in developing opportunities

Economy

A country with an inefficient economic situation, such as rampant inflation, debts, poor regulated financial system, lack of access to loans etc., will find difficult to attract FDI.

Society

And thirdly, a country with an uneducated and unskilled society, lack of access to public services, such as health, pensions etc. will definitely find it extremely difficult to develop.

A NIS needs to start any discussion based on the three factors. China and Mexico differ in these three elements as well. China´s NIS seems to be more interconnected between agencies, however it is necessary to add the actions of the academic sector with the entrepreneurial vision of technology generation and innovation, the departments and public bodies responsible for the design and implementation of policy. Mexico is facing a resistance towards reforms, evaluation and measurement of results. The interaction of the various actors in a sector system academic, business, engineering professionals and public

administration should result in an integrated approach that combines the above, taking into consideration the importance of each configuration has a harmonious and dynamic, by including all necessary agents for the development of science education chain technology innovation system.

Mexico´s education system needs to be improved; basic education is not up to OECD standards. Mexico allocates one of the lowest proportions of total expenditure on pre-from primary to tertiary education (USD 2 993) is among the lowest levels among OECD countries (OECD average of USD 9 313). However, from 2000 to 2010, expenditure per student increased by 23% at the primary, secondary and post-secondary non-tertiary level and by 19% at the tertiary level, as expenditure increased at a faster rate than growth of the student population over this period. Countries in expenditure per student between pre-tertiary and tertiary education

In order to achieve a successful NIS a regular evaluation exercise with feedback on policy design and financing needs to be done. Following practices increasingly implemented in other countries, CONACYT and other ministries responsible for the funding of S&T and innovation programs or projects should develop monitoring and assessment systems based on qualitative and quantitative information and indicators. The rationale of support programs as well as the expected outputs and outcomes should be highlighted at the outset. Monitoring and ex post assessments should provide feedback on policy design and funding.

Innovation is developed also in enterprises, therefore is important for a government to promote loans, but sometimes access becomes tedious and enterprises lose the interest. In order to increase the rate of access, governments need to:

1. Promote low interest loans

2. Reduce bureaucracy and times

3. Constant evaluation of loans

Government also has an important role in attracting capital from foreign firms. Foreign firms as we have seen in the technological balance of payments do not only attract capital but technology, a country deficit or superavit does not tell so much about its real technology development. It is necessary to study in more detail, the reason and results of such balance. Attracting foreign could be a difficult task for a government since politics, economy and society are involved. A country with a bad political environment would not attract the sufficient FDI. A country with bad economic situation would struggle to attract FDI. And a society that is not well educated will lack of opportunities. In addition governments must evaluate the results in order to reduce the risk of wasting money and have no impact on innovation. Many governments provide firms other incentives to attract such as tax holidays, suppression of trade union activity, and accelerated depreciation allowances.

As have mentioned in the hypothesis the analysis of the experiences in building a NIS from other countries allows to know the successes and mistakes made in implementing the policy, which makes possible to identify best practices and derive useful lessons for the design of our innovation policy country.

After the review of this thesis some question have arisen, Why did China advance in innovation field while Mexico presents stagnation? Undoubtedly policies in China have gone further than those in Mexico, especially policies regarding investment in scientific

research and development. Education in China has received more attention than in Mexico. Mexico is similar until bachelor level. When we look at postgraduate studies, China performed much better than Mexico, this is due to an increase in government investment in universities, and promoting universities to have international quality; but also having a master or doctorate degree increases considerably the chances of getting a job in China than in Mexico. In Mexico very few portion of jobs consider a postgraduate studies valuable for the job. This is an interesting point that deserves a more profound study in the future, in order to understand the reasons, and find a way to promote a higher education in Mexico.

What was the scenario in which the NIS was created in China and Mexico? Although both countries as we have seen are developing countries, the history behind is completely different. China has undergone drastic policy's reforms in term of economy, education, science, innovation etc, China is located in Asia, therefore has followed the Asian developing way, the same used by Japan and recently South Korea. A strong emphasis on education and a long process of FDI.

And Finally, What was the role of government in creating the NIS in China and Mexico?, China has a particular similarity with Mexico, and that is, the east part of China is more developed than the west, the reason could be the location of the east, near to the ocean, more likely to trade, also close to Japan, South Korea, Singapore, etc, while the west part is still not developed having some regions, such as Xinjiang or Tibet, not as developed as Shanghai or Beijing. Mexico faces the same situation with North and Central Mexico being more developed than South. Recently both countries have proposed some special region plans, to develop those areas.

Along this thesis we have examined the historical process of NIS in China and Mexico, have identified the changes and reforms in innovation in China and Mexico, and generated information that can be useful in policies that contribute to building a national innovation system in China and Mexico.

We finally conclude that the analysis of the experiences in building a NIS from is indeed an important tool to identify best practices and derive useful lessons for the design of our innovation policy.

REFERENCES

Asian Development Bank. (ADB) (2014). Access to finance microfinance innovations in the People's Republic of China, *Asian Development Bank Publications*

Beltrán Noriega, S. E., González Franco, R. A., & Ávila López, L. A. (2012). Efectos de la crisis de 2007 en las finanzas públicas de México. *Ra Ximhai*, 8(2). 319-342.

Ben-Oliel, D. (2013). *The Impact of Financial Crises on Patenting Activity*, University of Haifa Law School. Haifa, Israel.

Cai, Y. (2013). *The roles of universities in Chinese regional innovation systems a re-examination of the Triple Helix model*. University of Tampere, Finland

Croitoru, A. (2012). Schumpeter, J.A., 1934 (2008), The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest andthe Business Cycle, translated from the German by Redvers Opie,New Brunswick (U.S.A) and London (U.K.): Transaction Publishers: A review to a book that is 100 years old. *Journal of Comparative Research in Anthropology and Sociology*, 3, 137-148.

Beristain Hernández, L. M. (2009). *Una Revisión de la Interpretación Económica sobre la Innovación*, J. Technol. Manag. Innov. 2009, 4(4), 139-149.

Boeing, P., & Sandner P. (2011). *The Innovative Performance of China's National Innovation System*, Frankfurt School – Working Paper Series, No. 158. Frankfurt School of Finance and Management

Cheremukhin, A., Golosov, M., Guriev, S., & Tsyvinski, A. (2015), *The Economy of People's Republic of China from 1953*, CEPR Discussion Paper No. 10764.

Chow, G. C. (2004). *Economic Reform and Growth in China, annals of economics and finance 5*, 127–152 (2004), Department of Economics, Princeton University, USA

Dutta, S., Lanvin B., & Wunsch-Vincent, S. (2014). The Global Innovation Index 2014: The Human Factor in Innovation, Geneva, Ithaca, and Fontainebleau.

De Ferranti, D., Pewrry, G.E., Gill I., Guasch, J.L., Maloney, W.F., Sanchez Paramo, C., & Schady, N. (2003). *Closing the gap in education and technology*. Washington, D.C.

Dutrenit, G. (2008). The Mexican national innovation system: structures, policies, performance and challenges, *Background report to the OECD country review of Mexico's National System Innovation.*

Freeman, C. (1997). The Economics of industrial innovation, third edition, Library of Congress Cataloging-in-Publication Data.

Gao X., Li J., Yuan W., & He Y. (2010). *Following the Approach of National Innovation System: Evidence from National Innovation Platform in China*, TRIPLE HELIX Ⅷ International Conference, 2010

Hernandez, P. M., Leyva, S. L., Marquez, C. Z., & Cerda, A. B. N. (2015). Evaluación de la calidad de la educación superior en México: comparación de los indicadores de rankings universitarios nacionales e internacionales. *RIESED-Revista Internacional de Estudios sobre Sistemas Educativos*, 2(4), 35-51.

Hanson, G. (2012). *Understanding Mexico's Economic Underperformance*, University of California San Diego, and National Bureau of Economic Research, August 2012.

He, Y., & Maskus, K. E. (2010). *Southern innovation and reverse knowledge spillovers: a dynamic FDI model*, University of International Business and Economics, China; University of Colorado, U.S.A.

Inter-American Development Bank (IDB) (2010). *Science, Technology, and Innovation in Latin America and the Caribbean: A Statistical Compendium of Indicators, JEL Codes: 012, 014,030, 031, 032, 033, 034*, Publication Code: IDB-MG-101.

Jessop, B. (1993). Towards a Schumpeterian Workfare State? Preliminary Remarks on Post- Fordist Political Economy, *Studies in Political Economy*, (40), 7-39.

Kozikowski, Z. (2013). *Finanzas Internacionales*, Instituto Tecnológico de Estudios Superiores de Monterrey, tercera edición , Toluca, México.

Lajous, A. (2014). *Mexican Energy Reform*. New York: Colombia University, Center on Global Energy Policy.

Lara, R. (2009), Modelo de desarrollo regional chino: una experiencia que re-aprender, *Estudios Mexico – China.* Programa de Formación de Negocios México-China 2007-2010 vol. 8

Leydesdorff, L. (n.d.), The Knowledge-Based Economy and the Triple Helix Model, University of Amsterdam, Amsterdam School of Communications Research (ASCoR), Kloveniersburgwal 48, 1012 CX Amsterdam, The Netherlands;

Lindley, J. and Stephen M. (2011). Rising Wage Inequality and Postgraduate Education, *CEP Discussion Paper No 1075*, the London School of Economics.

López Leyva, S. (2005). L*a vinculación de la ciencia y la tecnología con el sector productivo*, Universidad Autónoma de Sinaloa. Culiacán, México.

López Leyva, S. (2006). *Políticas para la innovación en México*, Universidad Autónoma de Sinaloa. Culiacán, México.

Lawrence, S. (2012). Understanding China's Political System, *Congressional Research Service*, 7-5700 www.crs.gov R41007.

Mehdi, S. (2000). What did Frederick List actually say? Some Clarifications on the Infant Industry Argument, UNCTAD/OSG/DP/149

Metcalfe, S. (1995). "Technology Systems and Technology Policy in an Evolutionary Framework", *Cambridge Journal of Economics*, (19) 25-46.

Myro, R. (2010). Crecimiento económico e innovación: un breve apunte acerca de la evidencia empírica, *Revista Galega de Economía*, (19) (extraordinario)

OECD (2002). Foreign Direct Investment for Development "Maximizing benefits, minimizing costs". Paris: OECD.

OECD (2008). OECD Reviews of Innovation Policy MEXICO Overall Assessment and Recommendations (Draft-3nd revision), Paris: OECD.

Ortiz, M. (2013). *Varieties of Innovation Systems: the governance of knowledge transfer in Europe*, Frankfurt/Main.

Park, W. (2011). Technology trade and NAFTA, Department of Economics, American University, Washington, D.C. 20016

Piketty, T. (2014). *Capital in the twenty-first Century*, The Belknap Press of Harvard University Press.

Ros, J. (1993). *Mexico's trade and industrialization experience since 1960: a reconsideration of past policies and assessment of current reforms*. Working Paper #186 - January 1993

Schmoch, U., Rammer, C. & Legler, H. (2006). *National systems of innovation in comparison*, Dordrecht, The Netherlands.

Soete, L. (2009) Systems of Innovation, United Nations University - Maastricht Economic and social Research and training centre on Innovation and Technology Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands

Stewart, V. (2012). *A World-Class education, learning from international models of excellence and innovation*. Library of Congress Cataloging-in-Publication Data.

Tobar-Arbulu J. F. (1987). Economics and Planning. *Revista Internacional de los Estudios Vascos = Nazioarteko Eusko Ikaskuntzen Aldizkaria = Revue Internationale des Etudes Basques.* (35), 241-259.

Villareal, M. (2010). *The Mexican Economy after the Global Financial Crisis*, Congressional Research Service 7-5700 www.crs.gov R41402

Wessner, C. (2009). *Understanding Research, Science and Technology Parks: Global Best Practice*. Report of a Symposium, National Research Council.