Samantha Rullán Rosanis
Cornell University, Visiting Scholar at the Latin American Studies Program, USA
Universidad Veracruzana, Institute of Economics and Social Studies, Mexico
Email: sam@xoles.com

Lourdes Casanova
Cornell University
Senior lecturer and Academic Director of the Emerging Markets Institute, USA
Email: lc683@cornell.edu

INNOVATION IN LATIN AMERICA: THE CASE OF MEXICO

JEL classification: O3, H5

Abstract

Governments and business leaders are increasingly aware of the role that innovation plays in economic growth, development and competitiveness. There are imperative challenges for Latin American countries, among them, poverty, social inclusion, sustainable development, climate change, natural disasters, productivity, improve the quality of education and health. Innovations are essential to drive economic growth and prosperity in the region. According to the Global Innovation Index (2014), Mexico is ranked 66th. Most of the research on innovation performance is mostly focused on technological innovation. Therefore, the main variables used, such as patents and number of scientific publications, do not always reflect the other types of innovations (i.e. business model, organizational, etc.) that are developing in emerging markets. The aim of this paper is to analyze the Mexican innovation system using a broad concept with a focus on other types of innovation including cultural aspects to identify the main characteristics that distinguish and determine how innovation in Mexico is formed.

Key words: innovation, Mexico, innovation policy

1. INTRODUCTION

Latin American governments are facing important challenges such as inequality, poverty, climate change, natural disasters and competition, among others. Governments need to determine what will be the basis for their competitiveness. Natural resources have been a source of wealth for countries in the region. They can be an asset but also a weakness, mainly in times when demand for commodities are slow and prices are low. And overdependence on natural resources can hinder innovation. Mexico is an upper middle-income country with a population of over 120 million and a GDP (US$ billions) of $1,258. The country has one of the largest economies in the world ranked 15th and is an emerging power. In the last decades, Mexico's economy has shifted from commodity and agricultural to service and manufacturing. Mexico is one of the most open economies and is currently undergoing major reforms in the telecommunication, energy, fiscal, education and other sectors to drive growth. According to the 2013 Global Entrepreneurship Monitor (GEM) and the Global Competitiveness Index 2014-2015, Mexico is in a transition phase between Efficiency-Driven and Innovation Driven Economy. In the 2014 Global Innovation Index (GII) Mexico ranks in 66th.

Governments in the region are implementing strategies to enhance their innovation performance. Mexico has been slow in embracing innovation as a tool to improve productivity and competitiveness. In 2012, the Mexican government launched an ambitious 25-year Special Program for Science, Technology and Innovation (STI) to achieve economic and social sustainable growth in the country with scientific, technological and innovation development as the main pillars.

In this paper we argue that most research on innovation performance of a country is generally focused on technological innovation and the variables used are mainly suited for developed countries that have largely invested in human resources, infrastructure and other resources to enhance their innovation systems. Therefore, the main variables used such as patents and numbers of scientific publications do not always reflect the other types of innovations (i.e. business model, organizational) that are developing in emerging markets. To identify the main characteristics that distinguishes and determines the innovation that is produced in some developing countries we use a different approach. The types of innovation that are more prevalent and their socio-cultural traits are used to illustrate the innovation capabilities of emerging countries that transcend the traditional conceptions.

For the purpose of this paper we define innovation as the implementation of a new or significantly improved product or process, new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD & Eurostat, 2005). According to Lundvall (1992:2) National Innovation Systems "is constituted by

the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge".

In the last decade, many efforts have been made by the main actors of the innovation system to enhance the innovation performance of a country with high potential but low results according to standard indicators. As Lundvall (2007) noted, in developing countries, research, innovation and competence standard indicators may not capture the reality of the innovation systems. The major challenge consists on developing alternative indicators that capture these elements.

The structure of this paper is as follows. First the role of the public sector in the innovation system of Mexico is presented. Second, the main private actors are identified. Third, Mexican innovations and some of their cultural traits are presented. In the final remarks some recommendations are introduced.

2. THE ROLE OF THE PUBLIC SECTOR IN THE INNOVATION SYSTEM OF MEXICO

Based on the 2002 Science and Technology Law, the main actors in charge of the orientation of the innovation system in Mexico are:

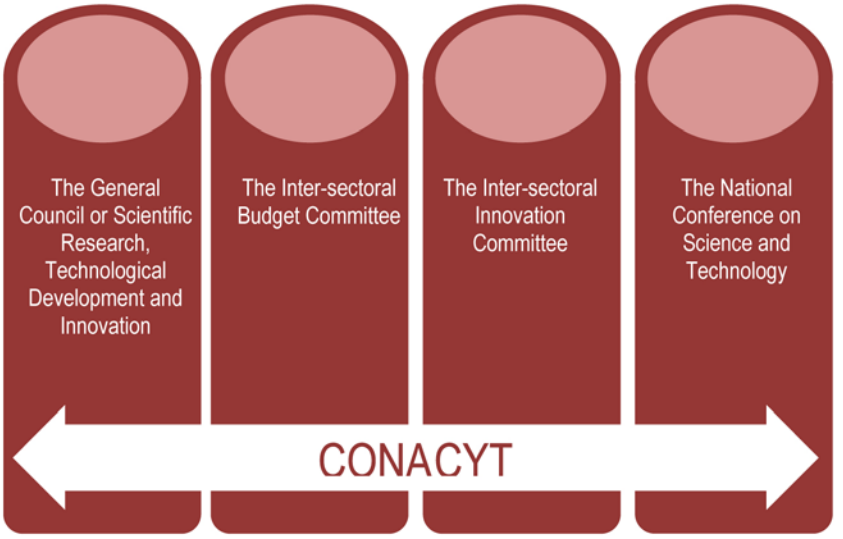

Figure 1 Main public actors of the Innovation System of Mexico

Source: Author's based on the Science and Technology Law http://www.conacyt.gob.mx/siicyt/images/pdfs/ley.pdf

The National Council for Science and Technology (CONACYT by its Spanish acronym) was established in 1970 and it is responsible for articulating the Mexican government's public policies concerning scientific research, technological development and innovation. CONACYT was restructured in 2002, before it was part of the Ministry of Education and it is now an autonomous body within the Executive branch.

The General Council is a high-level scientific advisory body that was created in 2002 to help set the national science and innovation policy. The President of Mexico presides this Council, the National Council for Science and Technology (CONACYT for its Spanish acronym) is the Executive Secretary and among the members are the Foreign Affairs, Energy, Economy, Rural Development, Education and Health Ministers, the Director of CONACYT, the coordinator of the Science and Technology Advisory Forum, the President of the Mexican Academy of Sciences, a representative of the National Conference on Science and Technology, three representatives of the productive sector that have coverage and national representation, a representative of the Public Research System and the Executive General Secretary of the National Association of Universities and Higher Education Institutions.

The Inter-sectoral Budget Committee is coordinated by the Ministry of Finance and Public Credit (SHCP for its Spanish acronym) and the Director of CONACYT, and reviews the correspondence of the programs with the budget.

The Inter-sectoral Innovation Committee is presided by the Minister of Economy, the Director of CONACYT as vice-president and the Minister of Education, and is responsible of approving the innovation program of the General Council.

The National Conference on Science and Technology is entrusted with the coordination of federal and state STI policies and is formed by CONACYT and the representatives of the State Governments in science, technology and innovation.

The public higher education and research institutions that are part of the innovation system are very important and are therefore presented in another section. In Mexico, the institutional structure can generate important limitations and incentives that impact the NIS. Except for CONACYT, most of these main public actors have been established in the last two decades. Until then, Mexico did not have an explicit innovation policy.

2.1. Innovation policies

The Mexican Science Technology and Innovation policy has been mainly structured around different programs proposed and coordinated by CONACYT with the participation of federal and state governments as well as the industry and academy. In June 5, 2002 the Science and Technology Law was promulgated. As mentioned before, this law created most of the main actors in the

Innovation System of Mexico: the General Council for Scientific Research, Technological Development and Innovation and the Science and Technology Advisory Forum, as well as restructured CONACYT. The Special Program for Science Technology and Innovation (PECiTI) was also established based on the guidelines of the National Development Plan. PECiTI is the framework document and planning instrument for the Mexican Science Technology and Innovation policy.

In 2009, an amendment to the Science and Technology Law introduced changes in the governance with the creation of the Inter-sectoral Innovation Committee. The aim is to develop a more comprehensive approach to innovation by fostering greater coordination at the ministry level. A year later, the Committee Specialized in Science, Technology and Innovation was created to improve information in the field. The main coordinator of the Innovation System is CONACYT.

The Special Program for Science, Technology and Innovation 2012-2037 (PECiTI) is the first with a horizon of 25 years in contrast with the previous program (2008-2012) that had a 6-year horizon. The PECiTI is updated every three years. Mexico has been slow in the race to become a knowledge-based economy. The four phases of PECiTI are associated to the six-year Presidential term of office.

The first phase 2013-2018 aims to strengthen and coordinate de STI capacities to transform the institutional setting and consolidate a significant segment of innovative businesses. The second phase from 2019 to 2024 is described as the launch where STI capacities oriented towards strategic sectors and social needs are strengthened, and accelerate innovation. The third phase 2025-2030 is the competitive consolidation; reinforce financing from the business sector. The fourth phase from 2031-2037 is maturity; the business sector accounts for most of the financing for scientific research and experimental development (SR&ED). Each phase comprises different outcomes that are expected in the process to achieve an innovation system that is articulated and will contribute towards Mexico's economic development and social welfare.

Figure 2. The four phases of the PECiTI with expected outcomes

Source: Author's based on the 2014-2018 PECiTI available at: http://www.conacyt.gob.mx/siicyt/index.php/estadisticas/publicaciones/programa-especial-de-ciencia-tecnologia-e-innovacion-peciti/peciti-2014-2018/2420--378/file

In the 2014-2018 PECiCIT significant efforts are aimed at boosting investment in science, technology and innovation. The linkage between the public and private sector is key. Some of the weaknesses mentioned above have been considered and strategies are being implemented to improve the innovation system of Mexico. The development of a comprehensive innovation policy that is coherent with the instruments available could significantly contribute towards achieving the goals set out.

2.1.1. Goals and Implementation Strategy of the Innovation Policy

There are six main strategies identified in the Special Program for Science, Technology and Innovation 2014-2018 (PECiCIT) to achieve scientific, technological and innovation development as pillars of economic and social sustainable growth in Mexico:

i. Contribute to the annual growth of national investment in scientific research and technological development to reach 1% of GDP.

The aim is to achieve a sufficiently high rate of investment in the next years with the participation of all sectors, especially, to encourage the private sector to contribute more.

ii. Contribute to high-level human capital formation and enrichment.

Continue efforts to enhance human resources for research, especially in priority sectors and in strategic opportunities. The insertion of this high-level human capital not only in the higher education institutions but also in the industry is very important.

iii. Drive the development of vocations and abilities of local Science, Technology and Innovation to strengthen regional sustainable and inclusive development.

Design and implement public policy that responds to the regional needs that will strengthen each of the entities according to their capacity, vocation and needs.

iv. Contribute towards the generation, transference and exploitation of knowledge by linking HEI and businesses research centers.

To articulate the actors which are not only diverse but there are also weak links among them (government, higher education institutions and industry) is a priority.

v. Strengthen the scientific and technological infrastructure in the country.

With a vision that, among others, reflects the needs of modern science (i.e. spaces, collaborations, connectivity).

vi. Strengthen the STI biotechnology capacities to solve the needs of the country according to the legal framework on biosecurity.

The current infrastructure and specialized human resources need incentives and support to generate biotechnological developments that include the experimental design and a biosecurity culture. The goals and their execution plan in the 2014-2018 Special Program for Science Technology and Innovation are presented in Table 1.

Table 1

Goals and execution plans for the 2013-2018 PECiCIT

Goal	Execution Plans
Contribute to the annual growth of national investment in scientific research and technological development to reach 1% of GDP.	-Increase the annual federal spending for SR&ED. -Promote business financing for SR&ED. -Increase STI spending in the federal entities considering their asymmetries. -Generate new incentives for Ministries to increase their spending on STI. -Increase spending in HEI and public research centers STI activities. -Encourage the use of international financing sources. -Coordinate the application of a harmonized methodology for the elaboration of the STI state accounts. -Finance scientific research, technological development and innovation projects with public, private and social resources. -Harmonize transversely the demands of sectorial funds towards the solution of national problems. -Promote the creation of clusters and public-private consortiums to develop STI projects at the sectorial and regional level.
Contribute to high-level human capital formation and enrichment.	-Increase the number of Scientifics and technologists in the National System of Researchers in priorities of the STI sector. -Encourage and strengthen inter and multidisciplinary research groups in priorities of the sector and emerging areas. -Promote the participation of Mexican Scientifics and technologists in the global knowledge community. -Create research networks in STI priorities that include Scientifics and technologists that are abroad. -Facilitate the mobility of postgraduate students, researchers and professionals between academia, the productive sector and government. -Strengthen the postgraduate quality programs accredited by CONACYT.

	-Encourage international projection of the postgraduate quality programs accredited in the PNPC. -Promote postgraduate studies in engineering and technology with the participation of the business sector. -Form high-level human resources abroad emphasizing sector priorities and emerging areas. -Stimulate international mobility of researchers and postgraduate students. -Incentivize the participation of researchers and professionals in STI forums and international organizations committees.
Drive the development of vocations and abilities of local Science, Technology and Innovation to strengthen regional sustainable and inclusive development	-Strengthen the STI capacities of the states according to their vocation and strategic sectors. -Orient the demand of FOMIX and FORDECYT towards the solution of local and regional problems. -Encourage the incorporation of high level Scientifics and technologists in state institutions. -Support innovative SME's focused on opportunity niches in the regions. -Promote public-private alliances for the development of technological capacities.
Contribute towards the generation, transference and exploitation of knowledge by linking HEI and businesses research centers	-Design mechanisms that facilitate the links of HEI and public research centers with businesses. -Promote the creation and strengthening of Knowledge Transfer Units (UVTC by its Spanish acronym). -Encourage incentives to create technology-based innovative enterprises. -Strengthen UVTC activities related to the intellectual property protection instruments. -Promote an intellectual property culture from the higher education. -Contribute to the financing of the intellectual protection of knowledge generated.
Strengthen the scientific and technological infrastructure in the country	-Increase and maintain the infrastructure of the research institutions and centers of the country. -Build a national information system of the scientific and technologic infrastructure. -Support the equipment of research laboratories of the country in the priorities of the STI sector. -Promote the certification of laboratories with international standards. -Contribute to the implementation of public policies that facilitate the importation of equipment and materials used in research. -Create programs and virtual public spaces for the social

	appropriation of science, technology and innovation. -Establish mechanisms for society to have open access to knowledge generated with public funds. -Encourage massive programs of public access to promote scientific and technology culture of society. -Stimulate HEI and public research centers to generate standardized open access repositories. -Create infrastructure for the connectivity of scientific and technological information repositories.
Strengthen the STI biotechnology capacities to solve the needs of the country according to the legal framework on biosecurity	-Encourage research to scientifically establish the adoption of biosecurity measures stipulated in the law. -Support research on possible effects of GMOs in: environment, biological diversity, human health, and animal, vegetal and aquatic health. -Generate knowledge on the socio-economic effects of the use of GMOs. -Promote innovative biotechnological applications to care for emergent human, animal and vegetal sanitary problems. Promote biotechnological developments that contribute to the production of quality food with added value. -Promote biotechnological developments that benefit the rural environment and the productive sector in a sustainable manner. -Develop biotechnological applications for the conservation of the environment and use of biodiversity. -Promote biotechnological application for industrial processes that drive competitiveness and generate high value added products. -Facilitate the international exchange of information and scientific experiences and techniques in biosecurity and biotechnology. -Coordinate the cooperation and exchange of information with international institutions. -Promote initiatives to strengthen regional capacities in biosecurity. -Encourage programs and actions to strengthen the biosecurity and biotechnology culture. -Promote continuous communication of the information on biosecurity and biotechnology towards society.

Source: Author's based on the 2014-2018 PECiTI available at: http://www.conacyt.gob.mx/siicyt/index.php/estadisticas/publicaciones/programa-especial-de-ciencia-tecnologia-e-innovacion-peciti/peciti-2014-2018/2420--378/file

After the North American Free Trade Agreement was signed in 1994, the Mexican government's policies developed what we would like to call the *maquila* model where efforts were made to brand the country as a cheap, good quality and efficient manufacturing destination (see www.maquilaportal.com).

Almost ten years later, China displaced Mexico as the second most important trading partner of the US and became a more attractive manufacturing destination for multinational corporations. And internally, this model did not deliver the expected level of economic growth and social welfare. Mexico's GDP growth rate averaged 2.57% for twenty years since 1994. According to CONEVAL, the average poverty rate is still more than 45%. This is inadequate for a country with high potential for growth. As seen in Table 1, the Mexican government is now focusing its efforts beyond manufacturing and moving towards fostering innovations for social inclusion.

In 2014 Mexico's Gross Domestic Expenditure in Research and Development (GERD) as a percentage of GDP remained low at 0.43%. The Government accounts for more than half of the contributions and the goal is to achieve 1% by 2018 with more investment from the private sector.

Table 2

Federal Expenditure in Science, Technology and Innovation in 2012.

Activity	Millions of Mexican pesos	Millions of US dollars[1]	Percentage by activity
Scientific Research and Experimental Development	39,474	2,610	63%
Postgraduate Education	13,894	919	22.2%
Scientific Services	7,075	468	11.3%
Innovation	2,228	147	3.5%
TOTAL	62,671	4,144	100%

Source: Author's based on CONACYT PECiTI 2014-2018.

In Table 2 the expenditure by activity clearly discloses the priority of the Federal Government with regards to STI. Most of the investment is in Scientific Research and Experimental Development (63%) activities compared to 3.5% on innovation. CONACYT has created different instruments to finance STI activities. For example, the subprogram AVANCE funds the creation and acquisition of methodologies to help consolidate commercialization and technology transfer developed in Technology Transfer Offices in Mexico to users, and to identify and integrate strategic investors and sponsors in research activities. In 2007 the Technological Innovation Fund (FIT by its Spanish acronym) was created and is operated by CONACYT and the Ministry of

[1] Conversion based on an Exchange rate of $15.12 Mexican pesos per $1 USD. Bank of Mexico http://www.banxico.org.mx/ Last accessed on 14 May 2015.

Economy as a support mechanism for Micro, Small and Medium Businesses (SME), start-ups and entrepreneurs to develop innovative products and services projects in areas of high value-added.

In 2013, CONACYT and the Ministry of Economy launched a call for proposals to establish Mexican Energy Innovation Centers (CEMIE): solar, bio-energy, geo-thermal and wind energy. The aim of the Centers is to create innovation alliances in the energy sector: human resources, technology transfer, establish links between academia and industry, among others.

2.2. Mexican Public Research Institutions and Higher Education

Education is not only one of the inputs but also a key driver of innovation. According to the Global Innovation Index (2014) Mexico ranks in 89th place in education. The Higher Education System in Mexico is complex and diverse. There are three types of institutions: universities, technological institutes and the Normal schools. According to Forbes (2015) only two Mexican institutions are among the 10 best universities in Latin America, ITESM (private) is ranked 7th and UNAM (public) 8th.

The Public Higher Education Institutions are separated in subsystems. According to the Mexican Ministry of Education (2015) there are 66 Public Universities in Mexico: 9 Federal Public Universities, which are actively involved in academic activities such as teaching and research; 34 State Public Universities that have been created by decree of local congress as decentralized public organisms; 23 Public State Universities with solidary support receive contributions from the budget and state governments mainly provide financing. The Federal government convenes with each state government the solidary contribution. Also, there are 12 Intercultural Universities were created with the aim to promote training for students who are engaged in economic, social and cultural development of Mexican indigenous populations. The institutions with most students, funding and intellectual influence are the universities.

Mexico is producing a large number of graduates in engineering, science, manufacturing and construction. According to the 2014 GII, Mexico ranks 20th in the number of graduates in science, engineering, manufacturing and construction (% of total tertiary graduates) with 26.8. This is the result of the Federal government's acknowledgement of the importance of technological training with the establishment of a System of Technological Institutes that is formed by 262 institutes and Specialized Centers (132 Federal Technological Institutes and 130 Decentralized Technological Institutes) with presence in the 32 federal entities and almost 500,000 students. There are 104 Technological Universities that offer students who have completed their middle education an intensive training that will allow them to incorporate in a short period (2 years) to the productive sector or continue their studies to obtain a bachelor's degree in

other higher education institutions. There are 50 technical colleges: created in 2001 to offer engineering, bachelors and postgraduate studies at the specialization level. Programs are designed on a competences based model and oriented to applied technological research with close links to the productive, public and social sector.

There are 26 CONACYT Public Research Centers that contribute to the formation of highly specialized human capital, design public policies and linkage with the productive sector, among others. The UNAM research system comprises 71 research centers: 49 for scientific research and 22 for research in social sciences. The National Polytechnic Institution (IPN) has 19 research institutes and CINESTAV has 9 research centers.

On the other hand, Mexico still has significant weaknesses in its education system that needs to be addressed. Although the ranking for the number of science and engineering graduates is high, the number of researchers, headcounts per million population, is low with 386.43 and is ranked 74th. The number of scientific and technical journal articles (per billion PPP$ GDP) is also very low at 5.86 and is ranked 100th. Academic research in public universities is generally emphasized more than commercial applications. On the positive side there are also strengths such as the number of citable documents H index (number of published articles that have received citations) where it ranks in 33rd with 232.

As for the collaboration between university and industry in R&D, CONACYT provides funding to foster knowledge transfer and university-industry collaboration such as the Innovation Incentives Program (PEI for its Spanish acronym), which supports innovation activities and provides 50% of total project costs for micro and SMEs that collaborate with HEI. According to the OECD (2014) this program has been effective in encouraging business innovation in SMEs. In 2014, the estimated budget for was program is 500 million USD.

3. MAIN PRIVATE ACTORS IN THE INNOVATION SYSTEM OF MEXICO

Historically in Mexico, as in most Latin American countries, there are strong ties between education and research institutions but limited ties to the industry. While CONACYT has increased the number of researchers in higher education and research organizations it has been weak at connecting research to the needs of the domestic productive sector.

CONACYT has established a National Registry of Scientific and Technological Institutions and Businesses (RENIECYT) to identify the institutions, centers, and businesses, among others, that participate in scientific and technological activities. In 2014, there are 6,889 registered individuals and corporations.

In Figure 3, from the 72.9% of Businesses 38.7% are Micro, 32.4% are Small, 16% are Medium, 12.7% are Large and 0.03% are not classified. In 2009, an innovation stimulus package was introduced to detonate private investment in R&D and innovation via subsidies that partially cover the costs of technological innovation projects focused on SME's and projects that link businesses with academia. In 2012 a seed fund for investment in high-tech startups was established by NAFIN.

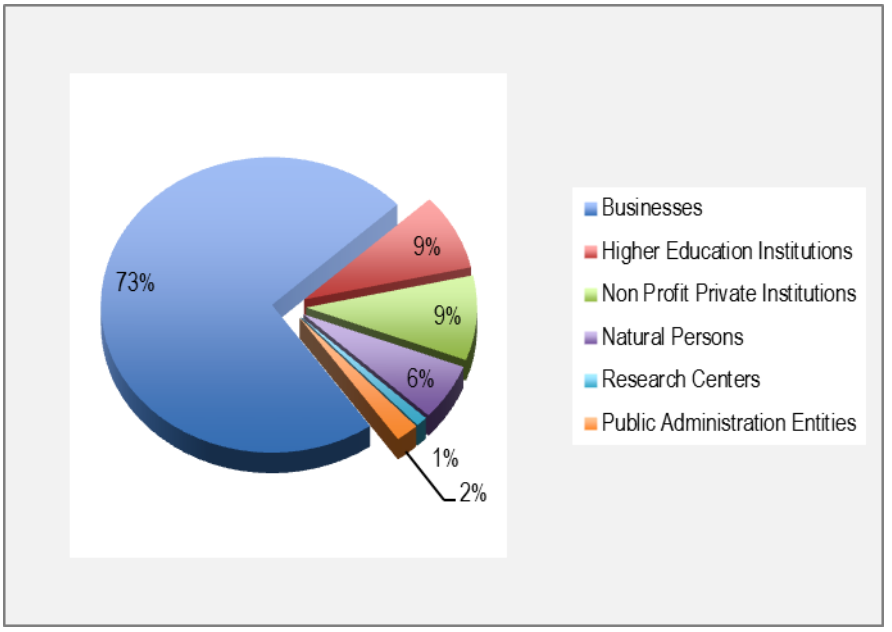

Figure 3. Individuals and corporations in scientific and technological activities members of RENIECYT.

Source: CONACYT, 2015. http://www.conacyt.mx/index.php/estadisticas Last accessed March 03, 2015.

According to data from the 2012 Survey on Research and Technological Development (CONACYT-INEGI) in 2011 the private sector investment in research and technological development as percentage of GDP was 0.2% and the percentage of businesses that carried out these activities was 5%. In 2010-2011 the percentage of businesses that carried out innovation projects was 11.7%, 8.2% of businesses introduced a new product to the market or implemented a new process and 10.3% developed at least one product or process innovation project (INEGI-CONACYT, 2012). This data illustrates the low investment by the private sector in innovation; there is room for improvement. By 2037, the goal of the Mexican government, as mentioned above, is to reverse this situation and for the business sector to account for most of the financing for innovation activities.

To foster linkages between the private and public sector in Mexico the Science and Technology Advisory Forum (FCCyT) was established in 2002 as an autonomous and impartial body in charge of analyzing the development of science, technology and innovation in Mexico. There are 19 members in the Board of Directors of FCCyT who represent of the business, research and technology sector. From 2002 to 2013 they organized 109 events, 60% aimed at the academic sector, 30% to the business and government sector and 20% to the legislative, media and civil society organizations.

Among the events organized by the FCCyT in 2012-2013 is the Citizen's Agenda for Science, Technology and Innovation, a survey conducted in Mexico in which the population could choose one out of 10 challenges that must be met using STI to achieve a better quality of life by 2030. More than 150,000 persons participated and the challenges with most votes were education, water and environment: 'modernize the education system with a humanistic, scientific and technological focus' with 17.09% followed by 'ensuring potable water supply for the entire population' with 15.42% and to 'recover and preserve the environment to improve our quality of life' with 13.54%

4. MEXICAN CULTURE IN INNOVATION

Socio-economic, cultural and political factors have an influence on the ability of Mexico to capitalize on its natural advantages. There are different types of innovation: product, marketing, business model and social, among others. In 2010-2011, the number of businesses in Mexico that carried out at least one type of innovation in product, process, organizational or marketing was 4,179. More than half of them were small businesses (20-50 employees). In 2011, the number of businesses that carried out organizational innovations was 1,231 and the number of marketing innovation was 609 (INEGI-CONACYT, 2012).

In InnovaLatino (2011) some examples of innovative organizations in Mexico are presented. Cemex-Patrimonio Hoy is displayed as an innovative Corporate Responsibility program that has benefited more than 300,000 families by providing assistance and resources to build and improve houses with a low-cost micro-credit system. Pineda Covalín as a successful marketing/branding innovative company that promotes Mexican culture via de production and distribution of design pieces. Softek, a firm specialized in providing information technology services is portrayed as a business process innovation. Oxxo (convenience stores chain), and Cinepolis (film distributor and theater chain) are presented as examples of business model innovation.

The 6-D model developed by the Hofstede center is used to present some cultural practices that are present in Mexico. According to the 6-D Model (see Figure 3) Mexico is a hierarchical and collectivistic society that avoids uncertainty with a culture that is normative and a tendency towards indulgence. This clearly illustrates that there are cultural traits are not conducive to a

innovation friendly ecosystem and have an influence on the types of innovations that are produced in Mexico.

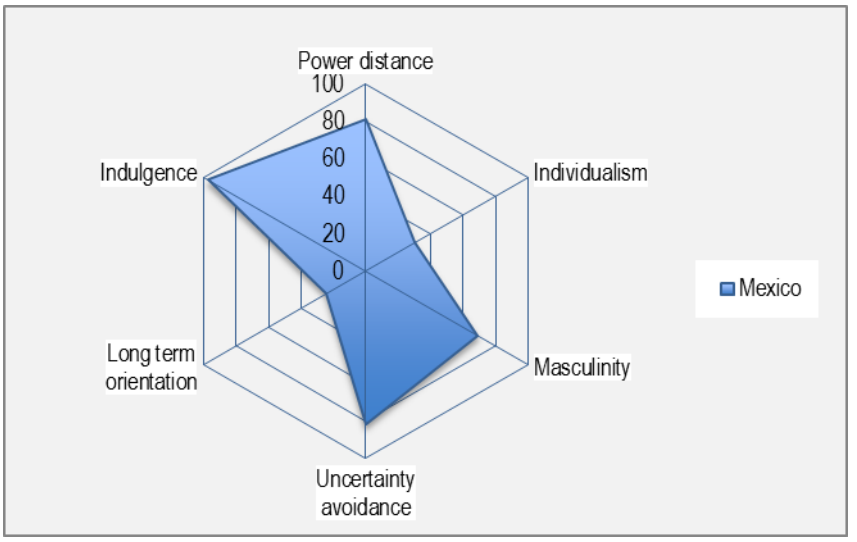

Figure 3. Mexican culture through the lens of the 6-D Model

Source: Author's based on data from the Hofstede center available at http://geert-hofstede.com/mexico.html Last accessed on 18 March 2015.

Perceptions and attitudes are important elements in the entrepreneurship activity of a country. In the 2014 Global Entrepreneurship Monitor, only 48.9% of Mexicans 18-64 perceives good opportunities to start a business in the area where they live, which represents a significant decline from the previous year 53.6%. This could be explained by the social and political climate in Mexico.

5. FINAL REMARKS

There are important deficits in the Innovation System of Mexico illustrated by the data presented in this paper. Regarding the public sector, since 2012, there have been policy and governance changes to improve the innovation performance. In the sections above, we have identified a shift in government focus to move from the *maquila* model towards policies focused on inclusive innovation. We believe this is a step on right direction but it is still early to evaluate its effectiveness.

CONACYT is the main body in charge of coordinating the national innovation system in Mexico. But we pointed out to the challenges that need to be addressed to enhance Mexico's innovation performance. Perhaps a ministry of Science and Technology could strengthen the coordination of the innovation

efforts in Mexico and reduce the current myriad of organizations, which make the process rather bureaucratic.

The government should also invest in improving the quality of the education system at all levels. There are incentives to offer high quality graduate programs with the National Program of Quality Graduate Programs (PNPC for its Spanish acronym) based on international standards, a similar program should also be designed to improve the quality at other educational levels. Transference of scientific and technological knowledge from higher education to the productive sector is limited. More internal and external incentives are needed to improve collaboration and identify opportunities to develop new businesses.

With regards to the private sector, although there are innovations we highlighted in the previous section, the data indicates the extremely low expenditure on R&D. Thus, the private sector is not a relevant actor and its interaction with the universities is weak. More incentives should be introduced to reverse this situation and increase the role of the private sector in the innovation system of Mexico as well as the linkages with the research centers and educational institutions. There are innovations emerging from a country that is experiencing important social and political problems. The resilience of Mexican entrepreneurs is evident. In adverse conditions and against all odds they are still innovating.

In this paper we presented the main public and private actors of the innovation system of Mexico. This overview provides a landscape from which policy makers and academics can build on to present proposals for ways to improve innovation performance in Mexico and other Latin American countries.

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