

**Institutional framework for fostering innovation capabilities and collective action:  
The case of Nuevo León, Mexico**

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Abstract

This paper focuses on how the institutional framework strengthens innovation capabilities and promotes collective action. Current implementations of innovation policy in developing countries face the challenges of how institutional framework may enhance or inhibit the innovation capabilities. This is to be analyzed in particular for the state of Nuevo Leon, located in Northeastern Mexico, through documental research and the application of semi-structured interviews. The theoretical approach is institutional analysis, where formal institutions such as laws and policies attempt to foster informal institutions such as cooperation and collaboration to promote innovation.

The paper is divided into three parts. The first addresses how institutions at the national level impact the design of regional innovation system policy, and how collective action meets a formal and informal set of rules. The second section presents the methodology to be applied, focusing on documental research and semi-structured interviews in the context of World Bank's capacity development framework. The third section analyses the institutional framework for Nuevo Leon to implement regional innovation policy.

This paper is the first overview to the PhD dissertation of how to design an institutional framework that may foster and promote more efficient innovation policies.

Key words: innovation policy, institutional capabilities, innovation capabilities, collective action, regional policy, Mexico.

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## **Introduction**

The complex dynamics of fostering innovation aimed at economic growth involves the joint participation, coordination, and articulation of policies that incentivize actors into developing a favorable environment which involves economic stability, respect for intellectual property, public-private partnerships, trade regulations, among others (Romo and Hill, 2010). This environment where innovation takes place involves a set of institutions that shape also the behavior of the actors within this system.

For some developing economies, especially in Latin America, the last five decades there have been implemented several strategies for economic development: the creation of institutions for science and technology; policies concentrated on strengthening national research capacities; policies to increase skilled human resources; the support of universities and research centers; strategies to stimulate technological change; commercial policies and intellectual property laws, among others, became part of the science and technology formal framework (Bell, 1995; Wionczek, 1980).

Current innovation policies in developing countries face the challenge of how to promote and enhance innovation in processes and products, and to fully acknowledge the relevance of having strong institutions in regional and national level to promote innovation.

Within this context, this paper addresses how institutional framework impacts the design and implementation of regional innovation policy, and how a set of new institutions might foster innovation within formal and informal set of rules. The paper is divided into four sections. The first section presents the theoretical framework discussing the concept of Institutions, institutional capabilities, collective action, and their relevance for promoting innovation capabilities in a region. The second section discusses the methodology to be applied to answer the research questions set for the study, proposing a conceptual methodology of capacity development based on the World Bank Capacity development framework. The third section analyses the institutional framework for Nuevo Leon to implement a regional innovation policy. Nuevo León was chosen as the location where to undertake this study due to its economic weight in the Mexican economy. The fourth and last section presents the final remarks.

## **1 Theoretical Background**

According to the literature on Innovation Policy, there are two main ideologies the scientific one and the market one. The first one, promote the idea that technology drives naturally from science. The market ideology supports the idea that governments need to maintain an open competitive environment and incentive funds to basic research (World Bank, 2010:54-55). Both ideologies assume the government role as a relevant for innovation practice.

Innovation policies are public actions that influence innovation processes. The way that innovation policy has been designed in a given moment in time partly reflects how innovation is conceptualized at the moment in time (Chaminade and Edquist, 2010:97).

This study focus on the implementation of a long-term program based in Nuevo Leon, Mexico, in order to evaluate how institutions foster innovation capabilities. Under an institutional perspective, I first discuss the conceptual evolution of institutions and the impact of those in the economic performance. Then I focus on how institutional capabilities strengthen the performance of the actor involved. Third, I introduce the collective action principles for an innovation policy context. Fourth and last, I focus on how innovative capabilities emerge within these two contexts of institutional capabilities and collective action.

### *1.1 Institutions*

Institutions are the structures and mechanisms of social order, and the cooperative behavior of individual in a community. Institutions are identified with their social purpose and permanence that transcends the intentions and the lives of humans and the application of rules that governs cooperative human behavior (Miller, 2011). Institutions are the main base of society, because they provide information about the behavior of the players, setting expectations and structuring them (Knight,1992). Institutions identify with their social purpose and permanence, and transcend the intentions and lives of humans (Miller, 2011).

For Douglas North (2008) institutions are the rules of the game in a society, or more formally, they are the humanly devised constraints that shape human interaction. This

constraints can be formal such as rules that human beings devise or informal such as convention and codes of behavior. Consequently, continues North, they are the incentive structures in human exchange, whether political, social, or economic. In this sense, the major role of institutions in a society is to reduce uncertainty by establishing a stable structure to human interaction.

Institutions may be created or evolve over time. The set of institutions provides the institutional framework. Just like institutions, organizations provide a structure to human interactions. But rules and actors need to be differentiated. Organizations are the actors within the institutional framework. Organizations<sup>2</sup> model the strategies and the skills to operate in an institutional framework. This process is different from modeling the creations, evolution and consequences of the rules (North, 2008:5).

The institutional framework fundamentally influences which organizations come into existence and how they evolve; at the same time, they influence the institutional framework from which they evolve.

The approach from institutionalism focuses on societies' institutions, actors, regimes, norms, and resources. The complexity of a society increases according to the characteristics of their components. At the same time, institutionalism focuses on the interaction between individuals and institutions, through the coercive capacity and influence of the latter on the conduct and behavior of the first, but also through the way they may alter their institutional settings. The structure of incentives, rules, norms, behaviors that remain over time, gives certainty are relevancy to the relationship between actors. Which is the main role of institutions.

In this paper we focus on formal institutions, and distinguish these from organizations, understanding the latter as “groups of individuals bound by some common purpose to achieve objectives” (North, 1990, p. 5), and whose interactions are vital for exchanging knowledge elements and collaborating in the development of innovations (Edquist, 2001). In order to also explore the dynamics of institutional settings it is considered necessary to

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<sup>2</sup> “Organizations include political bodies (political parties, the senate, a city council, a regulatory agency), economic bodies (Firms, trade unions, family farms, cooperatives), social bodies (Churches, clubs) and educational bodies (schools, universities, vocational training centers). They are group of individual bound by some common purpose to achieve objectives” (North, 2008:5)

also analyze 'soft' forms of social rules. For Scott (1995) institutions also are conceptualize as sets of rules of a regulatory, normative or cognitive character providing stability and meaning to social behavior. "Institutions guide human behavior by (1) utility-oriented rules which may be enforced by coercion ('regulatory'), (2) norm-based obligations ('normative') and (3) immediate participation in taken-for-granted models of reality ('cognitive')" (Smits, Kuhlmann, & Shapira, 2010:11). For Mayntz (1998) he identified two extensive definition which implies 1) more cooperative mode where state and non-state actors participate in mixed public/private networks, and 2) 'modes of coordinating individual actions, or basic forms of social order'.

Since institutions are those factors that provide incentives and constraints to individuals, the capacity of those individuals has to be in accordance to the enforcement of their established rules. Also the institutional framework holds the formal and informal rules, the organizational set where a certain actors interrelate in order to achieve specific goals, establish policies and procedures, among others (UNEP, 2006).

Given that institutions are the legal norms governing relationships among economic agents, state organizations, firms, etc., they should be designed in such a way as to be capable of providing unequivocal information on the expected performance for every individual involved in a transaction.

## *1.2 Institutional Capabilities*

The concept of institutional capabilities becomes the main issue for several years for International Organization such as United Nation Program for Development (UNPD). Capabilities, according to the UNPD, have to do with the ability of its individuals, organizations, organizational units and institutions to perform their functions effectively, efficiently and sustainably. This concept involves active use and a continuous process, where individuals are the central resource for capacity building in all settings. Also capabilities are defined as a context where a set of entities operates under a common purpose according to certain rules and processes (UNDP, 1997:121).

Of concern in this study, institutions are legal norms governing relationships, among economic agents, state organizations, and firms, among others. Then, institutional

capabilities are the ability of the state to enforce the board sets of rules that govern economic and political interactions (Grindle, 1999:9).

The concept of institutional capabilities (IC) has expanded. Some authors understand it as an input, a process; some others as a result (Morgan, 2006); an institutional quality (Fukuyama, 2004; Israel, 1987); as an attribute of governance (Grindle, 1997); as an organizational characteristic (Tolobem, 1992; Morgan, 1997), or as a factor enabling the individual (Sen, 1999). Also, it has been used as a synonym for quality management, organizational performance, efficiency, management or training (UNDP, 2009:49).

The issue of IC becomes relevant in the nineties due to the adoption of second-generation State reforms in developing countries. These reforms promoted a set of administrative measures within itself to achieve efficiency in service deliver and strengthening the conditions for the development of the private and public sector (Nickson, 2002 in Orchard, 2008).

The need for better management and performance of the state through the use of their capabilities and reforms raises its immersion "inside". This capacity-building concern has to do with: a) improving function and solve public problems, b) moving or adapting institutions to address public problems and c) developing, implementing, coordinating, monitoring, evaluating and reporting accounts under a system of governance (Huerta, 2008:121).

For innovative activity, the set of incentives for each of the actors involved differ greatly. The rising importance of innovation at national and regional development agenda has been accompanied by an important shift in the policy paradigm from the interaction and collaboration of public and private agents. According to Huerta (2008) the components and level of performance of institutional capabilities are:

Administrative Capacities:

- a) Micro level components: Individuals. In this level skills and abilities determines behaviours inside of an organisation.
- b) Meso level components: Organisations. Here the capability of management focus on strengthens the organisation as the area to create capacities, to improve performance of task and functions. This requires also a leadership, organization culture, communication and coordination systems, managerial structures, etc.

Political Capacities:

- c) Macro level: Institutions represent the last level of institutional capabilities. This refers to institutions and the economic, political and social context which frames the public sector. Strengthening institutional capabilities has to do with increasing their effectiveness.

### *1.3 Collective Action*

The study of collective action becomes the focus for various disciplines that try to understand how to solve problems that affect a particular context, population, and institutions, through collective action. Social dilemmas have to do with the nature of individuals, their behavior, their expectations, their particular way of viewing a given context and the tools they have. Within this context, from various perspectives such as philosophy, anthropology, political, economic and psychological studies have addressed that these factors favor the solution of social dilemmas.

Hardin (1968) in the "tragedy of the commons" made explicit that the need to solve a problem requires the application of mutual coercion. Those involved adopt rules and make explicit sanctions and incentives. This framework sets them apart from individual actions seeking personal gain at the expense of others.

One of the factors favoring cooperation is the establishment of social arrangements, where freedom is translated as recognition to solve a need. A second factor is that human beings are taken into account as rational individuals that always seek first to fulfill their needs. This approach is more rational economic. A third factor is the notion that human beings are like a "blank slate" (Pinker, 2002), it refers that we can adapt through experience: socialization, culture, family, and according to these situations are subject to be cooperative or not. A fourth aspect, is about bounded rationality, and has to do with the transaction costs, in which individual make decisions based on information that is available. A fifth factor is the ideology, that brings together under a framework of beliefs and ways of being to individuals and this becomes a facilitator for cooperation in those circles. A sixth aspect has to do with adapting to situations where the individual requires a systematic intuition and make it available to the group, the collective mechanisms that can explain such patterns is neuroscience and studies that allow empirical work with a better

explanation of collective agents. Among others, sense of solidarity, altruism, reciprocity, trusts; are issues that revolve around the above factors that favor the solution of social dilemmas in collective action.

Collective action holds trust-based relationships. These, among other factors, promote collaborative, cooperative and coordinated relationships. The collective action literature explores the fundamental aspects related to action arguing that society requires coordination and cooperation. Achieving common goals take us to understand why individual members or groups decide to cooperate. What are their incentives? What is the government's role in these interactions? What kind of effects do public policies have?

For Mancur Olson (1965) the importance of understanding the logic of collective action is to identify its inhibitors and drivers. Olson argues that individual rationality provides incentives to "free ride", but individual rationality into group boundaries with common interest provides a collective rationality where active participants receive incentives to keep cooperating.

The presence of private groups, and organizations is a clear demonstration of the human tendency to form associations. Olson (1965) identifies small and large groups, which act according to their principles and respond to different benefits. Thus the solution of the free-rider dilemma can only be prevented by selective incentives, allowing treating separately those who cooperate and those who do not.

Selective incentives are those elements that place individuals in a collaborative context. A rational decision to achieve their interests is the same as the group, which protects and helps to get them. There are two types of selective incentives: first, negative which acts under the high cost of not participating; and, second, positive incentives that brings the benefit of participating. For those reason, it can be said that the intent of the actors to reach consensus, agreements and collective action is in its rationality.

For Olson (1965) collective behavior can be explained in rational terms. It's a paradox to the free-rider dilemma because there is a strong temptation to expect others to make the necessary effort to achieve results that benefit everyone, as you know is under what conditions can be collective action. A significant number of people who share interests, act according to them. The attempt is to explain how rational individuals can have rational



collective actions. Individual interests, individual action guide to collective action by or through the participation in these groups, and organizations.

There are several types of collective action models, but according to Oliver (1993) there are four main types of them. First, single-actor models which treat the “group” behavior as given; second, models of interdependent aggregation of individual choices into collective action; third, models of collective decisions of individuals with different interests; and, fourth, models of the dynamics interactions among collective actors and their opponents.

The importance to take account collective action is to understand how new forms of coordination, cooperation, collaboration and communication might foster innovation.

#### *1.4 Institutions and Systems of Innovations: towards innovation capabilities*

From an innovation system perspective, institutions and organizations shape the behavior of the firms. The institutional framework plays a very significant role in the production of innovations as well as in the adoption and dissemination of innovations (Chaminade and Edquist, 2010:103-104).

Already back in the 1950s Joseph Schumpeter had argued that innovation was a key ingredient for economic growth through the generation of higher quality products at lower unit costs (Feldman and Florida, 1994), what became known as neo-Schumpeterian economics and represented a gateway for evolutionary economics, organization theory, and entrepreneurship (Augier and Teece, 2004). During the 1980s these Schumpeterian ideas constituted part of the backbone for the study of innovation from a systems perspective, which emphasizes and analyzes the role of institutions and provide a framework for understanding the impact of innovation where non-market synergies are present (Carlsson, 2007). Following on the notion that the pattern of innovative activity may differ between nations due to their “specific institutional factors related to national systems of innovation or of the presence of a firm or an industry with a peculiar history” (Malerba, 2007),

Through collective action and the institutional framework how can individuals, groups, organizations, and networks, innovate? Innovation studies appear in different literature such as institutionalism, sociology, education, management, science and technology, public policy, etc. In the institutional literature, innovation is a field related on how to shape

innovation systems through the role of supporting the structural changes, legal reforms, and capacity building of the actors involved (Oyelaran-Oyeyinka, 2005).

The innovation capabilities of firms and other types of organizations include a stock of resources that permit them to undertake production and differing degrees of innovation activity. Such capabilities are both in the nature of 'human capital' (i.e. specialist professionals, knowledge bases and skills/talents that are formally and informally allocated within specific organizational units, projects and teams) and 'organizational' (the firm's internal and external organizational arrangements such as their routines and procedures, linkages, managerial systems, including the firm's values, norms and beliefs that are reflected in its management style and behavior) (Figueiredo, 2010).

In most of the studies the process of building innovation capability has been studied by assuming the existence of a long-term continuity. Most studies address the accumulation of a firm's capability by considering (successful) technology-following trajectories (Figueiredo, 2010). Innovation capabilities related to a science and technology framework also take us to see the relationship between innovation systems and the creation and evolving of institutions.

System of innovation is an approach for understanding innovations occurring in an economy, and points the fact that innovation processes are evolutionary. Also, that firm does not normally innovate in isolation but in interaction with other organizations within a framework of specific institutional rules. The system approach to innovation is essentially an attempt to think through and analyze the nature and implication of the collective character of innovation (Edquist, 1999).

Nelson (1993) on his empirical work of systems of innovation showed that countries have developed different knowledge bases in both R&D and the capacity for innovation. He notes some principal differences, such as political circumstances and priorities, while size and degree of influence matter a lot (Nelson, 1993:507). This acknowledges the role of forces outside the domain of R&D and the institutions associated with it (Oyelaran-Oyeyinka, 2005).

The lack of innovation capabilities in developing countries has been explained by factors under the systems of innovation approach and lack of enforcement of the institutions. In the innovation system at least four conditions are mentioned to understand

the innovation capability level in developing countries. First, the amount of R&D carried out in universities and firms is significantly lower than is found in advanced industrial countries. Second, the competence-building capacity of organizations such as universities and training centers is still in transition compared to developed countries. Third, the function of information exchange is usually very weakly coordinated, exists a lack of databases in high technologies. And fourth, the regulatory functions like intellectual property still is an issue in developing countries (Oyelaran-Oyeyinka, 2005:17-18).

In terms of the institutional perspective, Oyelaran-Oyeyinka (2005) mentions five factors where institutional analysis takes innovation capabilities into account. First, institutional change constitutes a strong selection mechanism for innovation. This has both market and non-market origins, with the latter providing the leverage for policy intervention at different levels of the economy (Metcalf, 1997). Second, learning processes are key determinants of innovative activities and institutions are the carriers of knowledge, representing the cumulative learning of groups and societies (North, 1996). This is particularly so for tacit, non-codified knowledge. The speed of economic change is a function of the rate of learning, but the direction of that change is a function of the expected payoffs to the acquisition of different kinds of knowledge (North, 1996: 346). Third, path-dependence is a central concept of institutional change and it too underpins learning and innovating activities that are essentially heuristic and possess strong feedback loops (Edquist, 1997). Fourth, the observation of technological innovation relies strongly on institutional innovation (Sampat and Nelson, 2002). Fifth, considerable diversity is generated through learning, in much the same way economic change is brought about by market and non-market selection mechanisms that create diversity (Edquist, 1997:7).

Some of the functions of an innovation system are: first, reduction of uncertainty among institutions; second, the management of conflicts and engendering of cooperation among actors; third, the provision of incentives to engage in learning and participate in innovation; and, fourth, the channeling of resources to innovative activities (Edquist and Johnson, 1997). Also we can add some more: fifth, knowledge generation, including R&D; sixth, competence building, supply of inputs (finance, foreign direct investment, venture capital, loans); seventh, provision of regulatory frameworks and measure, standards and quality functions; eighth, facilitation and exchange of information, stimulation of demand

and creation of markets; and, ninth, reduction of uncertainties and resolution of conflicts through appropriate institutions (Fagerberg et al., 2004).

These refers that system functions are not only technical but also institutional and organizational. In a given institutional context, functions are related with a recognizable system.

In summary, the literature reviewed, which integrates the theoretical framework for this study notes, is that in the dynamics of economic development, institutions that foster not only innovation but also cooperation and coordination among relevant actors of an innovation system are key. There is a need for more empirical studies in developing countries such as Mexico, which address the issue of how to better, design such institutions.

## **2 Research Methodology**

### *2.1 Context of research*

The purpose of the study is to evaluate through an institutional perspective, the case of the State of Nuevo Leon as a region that has been developing strategies and policies in order to increase their economic growth through the implementation of policies that foster innovation and impulse a society and economy based on the intensive use of knowledge. The framework that will help us to do that is a combination of quantitative and qualitative indicators. The World Bank Capacity Development Results Framework combines these approach in a systemic way: focusing on the availability of resources, the factors that affect the achievement of goals and the change process that involves learning experiences. This framework will be explained.

There are three specific objectives for the empirical study: first, to study from an institutional approach innovation policy and the role of institutional capabilities with respect to its implementation; second, the identification and analysis of actor's capabilities that conform up the organizational structure of the sector and relevant institutions in the region; and, third, to evaluate the empirical evidence based on the impact of institutional capabilities in the implementation of regional innovation policies.

Therefore, this study will empirically address the question of how the relationship between the impact of institutional capacities and the implementation of innovation policies?

The following sub-questions complement this research:

- What is the structure of the institutional framework of STI policies in Nuevo León?
- What are the institutional capacities and the importance of the actors in this network?
- Under what constraints and incentive scheme does the current institutional framework works in the innovation policy in Leon?

To answer these questions, first there has to be a diagnostic on how is the current implementation of the Program Monterrey International City of Knowledge (MCIC) in order to compare with the formulation of the policies and evaluate how the institutional framework has impact on institutional and innovative capabilities.

Therefore through semi structure interviews and documental research seek quantitative and qualitative attributes. In that context, and with respect to the benefits it creates, seek factors like increasing/decreasing wealth and income levels, job creation or employment level, the availability of good and services, and improving financial security. As well consideration as generating creative capital, creating greater social and financial equity, achieving sustainable development, creating a spread in the range of employment, and gaining improvements in the quality of life (Stough, et. al. 2011).

The temporal time that has been assigned to do this research is two years, where first year will be used in the writing of theoretical chapter that involves the institutional perspective, institutional and innovative capabilities, and collective action, also the study of the institutional framework in NL.

The following sixth months will be used to field research through semi structured interviews and documental research and design a diagnostic of the current implementation of the MCIC in NL taking into account the World Bank Capacity Development Framework.

The following six months have to do with the revision of the findings in the field research work and been able to construct and explain how institutional framework has impact in the institutional and innovative capacities.

## *2.2 World Bank Capacity Development Result Framework*

The research interest in a broad sense is about the role of government in the design and implementation of public policies. These processes have many challenges in the current world economic, political, social, environmental affairs. One of those is the design and implementation of Innovation Policies. The area of interest in this research is how innovation policies are implemented and how institutional framework and institutional capabilities have a very critical role in this concern.

Since Institutional capabilities are the ability of the state to enforce the board sets of rules that govern economic and political interactions (Grindle, 1999). A critical point of view will be to evaluate how these capabilities perform in Nuevo Leon's Innovation Policy.

The World Bank has improved ways to measure institutional capabilities. The Capacity Development Framework Methodology is an approach to the design, implementation, monitoring, management, and evaluation of development programs and to learn for capacity development (World Bank, 2009). This framework can be profitably applied to monitor projects during implementation at national or subnational level.

A key feature of this methodology focuses on capacity factors that drive or impede the achievement of development goals, and on how learning interventions can be designed to support locally driven change.

Capacity Building Methodology (2009) identifies key actors in the change process and offers the knowledge and tools in order to produce change in the direction of the desired goals. The aim is to find critical points that might explain building capacity as the driving force.

This framework has to following objectives:

- To specified development goal or set of goals that motivates the capacity development effort
- To determine the extent of local ownership of the effort to achieve the stated development goal(s), as well as the efficiency and effectiveness of that effort.
  - Conduciveness of the sociopolitical environment

- Efficiency of policy instrument
- Effectiveness of the organizational arrangements
- To detect the change process that leads to improvements in the targeted capacity factors at the hands of agents of change empowered through learning
- To set activities and instruments designed to achieve the necessary learning outcomes for the agents of change.

Under this approach the Program MCIC will be analyzed taking into account the ecosystem build towards the implementation of the program, in its two first stages (Structuring 2003-2009 and Consolidation 2009-2015). In the following figure we can see the relation between the capacity development framework and the Model for the MCIC program.

**Figure 1: Capacity Development Framework and Model for the MCIC Program**

Capacity Development Framework		Model for the MCIC Program	
<b>Development goal (DG)</b>	A clearly specified development goal or set of goals that motivates the capacity development effort	<b>Strategies</b>	PROMOTE DEVELOPMENT OF HIGH-QUALITY GOODS AND SERVICES PROMOTE INNOVATION IN THE PRIVATE SECTOR INCREASE THE EDUCATION OF HIGH-LEVEL HUMAN CAPITAL PROMOTE CULTURE OF INNOVATION IN SOCIETY INCREASE INVESTMENTS IN TECHNOLOGICAL RESEARCH AND DEVELOPMENT PROMOTE NEW BUSINESSES BASED ON INNOVATION STRENGTHEN URBAN INFRASTRUCTURE AND CULTURAL OPTIONS INCREASE THE # OF RESEARCH & TECHNOLOGY CENTERS
<b>Sociopolitical environment</b>	<p><b>Capacity factors</b></p> <ul style="list-style-type: none"> <li>- Emphasis on changes in the use of knowledge and information that empower local agents</li> <li>- Commitment of leaders to the development goal (DG)</li> <li>- Compatibility of the DG with social norms and values</li> <li>- Stakeholder participation in decisions about the DG</li> <li>- Stakeholder voice in decisions about the DG</li> <li>- Accountability of public service providers for achieving the DG</li> <li>- Transparency of information to stakeholders about the DG</li> </ul>	<b>Foundation</b>	Culture of Knowledge State Policy Resources
<b>Policy instruments (institutional)</b>	<ul style="list-style-type: none"> <li>- Focus on change efforts targeting institutional and policy-related constraints and opportunities</li> <li>- Clarity of the policy instrument in defining DG and the related rights and responsibilities of stakeholders</li> <li>- Consistency of the policy instrument that defines the DG with policy instruments for other DGs</li> <li>- Legitimacy of the policy instrument</li> <li>- Incentives for compliance provided by the policy instrument</li> <li>- Administrative ease of implementing the policy instrument</li> <li>- Freedom of policy instrument from unintended negative consequences</li> <li>- Flexibility of the policy instrument in addressing varying DG situations</li> <li>- Resistance of policy instrument to corruption, rent seeking, and regulatory capture</li> </ul>	<b>Key Players</b>	Academics, Educators, Researchers, Research Centers, Researchers Government [Federal, State, Municipal] Businesses (Chambers, Associations, Businesses, Entrepreneurs) Information Technology Mechanisms & Advanced
<b>Organizational arrangements</b>	<ul style="list-style-type: none"> <li>- Effectiveness of organizational arrangements, or the systems, rules of action, processes, personnel, and other resources that government and non-government stakeholders bring together to achieve development goals.</li> <li>- Clarity of mission well related to the DG</li> <li>- Achievement of outcomes that lead directly to attainment of the DG</li> <li>- Operational efficiency in producing DG-related outputs</li> <li>- Financial viability and prudence</li> <li>- Supportiveness of stakeholders</li> <li>- Availability in providing and resourcing a resource</li> </ul>	<b>Focus Areas</b>	Manufacturing Health Sciences Biotechnology Nanotechnology
		<b>Key Programs</b>	REDESIGNING AND UPDATING OF THE EDUCATIONAL SYSTEM'S AGENDA RESEARCH AND INNOVATION PARKS, ATTRACTING NEW RESEARCH CENTERS & TECHNOLOGY BUSINESSES PROMOTION & FOSTERING OF INNOVATION IN BUSINESSES, UNIVERSITIES, AND RESEARCH INSTITUTIONS CREATION AND ATTRACTION OF NEW STRATEGIC BUSINESSES EXPANSION OF URBAN INFRASTRUCTURE AND CULTURAL OPTIONS PROMOTION OF THE NEW INNOVATION & COMPETITIVENESS CULTURE SET OF FINANCIAL INSTRUMENTS, TAX INCENTIVES, AND RISK CAPITAL TO SUPPORT INNOVATION
		<b>Organization</b>	TRIPLE HELIX MODEL - Collaboration of Academia-Government-Businesses • Citizens Councils for Development • Strategic Producer Groups (CLUSTERS)
		<b>Indicators</b>	• Economy • Human Capital • Technological Development • Competitiveness • Quality of life • Research and Development

Source: Own Elaboration with information of World Bank (2009) and BID (2009)

### **3 The case of Nuevo Leon, Mexico: Developing an institutional framework and strengthening institutional capabilities**

Mexico has become in the past decades one of the twenty larger economies in the world. Mexico made huge gains in export manufacturing in the seventeen years since the North America Free Trade Agreement was signed with the U.S. and Canada. But it has been a challenge to keep up with Asian countries like China, South Korea, among others. As science, technology and innovation are decisive factors for economic growth, and a fundamental factor for the wellbeing of contemporary societies (Bazdresch and Meza, 2010), stimulating such factors is part of a complex process which involves the participation, coordination, and joint articulation of policies that incentivize key actors to build a favorable environment for economic stability, respect for intellectual property rights, trade regulations, among others (Bazdresch and Meza, 2010).

For Mexico in particular, evidence has shown that science, technology, and innovation (STI) policies are weak in creating linkages between the coordinating STI organizations, mechanisms and the final users (Cabrero, Valadés, y López-Ayllón, 2006). Within this context, my study centers its attention on those factors that may be accountable for the weakness in the implementation of STI policy in Mexico, considering its institutions and their capacity to bridge the existing gap between design and implementation.

Encourage innovation in science, technological progress and the techniques and production processes are important factors in economic growth dynamics of capitalist societies (Romo and Hill, 2010:73). This complex process involves the participation, coordination and joint articulation policies that encourage actors in the creation of an enabling environment and economic stability, respect of property rights, support programs and linking businesses, public-private financing, regulation of trade, foreign investment and permeate into the national economy (Romo and Hill, 2010).

The evidence regarding the effectiveness of the STI Policies in Mexico shows that there is not connection between bodies and coordination mechanisms (inter-and intra-governmental) and binded to the target (Cabrero, et. al., 2006) . In this context, the gap between a design that significant progress has to have new actors in their formulation, however dissonances and dislocations generated in the institutional framework that should support (Cabrero, et. al.,2006).



In this context, the research interest focuses on the explanatory factors that may account for this lacking STI implementation of policies in Mexico. For this purpose we take into account their institutions and their capacity to effectuate the gap between design and implementation.

### *3.1 The Case of Nuevo Leon, Mexico*

The State of Nuevo Leon (NL), and its capital city, Monterrey, is located at the Northeastern region of Mexico (see figure 1); Monterrey is considered the most important financial and industrial center, as well as the must port of entry for the commercial exchange between the Northeastern Region of México and the United States (OECD, 2005). Also, it has been characterized for its industrial wealth and progress and as a competitive economic region (see chart 1).

Since the beginning of the twentieth century NL become a leader in national and international activities such as, steel, beer, glass, cement, ceramic products, chemical and metalworking and other manufacturing (IDB, 2009).

In the last decade the State of Nuevo León, has set strategies and policies to put the city and their region in the international spotlight not only in terms of commerce and industry. One of its main pillars for economic development is the strategic project “Monterrey International City of Knowledge”, which is based on an alliance between government, higher education institutions, and industry, also known as the Triple Helix, to promote growth through innovation (OECD, 2009:192).

In the beginning, the project followed some basic strategies which included revising educational contents and methods, the incorporation of technology specialists for industry, increasing the number of researchers and public research centers, promoting business incubators, and strengthening the city’s infrastructure. To make the alliance stronger, several clusters were initiated in sectors including auto, IT, medical services, life sciences, agro, nanotech and biotech, accompanied by Centers for Innovation and Intellectual Capital by sector (OECD, 2009).

**Figure 2:** State of Nuevo León: location remarks



Source: Parada (2009)

**Table 1:** Monterrey features

Capital: Monterrey

\* Population: 4.3 Million (4% of the total population of the country)

Producer of 11% of Mexico's manufactured goods (\$16.4 Billion USD)

GDP: \$69.2 Billion USD (7.6% of the country's GDP)

Exports 2007: \$17 Billion USD

GDP per capita: \$16,000 USD (\$8,000 USD above national average)

\* 2nd most important state to attract FDI (\$1.5 Billion USD avg./year)

\* 145,000 jobs created between 2006 and 2007

\* 2,000 foreign companies established in the Metropolitan area

Source: Parada (2009)

For the creation of new enterprises, the government launched the several programs like INVITE<sup>3</sup> in 2005, or FONLIN<sup>4</sup> in 2009. INVITE implementing a new form of regional development and integration of logistics to boost the 2nd stage of the free trade agreement for North America and for FONLIN helping researchers and local entrepreneurs license and register their knowledge while promoting the creation of new knowledge-based firms. Additionally the Institute for Innovation and Technological Transfer (I2T2) started two grants with seed money and resources from private investors to help firm start-ups as well as high-growth small and medium enterprises (OECD, 2009)

### *3.2 The Institutional Framework of Nuevo Leon*

Monterrey has maintained in recent years the top competitiveness in Mexico (OECD, 2009). However, the vision for the coming years Monterrey is to position the city within the twenty-fifth cities most competitive in the world.<sup>5</sup> The competitiveness of the city is based on the ability to attract, retain and develop human talent and investment to produce goods and services of high value added to generate gainful employment and quality of life for its habitants.

The Institutional framework that the NL government has established includes policies oriented towards better and effective interactions between de triple helix components.

The science, technology and innovation public policy issue is set in a fast technological development environment, and the composition of various actors taking part of it. There is an evolution in the STI policies in legislation in Mexico and in the State of NL, taking the development of scientific knowledge as an engine of development.

### *3.3 Planning*

The actions of a government are provided within a planning framework. This process is important because it is represented by a plan that includes explicit and consistent

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<sup>3</sup> INVITE (Integration of Regional Development and Logistics in the Northeast and its Link to Texas)

<sup>4</sup> FONLIN (Nuevo Leon Funds for Innovation)

<sup>5</sup> According to America Económica (2009, 2011) Monterrey was the twelve most competitive city in Latin America in 2009. By 2010 had the same Rank but in 2011 went down to the thirteen position. See more details for the methodology they used <http://rankings.americaeconomia.com/2011/ciudades/index.php>

decisions to allocate resources to predetermined purposes. Thus it is important to know the regulatory framework and the establishment of rules.

Under the Constitution, the law empowers the executive with the administration and coordination of planning in Mexico, these powers are outlined in Articles 25 and 26 of the Mexican Constitution as regards Article 25, the "guidance of the National Development to ensure that it is comprehensive and sustainable" and in the 2nd paragraph, "The state will plan, conduct, coordinate and guide national economic activity, and carry out the regulation and promotion of activity that requires the public interest under this Constitution grants freedoms "and Article 26:" The State shall organize a system of democratic planning of national development ".

Under the Law of Planning (LP), Article 3 and 4 explained that by National Development Plan (PND) is rational and systematic actions of the Federal Government are aimed at transforming the country's reality and fix the responsibility for the Executive to lead the planning of the country with the democratic participation of social groups, respectively.

The planning process is integrated into the National System of Development Plan (SNPD), which takes into account the participation of various social actors. For the federal government, the Plan will be the current operational framework, with the Ministry of Finance and Public Credit (SHCP), whom is the in charge of the task to develop, to coordinate, to monitor and evaluate the progress of the process (Article 34 LP).

In Chapters 5 and 6 of the LP are the mechanisms for coordination and consultation and induction, respectively. As for coordinating the Federal Executive may make agreements with the States (Article 34 LP) to participate in the National Development Plan (NDP) and contribute in the field of its competence in achieving the objectives of national planning. The Federal Executive through its agencies and companies working in direct partnership with the State, but as independent entities will arrange to carry out the actions envisaged in the Plan and the programs, with representations of social groups or individuals concerned (Article 37 LP).

### *3.4 Science, Technology and Innovation Regulatory framework*

The legal regulation of science and technology is constitutional, statutory laws, organic, regulations, decrees, and administrative tools. At the constitutional level the

Article 3, Sections II, V, VII indicate that the results of scientific knowledge are the criteria to guide public education also reflects the National State's obligation to support scientific and technological research, which is the backbone of the S & T policy, this rises to a constitutional point of authority and responsibility for research on autonomous university.

For the analysis of legal and regulatory framework in science and technology serves three items proposed by Cabrero, Valadés, Ayllon-Lopez (2006:40): a) research, b) the actual development and c) industrial plant processes.

Under the Constitution the Federation reserves only scientific research and technological innovation related to national development (as provided for in Article 124 of the MC).

Based on this premise, there is a clear centralization by the Federation about the guidelines to regulate STI in the country. Yet that, it is opt for an administrative decentralization where the states have the power to create S&T State Councils to coordinate under a National S&T Conference. The conference is a permanent body of coordination between the National Council for Science ,and Technology (CONACYT) and entities.

In the NL case, the efforts of the government has able to regionalize and create from bottom-up a set of policies and take into account the Law from National Level to State level. Which was reflected in the NL 2004-2009 State Development Plan (2004-2009). This Plan established the relevance of the interaction among government, industry and academia for economic development through initiatives that involve this actors.

In this period of government there was an strategic way of thing that need it to deep in the administration the long term concept where a “Knowledge city” can mean for the State of NL (Ciencia, Conocimiento y Tecnología, 2010). These initiatives seek to stimulate these interactions primarily through: 1) establishing the institutional settings for knowledge transfer, 2) creating the environment for attracting industry, and 3) strengthening and developing clusters in the state.

In 2003 the Law for the Promotion of Knowledge-based Development was approved by the State Congress. This led to the creation of the Coordinating Office for Science and Technology in 2004 with the purpose of bringing together all actors of S&T in NL (Coordinacion de Ciencia y Tecnologia de Nuevo Leon, 2010).

One of the key initiatives for 2004 was the creation of the Institute for Innovation and Technological Transfer (I2T2). The I2T2 it is an agency of the State Government of NL, establish in 2005, with the authority to sign agreements and allocate financial resources to programs and projects of innovation, science, and technology. The Institute administrates the program MCIC-Monterrey International City of Knowledge (I2T2, 2005).

MCIC revolves around seven basic strategies: 1) redesigning the agenda for the education system; 2) attracting new research centers and technology-based firms; 3) promoting innovation in firms, universities, and research institutions; 4) creating new innovation firms; 5) widening urban and cultural infrastructure; 6) diffusing a new entrepreneurial culture; and 7) improving instruments that support innovation (MCIC, n.d.).

The promotion of knowledge-based activities is also anchored in the national STI instruments such as the Mixed Funds CONACYT-Nuevo Leon, in addition to other programs designed by the NL government aimed at promoting the creation of new firms. The number of approved projects through the mixed funds as well as the amounts has been quite varied, and they include industrial development and the creation of a scientific and technological infrastructure (FCCyT, 2009).

According to Villasana (2011) the Institutional Framework for promoting a regional innovation system in NL (see figure 2) has the Council for Science and Technology of the State of Nuevo Leon (COCyTE-NL) has the coordinator and responsible to follow up the Law for Promotion of Knowledge and Technological Innovation, also link with the Advisory board for the Institute of Science and Technology the Program MCIC.

**Figure 2:** Institutional Framework promoting innovation

National institutional framework		Local institutions		Programs and strategies overseen by local institutions
Mexican Constitution	Science, Technology and Innovation Law	Law for the Promotion of Knowledge-based Development (2004, modified in 2009)	Institute of Innovation and Technology Transfer, I2T2 (2005)	Monterrey International Knowledge City, MCIC (2004) • Research and Technology Innovation Park (PITT)
National System for Science, Technology and Innovation	National Council for Science and Technology, CONACYT		Coordinating Office for Science and Technology Nuevo Leon (2003)	State Strategic Program for Science, Technology and Innovation
		Law for the Promotion of Investment and Employment (2007, modified in 2010)	Citizen Advisory Councils	

Source: Villasana (2011:32)

The I2T2 is in charged to monitor and evaluate the evolution of 1) the develop of a mayor cluster of researchers in the state, 2) to build of technological infrastructure, 3) to foster graduated programs in insert into international networks, 4) to promote and attract Foreign Direct Investment (FDI ), 5) to impulse to Nuevo Leon's exports, 6) to accelerated education of human capital (Specialists and Technologists), 7) to linkage and to make alliances between companies and academic institutions, 8) to incorporate of Science & Technology to basic education, 9) to patent technology developments and transfers, 10) to incorporate R & D in the companies, 11) to create business incubators and venture capital (Parada, 2009), (Ciencia, Conocimiento y Tecnología, 2010).

### 3.5 Institutional strength in figures

The quality and quantity of resources for science, technology and innovation for each Mexican state are ranked according to ten dimensions: 1) Investment in human capital development, 2) infrastructure for research, 3) Investment in S&T, 4) population and graduate professional studies; 5) development of human resources, 6) scientific productivity; 7) business infrastructure; 8) information technology and communications; 9) economic and social environment, and 10) an institutional component (FCCyT, 2010) (see Table 4). Table 3 shows how Nuevo Leon compares to the other 30 Mexican states by components that support STI.

**Table 3** Basic data of science and technology in Nuevo Leon

Number of programs in the National Quality Graduate Program-CONACYT, 2010	94
Current scholarships granted by CONACYT, 2009	1649
Research Centers, 2010	4
Budget for STI, 2010 (as % of state budget)	0.66%
Population 18 years and older with graduate studies, 2010	56,701
Enrollment in graduate programs related to S&T, 2007-2008 school year	2,803
Enrollment in technological university programs related to S&T, 2007-2008 school year	61,005
Researchers ascribed to National System of Researchers,	662

2011	
Patents granted, 2008	19
Patent applications, 2009	114
Large manufacturing firms investing in R&D for their production processes	200
Firms registered in the National Registry of Institutions and Scientific and Technological Firms, 2010	622
Percentage of households with computer, 2010	39.30%
Percentage of households with Internet access, 2010	31.76%
S&T Law (Law for promotion Knowledge-based Development)	yes
S&T Program	yes
S&T Legislative Committee	no

*Source: Free translation from Foro Consultivo (2010)*

According to this ranking, strengths and weaknesses are identified for each state. Nuevo Leon has remained in the first position regarding STI budget as percentage of the state GDP. In addition, it also is in first place in utility models registration per million inhabitants in the state, which shows a culture of property rights protection among entrepreneurs. In terms of opportunities, efforts are being made by NL's largest higher education institutions to attract star scientists and researchers as a response to the strategies implemented in the state aimed at strengthening the science base. With regards to the number of research centers in the state, one of the PITT's objectives is to attract more public research centers that the state was lacking before such a strategy was implemented. Public and private research institutions have been establishing at this research park seeking closer interactions with innovative firms.

Of particular interest for the authors is the last element on institutions shown in the ranking as a threat. This component encompasses if the state has a law, program, state council and a standing committee in the local congress on STI. Nuevo Leon is one of 6 states that do not have an STI standing committee in their local congress. It does have a Special Committee for Science and Technology, however, which is of transitory character.



Despite this fact, the authors consider that this should not be seen as a threat per se, since the state's institutional framework has shown effective for supporting arrangements between public and private actors, as evidenced by the allocation of resources for S&T.

**Table 4** Strength and weaknesses analysis

<b>Strengths</b>	<b>Position</b>
<b>Investment in STI</b>	
STI budget as a percentage of total state budget, 2010	1
<b>Innovative productivity</b>	
Utility model registrations per million inhabitants in the state, 2008	1
Utility model applications per million inhabitants in the state, 2008	1
<b>Opportunities</b>	
<b>Investment in human capital development</b>	
Scholarships granted by CONACYT per 1,000 graduate students, 2009	10
<b>Formation of human resources</b>	
Researchers ascribed in the National System of Researchers per 10,000 of the economically active population, 2011	10
<b>Weaknesses</b>	
<b>Infrastructure for research</b>	
Percentage share of total national research centers in the country, 2010 <sup>4</sup>	8
<b>Formation of human resources</b>	
Graduate faculty per graduate students in the state, 2008-2009	24
<b>Threats</b>	
<b>Formation of human resources</b>	
Undergraduate faculty per undergraduate students in the state, 2008-2009	31
Faculty per professional technical students in the state, 2008-2009	31
<b>Institutional Component</b>	
Permanent S&T committee in local congress, 2011	no

*Source: Free translation, Foro Consultivo (2011)*

#### **4 Final remarks**

The objective of this paper was to present the first approach of the study that will be undertaken in the Mexican state of Nuevo Leon during the year 2012-2013 aiming the evaluation through a case study about the impact that institutional framework has in the institutional capabilities and so on inferred innovation capabilities of the main actors in the science, technology and innovation sectors in the current implementation of the regional innovation policies.

Through the review of literature taking the institutional perspective, was address how institutions plays a critical role in the developing of a region and a national State. The establishment of rules provides an environment and specific constraints that alter human behavior. The institutional perspective also allows taking into account collective action characteristics, specially in science and technology matter where innovation and use of knowledge requires the collaboration of many resources (financial, geographic, human resources, ideas, etc.)

Institutional approach also let us to evaluate the institutional and innovation capacities within the actors involve. This outcome also provides a better way of seeing institutional framework enforcement. Several methodologies have developed to measure institutional capabilities and the result has take to an evolution of the concept. Nowadays not only the external financial efforts provides good implementation of policies, also innovation capabilities can turn bottom-up and strength the rules.

Current science, technology, and innovation public policies in developing countries face several challenges. Even the effort to built a sustainable institutional framework providing technological infrastructure, incentives for all the actors, is not enough. The lack of skilled human resources, or the lack of enough financial resources to STI affairs, a low integration between industrial, commercial and STI policies, or the not coordinated speed in the triple helix are some factors that might decrease levels of innovation.

Regional Innovation Systems still are theoretical and empirical cases that need more research and studies. Each geographical condition, type of government, level of competitiveness, level of innovation, and long term policies might be some factors where

can create an environment to foster collective action, institutional and innovative capabilities in order to innovate process and products.

The State of Nuevo Leon is an interesting case to take into account in regional innovation policies. The I2T2 has been challenge and take a long-term goals trying to pull up socioeconomic factors to increase growth and development in the region. It is also a critical opportunity at national level to set a path where other capabilities might joint these efforts.

The using a framework to test the institutional and innovation capabilities that have developed through the establishment of new set of Institutions will contribute to enrich the field for institutional as innovation system theory and practice. Feedback and comments on the theoretical approach and suggested methodology will be greatly appreciated by the author.

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