

**Industrial Upgrading Policy Processes  
in Democratic Emerging Countries:  
The Software Sector in Two Mexican States**

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*Abstract:* This paper examines industrial upgrading policies—defined as government initiatives to foster the creation or consolidation of knowledge-intensive sectors such as the Information Technology—in democratic developing countries. The following research questions are addressed: (1) What are the different types of industrial upgrading policies used to stimulate the software sector in democratic developing countries? (2) How can we explain such variation in policies? The argument, in brief, is that industrial upgrading policies can be distinguished in terms of two dimensions: the level of collaboration between state and business, and the degree of formalization of the policies. In turn, the types of industrial upgrading policy can be explained in terms of two variables: the level of executive leadership and the level of business organization. To test this argument, the paper relies on two in-depth case studies of Mexican states based on secondary sources and 14 semi-structured interviews with key actors of the software sector.

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Latin American countries have recently experienced a decade of high rates of growth and even managed to weather the global financial crisis that hit the world since 2008-09. So after several decades of debt, crisis and structural adjustment this could be seen as quite good news. In fact, policymakers have learned from past mistakes and devised prudent macroeconomic policies such as accruing high levels of foreign reserves, regulating hot capital inflows, and maintaining healthy fiscal balances. Nonetheless, the panorama is less bright if we scrutinize more closely those activities that are fueling economic growth in the 21<sup>st</sup> century: exports of soy (Brazil and Argentina), copper, iron ore (Chile, Peru), foreign-owned manufacturing assembly (Mexico) and oil (Venezuela). The global context has changed dramatically: we are living in an era where the production of knowledge has become crucial. Innovation intensive activities provide the highest value-added and Latin America is lagging behind in this realm.

In many ways, just as breaking away from a strong reliance on primary exports and beginning a process of industrialization was seen as the core challenge for Latin America in the 1950s, today industrial upgrading is critical if countries aim to sustain high growth rates with better equity. In fact, development experts have noted the risks of not moving production into higher technology levels: “In order to avoid the resource curse, rents have to be purposefully distributed against comparative advantages, fostering diversification of production in knowledge intensive activities” (Cimoli, Dosi, & Stiglitz 2009: 556). International institutions like the ECLAC, the World Bank and OECD are also encouraging governments in the region to adopt policies that increase innovation rates.

One of the most promising strategies to raise innovation levels and diversify the economic structure is to stimulate the Information Technology (IT) sector which comprises the hardware and software sectors. These are characterized by continuous change and are knowledge and labor intensive. New products appear in the market frequently and solutions to the old and current problems are sought constantly. The IT sector is strategic and has a cross-sectoral impact. Another characteristic is that the level of skills of the jobs created in this sector varies according to the type of services provided. These characteristics make it very attractive for developing countries that are trying to catch up and thrive in the network society era characterized by the prevalence of networks as a form of organization and innovation-based growth (Castells 2000; Castells 2004).

A quick glance at the Latin American region reveals that several governments have already set up specific initiatives to support the IT sector, especially software in the past two decades. Brazil and Costa Rica were early adopters of industrial upgrading policies to support the software sector in 1997 and 1999 respectively. Then Colombia, Uruguay Mexico, and Argentina followed in the period from 2000 to 2003. Bolivia set up an initiative in 2007 (Rovira & Stumpo 2013). In addition to the national level strategies, there are subnational programs to encourage the IT sector. Several cities have them (e.g. Medellin, Buenos Aires, Rio de Janeiro, Montevideo, Santiago) and all aspire to become the next “Silicon Valley”. In Mexico, 23 out of 32 states display some industrial policy/ program to support the software sector (See Maps 1 and 2 in Appendix).

An explanation and assessment of these efforts is in order. Hilbert et al. (2005) study how the characteristics of the state impact the implementation of the policies to promote the knowledge society yet their analysis places little emphasis on the business side. Several case studies document the emergence of software clusters in Latin America but these are mostly geared at describing the history of each region or “cluster” instead of looking more

systematically into the political economy that shapes them (Casalet et al. 2008, Hualde 2007, Ruiz-Duran 2004). So there is room for increasing our understanding of two broad issues: what accounts for the different levels of success in the efforts for industrial upgrading of democratic developing countries and under what conditions is the outcome of industrial upgrading policies rent-seeking rather than an actual increase in growth, employment or innovation.

This paper will address the following specific questions: What are the different types of industrial upgrading policies to spur the software sector in democratic developing countries? How can we explain such variation? Who are the actors, interests and coalitions that shape industrial upgrading policy processes? Available explanations are useful but insufficient to understand the processes underlying industrial upgrading policy. They either put too much emphasis on the state side (developmental state and public choice/special interest politics) or examine inter-firm relations with scant reference to government (varieties of capitalism). Additionally, most of the works are at the national level and assume subnational trajectories follow the same path. Overall, we need a more strategic view of the process of industrial upgrading policy underscoring state-business interactions and the variety of paths and outcomes in the context of fragile democracies.

This project seeks to contribute to the debate by shedding some light on the prospects of achieving industrial upgrading and start thinking on ways to make this possible. I argue that business-government relations are crucial in the industrial upgrading policy processes. These processes can be characterized along two main dimensions: the level of collaboration between state and business actors and the degree of formalization of the sectoral programs. The combination of these variables generates four broad types of sectoral policies: disarticulated, state-led, firm-led and articulated. Countries and regions can move along these types of industrial upgrading policies overtime. My hypothesis is that the types of industrial upgrading policy processes are shaped by the level of executive leadership and the level of business organization.

The rest of the paper is organized as follows: Section 1 introduces the analytic framework, Section 2 presents a subnational paired comparison of two Mexican cases: Puebla and Nuevo León from 2003-2015 that serve as plausibility check. Finally, Section 3 contains some preliminary conclusions as well as a future research agenda.

## **1. Analytic Framework: Industrial Upgrading Policy Processes in Democratic Emerging Countries**

A first step in analyzing industrial upgrading policy processes is to conceptualize them in order to have a clear understanding of what they are. In this section I define industrial upgrading policy and unpack the actors and stages of the processes underlying it. Then I present a typology with the varieties of industrial upgrading policy processes and lay out an explanatory framework from which four hypotheses are derived.

### **1.1. Industrial Upgrading Policy Processes**

A broad definition of industrial policy consists of “policies affecting infant industry support of various kinds, but also trade policies, science and technology policies, public procurement policies affecting foreign direct investment, intellectual property rights and the allocation of financial resources. Industrial policies, in this broad sense come together with

processes of ‘institutional engineering; shaping the very nature of economic actors, the market mechanisms and rules under which they operate, and the boundaries between what is governed by market interactions, and what is not’ (Cimoli et al. 2009: 1-2). Chang (2002) defines industrial policy as interventions which seek to alter the production vector of goods and services through the creation of new activities.

My definition of industrial upgrading strategies is that these are policies whose objective is the creation or consolidation of *new high-tech sectors* in which knowledge plays a critical role, for instance software, biotechnology and aerospace. Traditionally, the main tools used by governments have been trade protection and promotion of direct investments (state or foreign) financed by national development banks. But in recent years new strategies have emerged such as fostering clusters, stimulating innovation and coordinating collective action (O’Riain 2004; Peres 2009). Thus we have to include these new tools in our assessments.<sup>1</sup> Finally, in the recent era, industrial upgrading policies are layered. That is they are created and implemented at multiple levels: national, regional and even local.

An alternative yet complementary definition is that industrial upgrading strategies are those policies used to *stimulate firms in existing sectors to increase their levels of innovation through the adoption or development of new technologies*; for instance sugar producers moving into ethanol production.

### *Actors*

Another relevant clarification is that industrial upgrading policies are a process with several stages in which different actors are involved and interact. So when analyzing these processes we must have in mind that not all actors have a role in each of the stages, their power may vary and their exchanges will shape the programs adopted as well as the ultimate outcomes.

Industrial policy is often beyond the general public debate and involves interactions between the state and societal actors, mainly business, and sometimes universities and labor. Regarding the state side, in democratic countries there are multiple actors involved especially from the executive and legislative branches. The executive branch of the state encompasses not only the president (or governor) and other bureaucratic agencies. It is there where technocrats also have a place. The legislative branch is made up by elected legislators as well as the committees in which they are organized. Business can be characterized by the number of firms in the sector, the levels of market concentration and the ownership origin: domestic vs foreign. Relatedly there are business associations and chambers which can be encompassing or sectoral. It is the interaction of state and business, which creates different industrial upgrading policy processes.

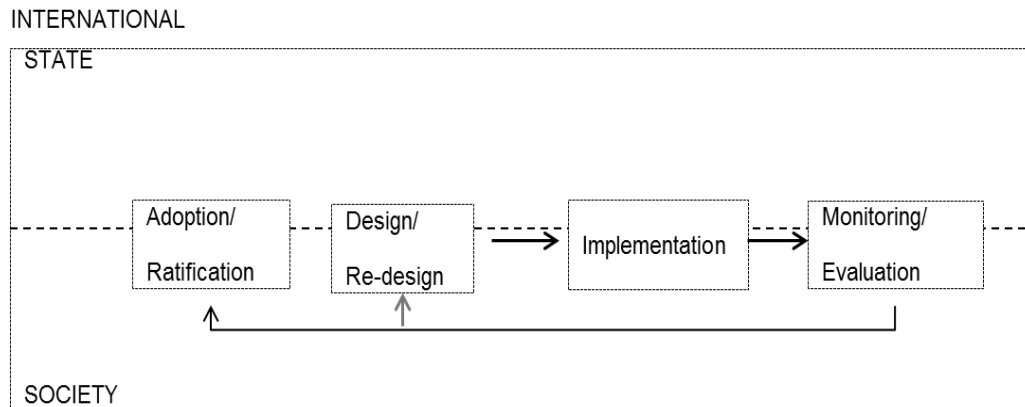
### *Stages*

The stages of the policy process are well known in the public policy literature, but political scientists often put them all in the same box. Separating them into adoption, design, implementation and evaluation allows for a clearer understanding of the roles the main actors play and the influence they may have (see Figure 1).

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<sup>1</sup> Another distinction considers the specificity of the tool used. Horizontal policies are those directed at overcoming market failures (i.e. education, R&D spending). Vertical policies target a specific sector through incentives (tax subsidies, credits) and/or protection measures (tariffs, quotas).

**Figure 1. The Stages of Industrial Upgrading Policy Processes**

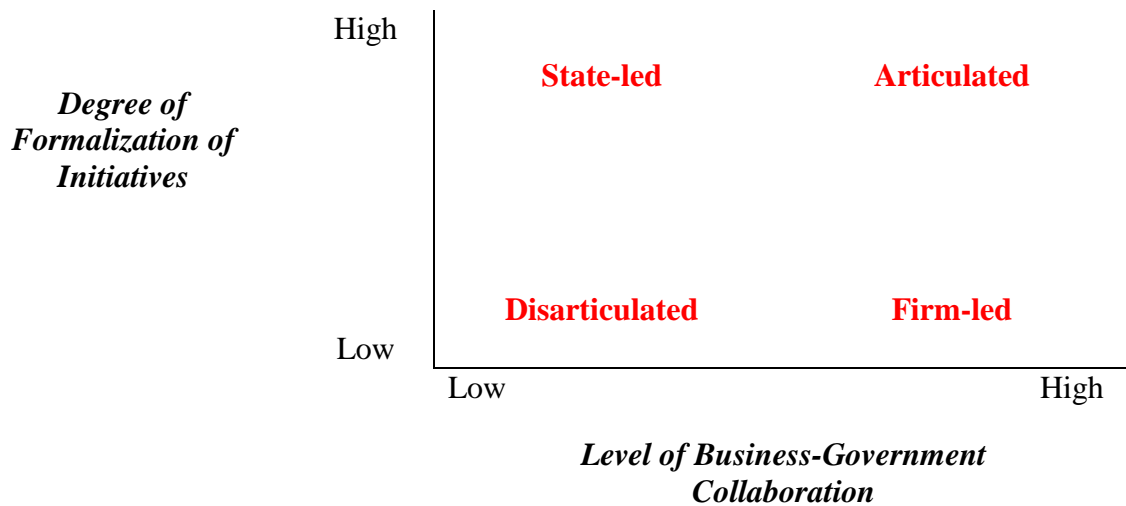


This definition of industrial upgrading policy processes whereby multiple actors participate in the adoption, design, and implementation of programs to stimulate high technology industries, lends accuracy to the guiding questions of the present study: What are the different types of industrial upgrading policies to stimulate the software sector in democratic developing countries? What accounts for such variation? Who are the actors, interests and coalitions that shape industrial upgrading policy processes?

**1.2. Types of Industrial Upgrading Policy Processes**

Not all industrial policy processes are the same. They can be situated along two dimensions: the level of collaboration between state and business, and the degree of formalization of the policies. Thus there are four broad types of processes: disarticulated, state-led, business-led and articulated (see Figure 2).

**Figure 2. Types of Industrial Upgrading Policy Processes**



The *level of business-government collaboration* refers to the degree to which the state and business exchange information and share the responsibility of generating, adjusting and implementing industrial upgrading policies. It varies from low levels to high levels of collaboration. When collaboration is low the state can take steps to foster the sector but without considering business' voice. Thus the policies might be out of target. Furthermore, with low levels of collaboration each actor may act to solve the challenges faced such as: scarcity of skilled workforce, low availability of venture capital, low technological infrastructure, generating a multiplicity of efforts that may overlap and neglect some areas. In short, firms and government actors do not create joint comprehensive projects.

This level of business-government collaboration goes beyond the "embedded autonomy" model though it is related to it (Evans 1995). In the "embedded autonomy" model there are varying degrees of collaboration between government and business, but the ideal state is assumed to have a meritocratic bureaucracy and the ideal business is one that subjects itself to state incentives usually large conglomerates. Such combination is a prerequisite for a successful industrialization. Meanwhile, here, the state is not always meritocratic and the business sector has its own channels of influencing policy making (Pierson and Hacker 2002). From American Politics literature we know that business can lobby congressmen and committees or try to shape elections through campaign contributions (Persson and Tabellini 2000). And from the European analyses on corporatism and neo-corporatism we know how industry associations have a crucial role in government decisions (Schmitter 1974, Culpepper 2001, Martin and Swank 2012). Another way firms can shape the process is using the revolving door mechanism by which business leaders hold high-level government positions. Often top executives in big conglomerates have direct access to the president and congressmen. Lastly in Latin America big groups are owned by families; these families often have a few relatives who participate in politics (Schneider 2014). All these channels can be used to generate collaboration which is positive (growth/development generating) or negative (rent-seeking). What perhaps makes a difference takes us to the second key variable: the degree of formalization.

The *degree of formalization* refers to the extent to which the industrial upgrading program after a brief incubation period is capable of generating autonomous organizations which survive changes of administration, specifically the transition from one leader to another and from one ruling party to another. These organizations should also be able to monitor the allocation of resources in the implementation phase. Considering that in a democratic context policies are vulnerable to the political business cycle this is of particular importance.

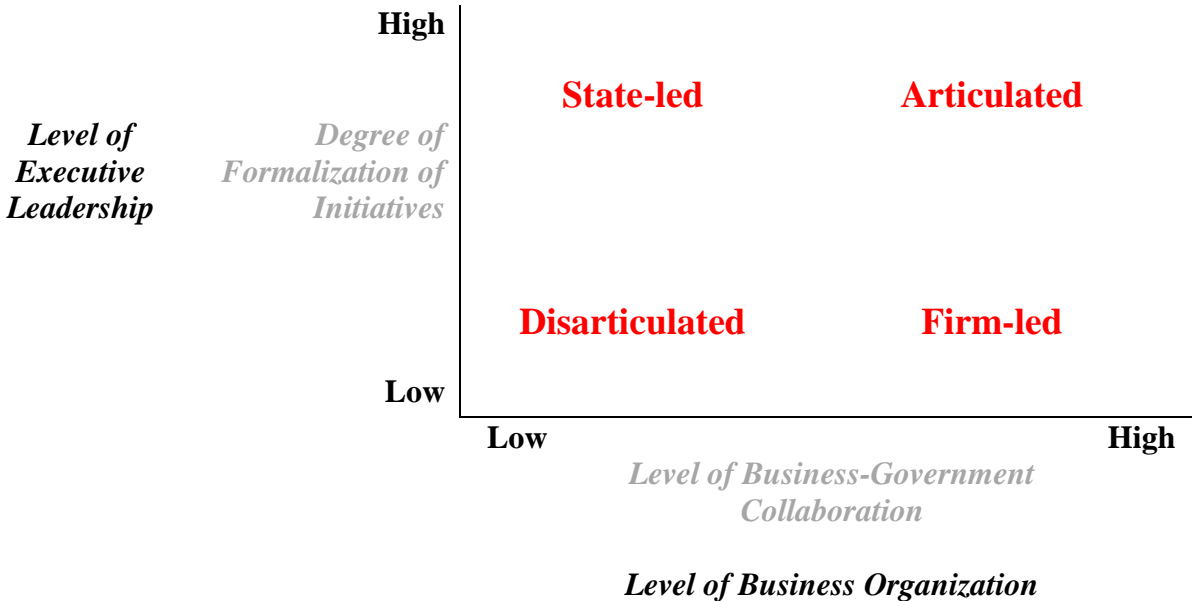
When there is a low degree of formalization, the actors collaborate because they may be under a charismatic leadership or know very well each other but this collaboration is fragile. If there is a change in the government leadership or the opposition party arrives, they may lack the same amounts of trust and the projects may cease working. Whereas when there is a high level of formalization, the policy will probably hold. Policies with low level of business- government collaboration may be resilient if within each sector there are institutions that ensure the continuation of programs conducted in isolation by government or firms. For example, if there is a training program designed by a business association that is already well established, and a technology park has been built by the government. The limitation of disarticulated policies is that these policies do not maximize the use of resources available either from the state or from the business sector (i.e. knowledge, capital, etc).

While the assessment of the outcomes of industrial upgrading processes (success or failure of the policies) is beyond the scope of this paper, ultimately we could expect that those countries or regions that manage to generate more collaboration and a more formalized set of policies are likely to have lower rent-seeking levels and higher levels of success in their efforts because they will be better positioned for generating informational inputs and innovation projects which are the key elements knowledge-intensive sectors

**1.3. Explaining the Types of Industrial Policy Processes**

Building on the developmental state works I contend that some state characteristics help explain the types of industrial policy processes: especially the executive leadership. Still, there are also some business traits that need to be considered mainly the levels of business organization (Culpepper 2001; Hacker & Pierson 2002; Persson and Tabellini 2000; Schneider and Maxfield 1997).

**Figure 3. Explaining the Types of Industrial Upgrading Policy Processes**



*Level of Executive Leadership*

The leadership of the executive power (president/governor) is important in the process, especially in the adoption and design stages, because actors with different interests will try to gather resources for their own camp. If there is a person that encourages the dialogue then higher levels of cooperation will occur and eventually translate into articulated actions where the program is not captured by a few actors. Prior developmental state literature demonstrated that a key element in successful cases was the presence of a leader capable of generating consensus across the actors and sustaining the project for several years (Wade 1990, Evans 1995, Breznitz 2007). Works from the political institutions literature posit that fewer veto players facilitate policy choices, so a caveat we can add is that the executive power will be able to exert its leadership if it has support from the congress (through holding a majority of the seats or alliances).

### *Level of Business Organization*

The innovation economy requires the active engagement of firms in collaborative networks. The dominant view of close business-government cooperation is that of collective action and special interest politics that derive into rent-seeking (Olson 1965, 2000, Buchanan 1980, Bates 1982, Grossman and Helpman 1995, Krueger 1990). Still other authors have shown how close cooperation between state and firms through corporatist arrangements or embedded autonomy can also generate positive outcomes when it comes to industrial upgrading and innovation (Amsden 2001, Culpepper 2000, Evans 1995, Johnson 1982, Ornston 2012, Wade 1990). The clusters literature also demonstrates that agglomeration and close interfirm cooperation are fundamental but these works do not delve into the state's role (Krugman 1990, Castells and Hall 1994, Saxennian 1996).

I posit that prior level of business organization shapes the interactions between firms and the state. When business has already organized into associations the articulated or firm-led policies will be more likely because firms will be able to work as a sector. This means that they will have a certain level of trust and will share information about their specific needs. In sectors like software where big business exist amidst a large number of small and medium enterprises (SMEs), business organizations may become a bridge between them. A high level of business organization will also promote the formalization of policies in order to try to overcome the problems that arise from a change in leadership in the governmental structures. If this variable was not relevant we would observe the emergence and consolidation of initiatives in spite of the lack of sectoral organization.

### *Hypotheses*

Four hypotheses emerge from this explanatory framework:

- H1: Low levels of executive leadership and low levels of business collaboration will generate a disarticulated industrial upgrading policy process.
- H2: Low levels of executive leadership and high levels of business collaboration will generate a business-led industrial upgrading policy process
- H3: High levels of executive leadership and low levels of business collaboration will produce a state-led industrial upgrading policy process
- H4: High levels of executive leadership and high levels of business collaboration will create an articulated industrial upgrading policy process

The following section contains a preliminary test of these hypotheses as well as a plausibility check for the analytic framework as a whole.



## 2. Empirical Test: The Software Sector in Two Mexican States

To ground the analytic framework into an empirical dimension and test the hypotheses derived from it I will examine those processes seeking to consolidate the Information Technology sector. Still, the IT industry encompasses two main branches with very different dynamics: hardware and software.<sup>2</sup> For now, I will only attempt to explain the policies geared to stimulate the development of the software sector. As noted in the introduction, the sector is strategic because software can be used across a wide variety of industries to improve productivity and could generate much needed employment for the youth. Latin American countries have created programs to support their software sectors so it is relevant to see what variations their policies have and how those variations affect the outcomes.

### 2.1. Methods and Case Selection

I undertake an in-depth subnational comparison of two cases in Mexico. Mexico is a country where efforts to support the software sector have emerged in the context of increasing democracy and during the network society era: at the national level there is PROSOFT and at the subnational level 23 out of 32 states have announced policies to stimulate the software sector since 2003.<sup>3</sup> The two cases I consider are Nuevo León and Puebla. This is a most similar design (method of difference) with variation in the dependent variable: both states started with similar amounts of informational inputs like skilled workforce and researchers (see Table 1).

**Table 1. Innovation Potential of Selected Cases: Nuevo León and Puebla**

		Nuevo León	Puebla	National Total
<b>Sources of innovative technological information</b>	Number of Universities (2002)	145	343	7,688
	Number of Universities offering IT Programs (2002)	13	45	531
	Students in Computer and Systems Programs (2001)	9,267	9,098	177,110
	National Researcher System (SNI) researchers (2004)	303	455	10,904
	Research Centers (2004)	10	6	213
<b>Other characteristics</b>	Land (sq km)	64,220	34,290	1,964
	Population (million inhabitants) (1999)	4	5	97
	GDP (US billion) (2000)	64		581

Source: Elaborated by the author. Data from Foro Consultivo (2009), Gobierno de Nuevo León (2004) and Ruiz (2008)

<sup>2</sup> Hardware entails manufacturing of goods, whereas Software is a services-based sector.

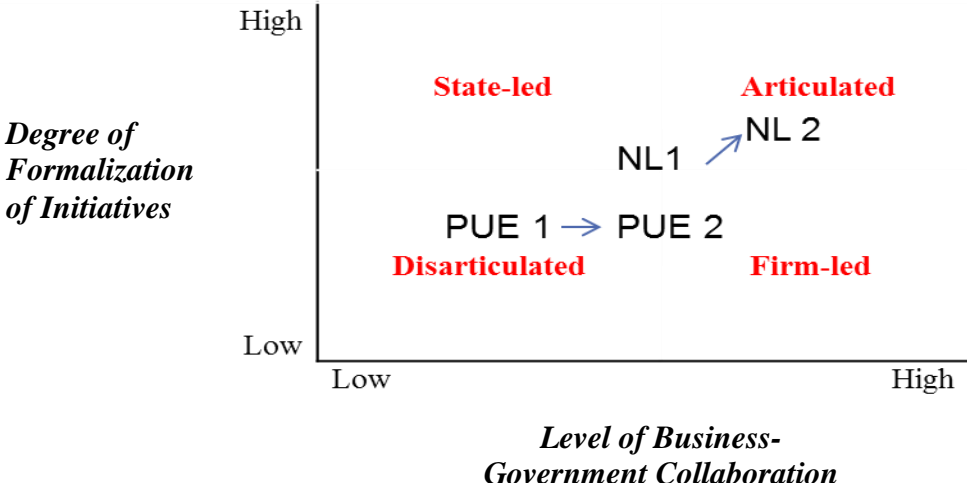
<sup>3</sup> Software has been one of the fastest growing sectors in Mexico with an average growth rate of 14% from 2006-2010. From 2002-2012 employment in the sector passed from 168,000 to 201,000 employees; and exports grew from US\$ 1.750 billion to US\$ 4.940 billion (Secretaría de Economía 2013). While the sector's contribution to the national economy is still small (< 1% of the GDP), its evolution is a positive signal of what developing countries can accomplish in their quest for industrial upgrading. Since 2002 PROSOFT funds projects that may be proposed by firms, business associations, universities or regional governments.

In both Nuevo León and Puebla, the regional government set up policies to stimulate the sector in the early 2000. However they developed different processes: Nuevo León moved from an initially disarticulated/state-led to an articulated industrial upgrading policy process whereas in Puebla transitioned from a disarticulated towards firm-led industrial upgrading policy process. By 2008, Nuevo León cluster ranked 2<sup>nd</sup> and Puebla 15<sup>th</sup> out of 23 in a competitiveness assessment (Secretaría de Economía 2008)..

I subdivide the cases into two periods to illustrate the four varieties of industrial upgrading processes (see Figure 4). Doing so also reveals the dynamic component of the analytic framework. I use process-tracing to examine how the leadership of the governor and the level of business organization produced the different types of industrial upgrading policies. The information for the case studies comes from 14 semi-structured interviews with key actors conducted in Monterrey and Puebla as pre-dissertation fieldwork during the 2012 and 2014 summers. Secondary sources like newspapers, official reports and websites provided additional information.<sup>4</sup>

While this is a limited test of the theory, it may validate the importance of business-government interactions. The next step requires adding case studies or conducting quantitative tests either at the subnational level or with a cross-country set of developing countries

**Figure 4. Illustrating the Types of Industrial Upgrading Processes**



**2.2. Measurement and Data**

The *level of executive leadership* is a qualitative variable that is measured in three ways. First whether the governor made public interventions to foster the industrial upgrading policy to support the software sector. I also assess if the program was placed into the official development plan; and if he met with business leaders or took part of the committees created. I also consider to what political party did the governor belongs and how changes of governor have impacted the software policies. A governor from the PAN (a party that historically has been associated to the business sector) will probably be more likely to support them. If the leadership of the executive power is not relevant then we would observe that even when the

4 A full list of interviewees and references for the case studies is available from the author upon request.

executive does not push for cooperation or has a minority in the congress, industrial upgrading efforts can emerge and be sustained.

The *level of business organization* can be captured by the existence and number of sectoral associations and business chambers that were in place at the start of the policy. And not only whether they existed or not but also the number of members they had. The effect of a large number of associations is unclear because on the one hand having zero organizations can represent a challenge in generating coordination with firms especially in the software sector which is usually made up of big companies coexisting with numerous medium and small size firms. Yet multiple associations can hurdle cooperation as well. So a critical issue will be how well these organizations coordinate. For this I will search for signs of coordination such as the creation of committees, existence of collaboration agreements and joint projects. The membership levels in this organization are also important because we can expect that higher numbers of members will lead to a more cooperative stance which will lead to higher levels of collaboration.

Endogeneity is a threat to validity of this study because industrial upgrading policy processes may shape the levels of business association but by using process tracing<sup>5</sup> it is possible to distinguish the sequence in which the relationship between the two main independent variables and the dependent variable appeared.

Table 2 presents a summary of the case studies. Overall, the results are in line with the hypotheses derived from the analytic framework. The study of the period from 2010-2015 also reveals how trajectories can take different paths as the degree of business organization increases (Puebla). In the case of Nuevo León I find that even if the executive leadership has decreased, the fact that the C-Soft evolved into an autonomous organization buttressed the articulated model.

**Table 2. Summary of Case Studies**

	<b>Cases</b>	<b>NUEVO LEÓN 1</b> <i>2003-2009</i>	<b>NUEVO LEÓN 2</b> <i>2010-2015</i>	<b>PUEBLA 1</b> <i>2003-2009</i>	<b>PUEBLA 2</b> <i>2010-2015</i>
<b>Independent Variable</b>	<b>Level of executive leadership</b>	High	Medium	Low	Low
	<b>Level of business organization</b>	Medium-High	High	Low	Medium
<b>Dependent Variable</b>	<b>Type of industrial policy process</b>	State-Led /Articulated	Articulated	Disarticulated	Business-led

<sup>5</sup> Falletti (2006) identifies this type of process tracing as “theory-guided process-tracing” (TGPT) method. She notes that according to Aminzade (1993: 108), the researcher has to provide “theoretically explicit narratives that carefully trace and compare the sequences of events constituting the process” of interest... By comparing sequences, we can determine whether there are typical sequences across [cases] ... and can explore the causes and consequences of different sequence patterns.”

## 2.3. Nuevo León

Nuevo León (NL) experienced competitive elections and an alternation of power from authoritarian-era centrist-PRI to conservative business-led PAN in 1997 when Fernando Canales-Clariond won the gubernatorial race. But the PRI managed to recover power in 2003 with the election of Natividad Gonzalez-Paras. In terms of the region's Software industry, its origins date to the late-1980s and 1990s when local small and medium enterprises emerged to cater the needs of a growing market for IT solutions during. Some big-conglomerates like CEMEX, VITRO and ALFA created their own IT areas to facilitate the adoption of vanguard technologies for their manufacturing operations. The region also saw the birth of Softtek in 1982, one of the few international Mexican software companies that by 2005 had successfully expanded to Latin America.

### 2.3.1. NL 1 (2003-2009): From a State-Led to an Articulated Policy Process

#### *Level of Executive Leadership*

The leadership of the Governor Gonzalez-Paras was critical for the adoption and design of an industrial upgrading policy in the Software sector. During his term (2003-2010), Gonzalez-Paras launched the project of Monterrey City of Knowledge (MCK) through a decree that created a public decentralized organization with citizen participation in 2003. The main objective of this organization was to plan, design and manage strategic programs for Nuevo León. Since its origins the organization invited members of three sectors: public, private and academia to work jointly following the idea of the triple helix. After some meetings throughout 2003 the group identified five strategic sectors: Nanotechnology, Biotechnology, Mechatronics, Information Technologies and Communications, and Health.

Among the specific projects started in the context of the MCK was the creation of a mixed fund for scientific research and development of about US 6 million (70 million pesos) (Garcia 2004); a Research and Technology Innovation Park (PIIT) to link universities, firms and research centers in 2005; and the creation of "clusters" through the regional Ministry of Economic Development (SEDEC) (CLAD 2007). The original project did not envision a specific program to support the software industry but some business leaders approached the governor to request support and he proposed to set up an advisory council integrated by representatives of the business, government and academia that would devise specific actions to strengthen this industry.<sup>6</sup>

The Advisory Council for the Development of the Software Industry of Nuevo León (Consejo Consultivo Ciudadano para el Desarrollo de la Industria de Software) was housed in the SEDEC in September 2004. The council had 28 members representing the regional and federal governments, business and local universities. The three sectoral associations AETI, CANIETI and ANADIC were also incorporated and Blanca Trevino, Softtek CEO was appointed as the coordinator (Sanchez 2004).

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<sup>6</sup> Two local businessmen had approached the SEDEC during the Fernando Canales (1997-2003) administration to request support for the sector, inspired by the Indian and Irish cases. They had some talks regarding the possibilities of collaboration but these were unfruitful. In 2004 "Three elements coincided: the project of Monterrey International City of Knowledge, the idea of creating civic councils that Gonzalez-Parás was promoting and our own request for support for sectoral development" (Safa 2012).

In 2005 the members of the Advisory Council proposed the governor to become an executive council (the C-Soft). So rather than just giving suggestions, they would have their own staff and achieve tasks to fulfill such recommendations. The governor liked the idea and requested Antonio Zarate (then director of the MCK) to host the initiative. The council would have its own staff but the government would facilitate them an office, a secretary and for every peso that they spent, the regional government would spend another (Safa 2012). To gather funds, the C-Soft set a contribution fee to belong to the advisory board. Since then, the C-Soft was embraced as an important element of the MCK. Its three priorities would be: human capital formation, innovation and financing for firms.

A government initiated project, then had its own life and organization (CSOFT). Many other more informal linkages and exchanges emerged as a result. Universities and firms have devised training programs; and a group of firms pulled resources for a building and conducting joint projects through the MTY-IT Cluster (Lago 2012). So there will probably be no turning back.

### *Levels of Business Organization*

The software sector in Nuevo León comprised 323 firms in the early 2000 (INEGI 2004). The state had three main industry associations: ANADIC, CANIETI-Noreste and AETI. ANADIC-Monterrey (Asociación Nacional de Distribuidores de Computación) was created in 1998 and by 2004 had 55 members but it mostly incorporated retailers of computer equipment and packaged software. CANIETI-Noreste (National Chamber of the Electronics and Information Technology<sup>7</sup>) opened its office in Nuevo León in December 2002. By 2006 it had 70 members of which 40 were in the IT sector. Sixteen local software entrepreneurs founded AETI (Asociación de Empresarios de Tecnologías de Información) in 2003. By 2006 it affiliated 60 firms. Firms usually belonged to more than one association.

In fact one of the main challenges for the increased coordination required by industrial upgrading policies was the general apathy of entrepreneurs. In 2005 Oscar Balderas then director of CANIETI-Noreste asserted that “it has been difficult to convince businessmen to become members of a chamber or association to gain strength and raise our voices... there is a lack of collaborative culture amongst them.” Thus leadership from the government and the business sector was needed to articulate the industrial upgrading policy. But these organizations were also important because through networking events and meetings they managed to coordinate the efforts of many firms.

Knowing about the plans to create the Technology Park for Innovation and Technology transfer (PIIT), a group of businessmen through AETI and ANADIC requested a space there (Safa 2012). According to Lago (2012), the original PIIT project did not consider software companies in it. But sectoral representatives (including himself) approached the governor and showed their interest in joining the park. The government agreed to grant them land in the park with two main conditions: firms would need to register as a cluster and assume the financial costs of constructing the building. Thus the “Monterrey IT Cluster” was formed with 25 members of AETI and 15 members from ANADIC, who accepted to share the construction costs (MCIC 2007). The federal PROSOFT program funded the IT infrastructure required by the new facility.

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<sup>7</sup> CANIETI was created by the PRI government in 1957 as the authorized consultative organization for the radio sector. In 1995 it incorporated the electronics sector and in 1997 and IT firms. But for several decades its offices were centralized in Mexico City.

Pre-existing associations, AETI, CANIETI and ANADIC also became a bridge between the C-Soft and small and medium enterprises. Because shortly after the C-Soft was created, the government started to neglect firms that were not members of the “cluster” (Gonzalez 2012). But the organizations have secured a seat in the C –Soft and through their contribution, SMEs registered in CANIETI can obtain the benefits such as access to training programs and events organized by the C-Soft.

In fact, these two organizations (AETI and CANIETI) underwent a consolidation process. In 2008 AETI signed an agreement to merge with CANIETI and AETI president was designated as the vice-presidency of the Information Technologies branch inside CANIETI. The former members of AETI automatically became members of CANIETI. According to Gonzalez (2012) the negotiation process took long but it succeeded. They set up a common agenda and dynamics. “The fusion increased the business sector leverage vis-à-vis the government.” (Gonzalez 2012). CANIETI has strived to channel the benefits of the C-soft to their members which are mostly small and medium sized (Gonzalez 2012)<sup>8</sup>. Initially, SMES were confused about the roles that CANIETI and the C-Soft had and whether they should belong to one or the other, but CANIETI insisted that they were part of the C-soft and the objective was to consolidate the industry not to struggle for them.

### **2.3.2. NL 2 (2010-2015): Articulated Policy Process**

#### *Level of Executive Leadership*

In 2009 there were gubernatorial elections in Nuevo León.<sup>9</sup> Voters favored continuity and the PRI candidate, Rodrigo Medina, who had been endorsed by Gonzalez Paras won 49% of the total amount of votes. Meanwhile the PAN candidate Fernando Elizondo won 43.4% (CEE 2009). Medina appointed Othón Ruiz, former director of the largest Mexican owned bank in Mexico Banorte) as head of SEDEC. The new administration faced a learning curve of understanding of the strategic sectors (including software). But after that phase they had his backing for the C-Soft (Safa 2012).

In this phase the executive leadership has decreased as Rodrigo Medina has not actively participated in the C-Soft activities. His support has been rather indirect, through the provision of funding and making sure that the SEDEC grants support for PROSOFT projects.

#### *Level of Business Organization*

When Gonzalez-Paras left, the C-Soft lost some of its funding so it developed activities such as seminars and training in which it charged. The C-Soft organizes big industry events and has developed important collaborative projects for training with local universities and firms. CANIETI has focused on a more personalized contact with SMEs. This organization designated a person of their staff to offer advice on the application process to PROSOFT funds which is the federal initiative to support software firms and projects and CONACYT funds. The chamber also follows closely governmental plans to ensure that the Information Technology sector is kept as a priority. If there are plans to reduce funding they lobby, especially at SEDEC and

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<sup>8</sup> A small firm owner considered that they are not well represented in the C-soft, even if they have a seat through CANIETI, the government only cares about the big firms. But more research would be needed to confirm if this view is widespread. As a result, his participation in sectoral activities has decreased (Guzman 2012).

<sup>9</sup> The election was surrounded by corruption accusations against Gonzalez-Paras administration and denounces of incumbent’s use of vote-buying strategies.

CONACYT. Another important role is to create a database with the characteristics of the firms in the sector and encourage monthly networking events. They also generated a survey of wages to offer firms a benchmark and prevent a spiral of competition of workers. Some of its members have created “empresas integradoras” a figure where a few companies join together to increase their capacity or complement each other while serving a large client. An example is Origo (Guzman 2012).

Perhaps the real test will come in 2016 because the PRI lost the gubernatorial elections in 2015 to an independent candidate. However given the level of institutionalization of the industrial upgrading policy through the C-soft, it is most likely that the organization will continue to exist. The main challenge will be to preserve the funding from government.

## **2.4. Puebla**

Puebla was also governed by the PRI in the early period when industrial upgrading policies to stimulate the software sector were announced.<sup>10</sup> In 2004 Mario Marin was elected with 49% of the support followed by the PAN candidate that gathered 36% of the total votes. He replaced Melquiades Morales also from the PRI and he kept with the industrial upgrading initiatives started by his antecessor.

The origins of the software sector in Puebla also go back to more than two decades ago when firms emerged to cater the manufacturing and services sectors of the Puebla economy. Regarding domestically owned companies, the majority is small and medium. In 2004 there were approximately 191 firms in the sector. One of the oldest and most important companies for the evolution of the sector is the multinational company T-Systems that arrived in Puebla to provide IT services to Volkswagen. Eventually the company developed other customers throughout Mexico and Latin America (Zuñiga 2014).

### **2.4.1. Puebla 1 (2003-2009): Disarticulated Policy Process**

#### *Level of Executive Leadership*

During Mario Marin mandate specific programs to support the industry remained in operation (FISEP)<sup>11</sup> and others like the Center for Innovation and Information Technologies (CITI) were launched. Additionally during his administration there were resources from the regional government to support PROSOFT.

Nevertheless, there was no clear leadership from the governor. He did not assume a major role by sending a message of collaboration nor there was a more integral plan to buttress

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<sup>10</sup> Despite the fact that elections were relatively close, Puebla had not yet experienced alternation.

<sup>11</sup> In 2002 the Puebla government announced the Program to Stimulate the Software Industry (Programa Fomento a la Industria del Software) FISEP. Hosted in the Ministry of Education FISEP's main objective was to train technicians that met market's needs.<sup>11</sup> According to Juarez (2002), Microsoft donated MXN \$2.5 million (around US\$250,000) for software and they were having talks with other companies like Motorola and Gedas to train students in public technology colleges. The plan also included the construction of industrial parks and creation of micro companies with a seed fund of MXN 50,000 (around US\$5,000). Throughout Marin administration the FISEP continued to offer scholarships for IT training programs but did not evolve into a more comprehensive policy. Some businessmen, like the former president of CANACINTRA IT have never heard about it. So apparently it was a very limited effort.

the innovation capacities in Puebla. Furthermore, it is possible that the several scandals in which the governor was involved prevented him from becoming a source of articulation.<sup>12</sup>

In 2006 the Puebla government in partnership with Microsoft, CompuEducacion and the Council for the Development of Industry, Trade and Services announced the creation of the CITI. The center would be the first to focus on developing software for mobile technologies and provide training, certification and IT consulting to firms, students and government (Carballido 2006). But there is no information on how it has evolved since then or who directed it. Apparently the main activity has been training (Reyes 2008).

Another strategy deployed by Puebla's government was to co-finance the PROSOFT federal initiative by contributing with 25% of the resources needed for the projects presented by firms from Puebla. In 2007 the president of Canacindra-Puebla, Charles Mtanous asked the government to keep its funding towards IT sector. And Gerardo Fernandez, from the regional Ministry of Economic Development (SECOTRADE) promised the state government would pour \$20 million pesos (Aroche 2007). Still the lack of executive leadership impacted the levels of formalization of these industrial upgrading policies

#### *Level of Business Organization*

Unlike Nuevo León, where three sectoral associations coexisted, in Puebla the only association was ANADIC-Puebla but it represented the interests of computer equipment distributors. A few software firms tried to organize a branch called ANADIC-Soft but it was a very limited group (10 firms) and it was very informal. Nowadays such division no longer exists (Zuñiga 2014). CANIETI did not have a regional office in Puebla and firms from the region wanting to participate in the chamber activities had to go to Mexico City.

Eventually firms in the sector organized inside CANACINTRA-Puebla which is an encompassing association (members from a wide variety of economic activities). They created a branch called CANACINTRA-TI in the early 2000s to coordinate their efforts especially in training and later towards the creation of a cluster. In 2008 CANACINTRA-TI had about 53 members and 13 of them created a "cluster" (Reyes 2008). By 2012 CANACINTRA-TI had about 45 (Mejia 2014). Its tasks are mainly to organize monthly meetings and business trips, lobby the government and generate an IT services yearbook.

The weak levels of organization of the IT sector in Puebla reinforced the disarticulation and hindered the formalization of industrial upgrading policies. After a period of close coordination with the government to attract PROSOFT federal resources from 2004-2011 the support ended and the relationship deteriorated.

#### **2.4.2. Puebla 2 (2010-2015): Firm-led Policy Process**

##### *Level of Executive Leadership*

Puebla experienced an alternation of power in 2011. Rafael Moreno (PAN) was elected governor in the 2010 elections with 50% of the votes followed by the PRI candidate who amassed 40%. In theory a PAN-governor would have more affinity with the business sector. Instead during his mandate the already low levels of formalization of industrial upgrading policies have dwindled and so have the possibilities of moving into an articulated relationship

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<sup>12</sup> During his mandate Marin was accused of facilitating a child-trafficking network. The Supreme Court of Justice investigated him for using its power to arrest the journalist that uncovered the network but the tribunal dismissed the charges. This scandal damaged his image and probably his leadership.



between state and business. IT business leaders claim that the governor has never received them. Others said there is “moral” support but no resources because in prior administrations firms did not adequately use public funds.

Official documents of the SECOTRADE show the existence of an IT strategy on paper. The main objective is to “generate strategic alliances to create high value added projects through strengthening the economic infrastructure comprising the following pillars: human capital, funding, research and development, intellectual property rights, technology infrastructure and commercialization” (SECOTRADE 2011). Among the strategies are: maintaining a public-private agenda to foster entrepreneurship in the IT sector; promoting associational projects of innovation and signing agreements for research and development with universities”.

However interviews revealed that the actions have not been executed. There are no newspaper declarations or meetings where the governor backs up the program. A bureaucrat from SECOTRADE acknowledged that the state has not complemented the PROSOFT federal initiative because even if IT is strategic, in Puebla it has been very problematic, “very politicized” (Herrera 2014). Furthermore there is a lack of trust: “We believe that entrepreneurs are not seeking to grow their business and development, but instead they are only seeking to secure funds for their own benefits. There has been some support for firms through a CONACYT program called Stimulus for Innovation” (Herrera 2014). In general the strategy adopted by government has been to stimulate the industry through universities, with so called “technology parks” but these are actually incubators that do not help existing firms.

#### *Level of Business Organization*

Within sectoral organizations, firms have attempted to institutionalize their cooperation through “clusters”<sup>13</sup>. Through it they generate a governance structure to jointly develop projects. Some of these so called “clusters” include universities. There was a cluster *TI in Canacintra* led by Raul Mitchel that had recognition from the federal Ministry of Economy in 2005, but it did not mature because it had few members with low trust levels (Zuñiga 2014, Mejia 2014).

In 2010 another attempt was undertaken inside CANACINTRA-TI yet it also failed. Then *Puebla en TI* was created by Daniel Santin and few other companies. Finally in 2007 CANACINTRA-TI sector partnered into *Puebla-TIC* led by Javier Zuñiga. *Puebla-TIC* is recognized as official by the National Software Clusters Association and is now eligible for PROSOFT federal funds.

Businessmen acknowledge that they have not managed to increase collaboration levels through sectoral associations: “In Puebla we need associations like CANIETI that can really help to develop the sector” (Mejia 2014).

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<sup>13</sup> Theoretically clusters are geographically defined production systems, characterized by a large number of SME firms involved at various phases in the production of a homogeneous product family. These firms are highly specialized in a few phases of the production process, and integrated through a complex network of inter-organizational relationships. But here it means a group of companies in the same sector that formalize their relationships through a legal organization.

### 3. Preliminary Conclusions and Next Steps

This paper addressed the processes underlying industrial upgrading policies, which are public efforts to stimulate the emergence or consolidation of high-technology sectors, in developing countries. Despite being a critical issue it has remained on the margins of scholarly work in the comparative political economy field.

To answer these three inter-related questions—What are the different types of industrial upgrading policies to stimulate the software sector in democratic developing countries? And how can we explain such variation? Who are the actors, interests and coalitions that shape industrial upgrading policies?—I built an analytical framework that underscores business-government interactions as a key explanatory component. The model also reveals the strategic and dynamic elements present in the attempts to move up in the development ladder. It bridges but also goes beyond existing bodies of literature.

The plausibility check presented in the empirical section supports the importance of business-government collaboration. Specifically, the leadership of the executive and the level of business organization appear to shape the emergence of a variety of types of industrial upgrading policy processes. Yet additional research is required to advance the theory as well as its testing. I will mention a few future steps I plan to undertake.

To further test and refine the analytical framework, I would like to add casual-process observations or conduct a quantitative study of the adoption/design stage either at the subnational level or at the national level using cross-country data. I plan to consider how political variables related to the leadership of the executive, such as the effects of party ideology, the number of veto players and the lobbying activities deployed by firms, shape the industrial upgrading policy processes. Another research avenue would be to explore how market structure and firm characteristics (origin of capital and size) affect the collaboration with government. Finally, though the interviews I conducted suggested that universities are also central players, it is not so clear whether they are followers of business-government decisions or if they pursue their own agenda.

Another equally important task will be to assess the outcomes of the varieties of industrial upgrading policy processes. For this, more work needs to be done in the conceptualization and measurement of variables that capture the results of implemented programs such as development and rent-seeking. It remains to be tested whether developing countries, including Latin American ones, can overcome structural limitations, the lack of meritocratic bureaucracies, and the actor's short-term objectives (like winning elections and raising profits) through state-business collaboration that stimulates the transition towards a knowledge-intensive economy and society.

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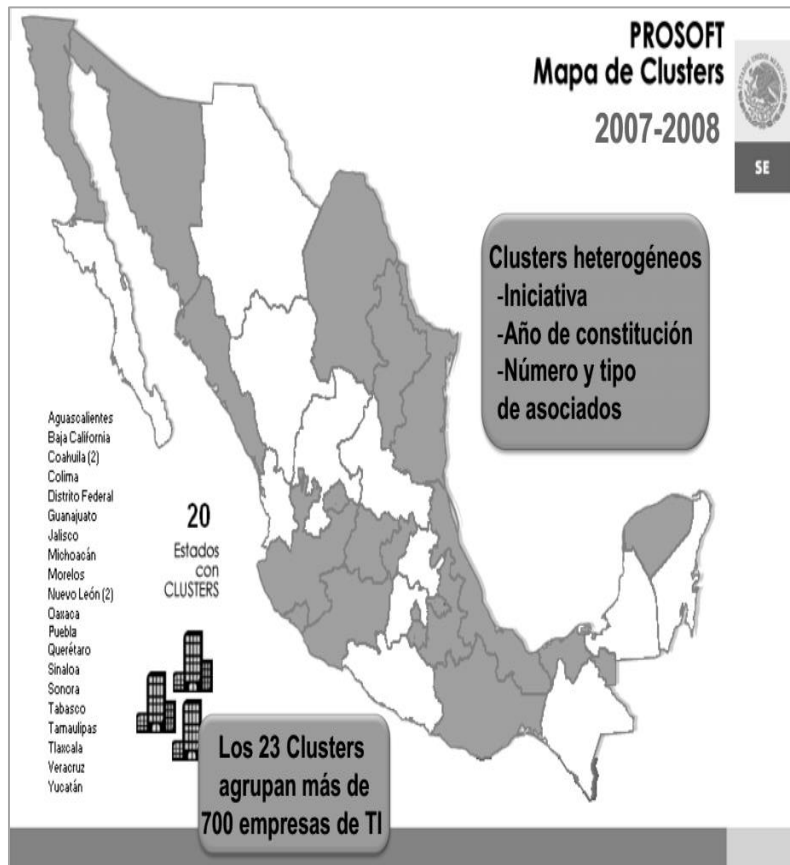
## Appendix

Map 1. Latin American Cities with IT Programs



Source: Ciravegna, L. (2012). Promoting Silicon Valleys in Latin America.

Map 2. Mexican Software Clusters



Source: Secretaría de Economía. (2008).