

Electronics Cluster in Guadalajara, Mexico

Analysis of an Unusual Cluster in a Developing Economy

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COUNTRY ANALYSIS - MEXICO

Mexico's GDP is the second largest in Latin America, and it is one of the most prosperous countries in the region measured by GDP per capita. However, Mexico has lagged behind the region in terms of GDP per capita growth (please refer to Exhibit 1 for details) with an unimpressive average growth of 4.8% from 2003 to 2007. Moreover, the slowdown of the US economy sparked by the recent sub-prime mortgage crisis will likely stunt Mexico's growth, now forecasted at 1.9% for 2008 and -2% for 2009.

In terms of macroeconomic performance, Mexico has achieved an "investment grade" macroeconomic environment. In the last ten years, it has maintained a balanced budget and single digit inflation. Notwithstanding these positive developments, Mexico's government has been unable to curb the increasing levels of insecurity and corruption within the country (Exhibit 3).

As shown in Exhibit 6, Mexico is Latin America's top destination for (foreign direct investment) FDI. It attracted around US\$19.04 billion in 2007, ahead of Brazil (US\$ 18.78 billion) and Chile (US\$ 7.950 billion) (Factbook, 2007). Mexico's multiple free trade agreements have allowed it to capture foreign investment by export-oriented firms who want to take advantage of Mexico's lower cost of production and labor. While it is generally accepted that NAFTA has encouraged huge inflows of FDI into the country, the trade agreement has not evenly benefitted local economic growth and cluster development.

The emergence of China's manufacturing industry has pushed Mexico to a distant second place in terms of total exports to the US. As shown on Exhibit 2, Mexico's top 15 clusters have mostly declined as share of world exports from 2002 to 2007. Now, as the second largest business partner of the US and facing increased competition in the international markets, Mexico's structural reforms become imperative to remain competitive.

At a micro level, Mexico has made substantial progress on some fronts, but still lags when it comes to providing a good environment for business. While the number of days required to start a business

dropped from 58 to 27 days, widespread red-tape and corruption remain huge obstacles. More recently, the high levels of crime and violence have also imposed considerable costs on doing business.

COUNTRY DIAMOND

We based our analysis of Mexico's country diamond on the Global Competitive Index (GCI) 2008. The main competitive advantages highlighted by the GCI are largely related to Mexico's geographic location and openness to commerce, while the primary weaknesses are poor innovation infrastructure and scant competition among corporations (Please refer to Exhibit 4 for details on country diamond).

Factor (Input) Conditions

Mexico has a privileged geographic location that gives it access to the biggest market in the world, the US. After the signing of NAFTA, Mexico saw its commercial ties with the US increase dramatically: today, almost 85% of Mexican exports go to the US and 64% of Mexico's total FDI comes from the US (Secretaría de Economía de México and US Department of Commerce, 2007). NAFTA also prompted a major overhaul of Mexico's ground transportation infrastructure. Mexico has one of the most developed road networks in Latin America (built to facilitate trade with the US), but paradoxically, its trade with other countries is limited by poor port infrastructure and problematic customs bureaucracy.

Mexico faces great challenges in education and knowledge production. Mexican universities carry out the majority of R&D activity in Mexico, but the country lags in terms of knowledge production at an international level. Its technology and engineering programs receive little government or private sector support, and its knowledge production (measured in terms of patents produced) is below average for industrialized nations and for some Latin American countries (Casalet, M. 2000, Global Competitiveness Report 2008).

Context for Firm Strategy and Rivalry

After the lifting of most restrictions on foreign ownership in 1998, foreign investors have acquired many firms within the country. Many important sectors such as the banking industry are now composed

predominantly of foreign firms. This trend is coupled with effective investor protection systems, which greatly encourages FDI.

Mexico's taxation system distorts competition and the incentives it creates are poor, according to the GCI. Also, an overregulated labor market offers a powerful incentive for informality (Mexican Social Security Institute 2006). The informal market also reduces the tax base, compromising the stability of public finances.

Mexico holds relatively high non-tariff barriers in key sectors such as telecommunications and electricity, which shelter these sectors from competition and reduce the cost-competitiveness of Mexican firms that use inputs affected by these barriers.

Demand Conditions

Because of the macroeconomic stability in Mexico, a robust middle class has been created in the last decade. This has boosted levels of consumption in urban centers such as Mexico City, Guadalajara and Monterrey. However, the score on buyer sophistication on the overall population (69th place on the GCI Ranking 2008) is disappointing. Moreover, the government has done an unsatisfactory job of promoting the adoption of latest technologies, particularly in telecommunications sector.

Related and Supporting Industries

Fifteen years after signing NAFTA, Mexico has developed a strong network of specialized suppliers. This was fueled initially by policies directed to incentivize the proliferation of maquiladoras. While initially small and unsophisticated, the suppliers of maquiladoras gradually evolved into world-class industrial suppliers. In the process, high-technology process machinery spread across the industrial sectors of Mexico.

COUNTRY-LEVEL RECOMMENDATIONS

Improve Regulatory Framework for Businesses

Although Mexico's entrance into GATT in 1986 and NAFTA in 1994 certainly prompted improvements in the country's internal regulatory framework for businesses, there is still much room for progress. In that regard, we have the following recommendations:

To promote competition, Mexico must end market dominance of monopolies such as Telmex and reduce restrictions on foreign ownership in critical industries like airlines, insurance, telecom and coastal shipping. Many other industries require government approval to exceed 49% foreign ownership such as airports, distribution of petroleum, ports, and cellular communications. Furthermore, Mexico must privatize some of its state-owned enterprises, particularly in sectors such as petroleum, petrochemicals, electricity and many transportation hubs.

Improve Security and Curb Corruption

Mexico has recently been hit hard by a rise in crime and violence, and government measures designed to slow this trend have been largely ineffective thus far. As a way to face the current security problems, Mexico must improve coordination of local police forces. Concretely, different police forces at the state and municipal levels need to coordinate actions and share information regarding organized crime. In addition, it must increase the effectiveness of the Agencia Federal de Inteligencia, by increasing funding on intelligence and accelerate the disbursement of US funds for organized crime-related security issues. Coupled with this, Mexico requires an Anti-corruption task force that focuses on building a program to detect and punish corruption within the public sector.

Encourage Innovation

Mexico's rate of innovation, as proxied by its patent counts, seems to be lagging behind its North American partners and several Latin American countries. Since part of this problem is fueled by the bad performance of the education system, Mexico must provide continued training for teachers, by gradually enrolling teachers in skill upgrading programs. Moreover, the curriculum must be enhanced and benchmarked to international best practices. To ensure that the educational system is meeting the labor market's requirements, the Secretaria de Educacion Publica (SEP) should work with industry task forces to

ensure the course materials are current. In addition, The Sep can build programs to fund scientific chairs/researchers to teach in Mexico and provide scholarships for students to train abroad with stipulations on employment in Mexico afterwards.

Mexico's education institutions have done a poor job to encourage new ventures. We suggest that they co-invest with venture capitalists to fund new ventures. In concordance with this, Mexico's government can jumpstart this program by providing leading public universities such as UNAM and UAM enough capital to incubate new technologies.

JALISCO

Performance

Jalisco's GDP had a modest growth rate of 2.2% in the last decade, with a recent decrease due to the global economic slowdown. Despite this growth and a fourth place of total output among 32 Mexican states, Jalisco is ranked in 14th place in terms of GDP per capita (6,237 USD) (Indicadores Jalisco 2009, Numeralia por delegación 2009). Commerce, restaurants and hotels have a share of 25% of GDP. Services rank second with 21% and manufacturing is third with 19.7%. However, manufacturing has received more than 85% of FDI in the last decade, making Jalisco the fifth recipient of FDI nationally, while commerce has received just 7% and agriculture hasn't received FDI in the last four years (SEIJAL 2009).

Endowments

Situated on the West coast of Mexico, Jalisco is the fourth largest state out of 32 by population and sixth largest by area. It has access to the Pacific Ocean, and is bordered by six states. It has the largest lake in the country as well as the third largest arable surface (SEIJAL, 2009). Jalisco has had a population growth of 1.8% in the last decade and 26% of its population is considered economically active (Enciclopedia de los

municipios de México, 2009). The education average is 8.2 years. Although historically Jalisco had been primarily an agricultural and services state with rich natural resources it is now home of the electronics cluster in its capital city Guadalajara.

Macroeconomic Competitiveness

Jalisco's education public expenditure is 3.8% of the state's GDP. With 8.24 years of formal education per inhabitant, it ranks 8th place among all the states. In the Program for International Student Assessment (PISA) standardized test, Jalisco was ranked in seventh place in 2008. The state ranks 13th in the Human Development Index with a score of 0.82 and fifth in the Margination index with a score of 0.77 (Indicadores Jalisco, 2009).

Jalisco is governed by the National Action Party with a majority of the same party in the local congress. The state government is ranked 27th in the transparency index and 22nd in the corruption index (Transparencia Mexicana).

STATE BUSINESS ENVIRONMENT – DIAMOND

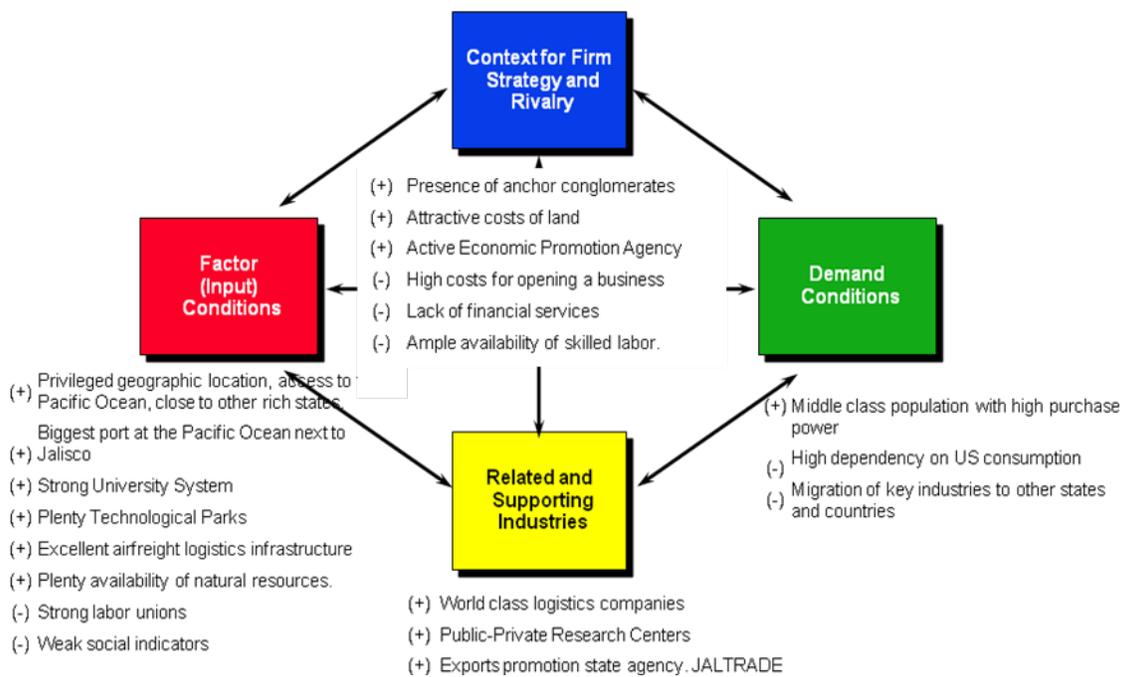
Factor Conditions

Guadalajara is a three hour drive from Manzanillo port, Mexico's biggest port on the Pacific Ocean. Good road and rail infrastructure connect the port to the Jalisco's capital city, and this city in turn is connected by a high-speed highway to Monterrey and to the border town of Laredo. Guadalajara also has the second largest airport in the country, which is conveniently located in the middle of the various technological parks and has the most open positions dedicated to specialized cargo (SEIJAL, 2009). Several airfreight companies specialized in the electronics industry are located nearby the technological parks and airport.

With 15 universities that have a close relationship with the manufacturing industry, Jalisco ranks as the third state with most students enrolled in higher education and ranks first in the number of work

training schools with a 10% share of the national total (SEIJAL, 2009). However, as it was mentioned earlier, weak social indicators contrast with the good quality of middle and higher education. The bad score in the Human Development Index gives a picture of how difficult it has been to incorporate the lower income population to the productive sector.

Regarding labor relations, in 2008 Jalisco was ranked fifth in number of labor strikes and sixth in terms of unionized employees (SEIJAL, 2009). The strong presence of unions affects the general business environment and diminishes the attractiveness of Jalisco to FDI.



Context for Firm Strategy and Rivalry

Jalisco has done a very good job in creating a context that promotes the development of its key industries. The state Economic Promotion Agency works together with the private sector to make sure that the state attracts new companies from different manufacturing sectors. The strategy of having key anchor conglomerates, like IBM and HP as OEMs, and Flextronics, Jabil and San Mina SCI as contract

manufacturers has helped the state to attract more electronics companies. The low cost of land with good access to infrastructure in the metropolitan area, has created an adequate place for firms to compete.

Unfortunately, because Jalisco ranks 25th in terms of difficulty to open a new business and 29th in terms of financial services per capita, it is an expensive place to start a business (SEIJAL, 2009). The decline of industries like agriculture and the shift of low cost manufacturing companies to cheaper locations have left Jalisco with an ample availability of skilled labor that has to be retrained to meet new labor demands.

Demand Conditions

The state's ample middle class with high purchasing power in terms of GDP per capita creates a fertile environment for different industries like services, tourism and apparel (Indicadores Jalisco, 2009). In recent years and particularly with the current economic slowdown, the state's export-driven economy, 86% of which goes to the US, has struggled to sell its output. This slowdown has affected Jalisco because key industries like textiles and basic electronics manufacturers have migrated to cheaper states or cheaper Asian countries.

Related and Supporting Industries

The quality and quantity of logistics companies in the state is high. FedEx's national specialized cargo hub is located in Guadalajara and more than 50 custom agents serve the different industries inside the airport (FedEx). As Jaime Reyes, former HP Guadalajara director mentioned, "Guadalajara is now prepared to ship low volume, high weight, and customized electronics due to its good infrastructure" (Jaime Reyes). The public-private exports promotion agency, JALTRADE, has helped Jalisco to attract and develop electronics supporting industries in the state.

In terms of research an innovation infrastructure, the state is home to CINVESTAV, the research center of Instituto Politécnico Nacional. It has also two dedicated electronics research centers, the Systems

Research Center and the Communications Research Center, which were created with a public-private partnership investment. These three centers support the electronics industry in Jalisco as well as other industries like software and electronics design.

STATE-LEVEL RECOMMENDATIONS

Jalisco lagging social indicators

Although Jalisco has a low unemployment rate relative to the country (3% vs. 3.8%), its human development index and marginalization index are significantly lagging as we can see in the Exhibit 7.

The Jalisco Social Development Agency should provide low-income populations with specific technical training programs tailored to Jalisco industries (manufacturing, tequila, electronics, etc.). Since low-income populations rarely finish high-school, these technical degrees would allow them to partake in the workforce with a significantly upgraded skill set. It is important to note that the training programs should be designed to fit the companies located in those areas where people are marginalized.

Limited financial services offering

In 2007 Jalisco ranked as the 29th state in financial services, with only 2.7% of national output. Jalisco authorities should work with banks to have them extend their portfolio of banking services. Bank branches should seek more decision-making power at the local level so they can approve major projects without consulting headquarters.

Decreasing share of manufacturing FDI

Manufacturing companies have left Jalisco and thus there are fewer jobs available for low-skilled populations. As is shown in Exhibit 8, Jalisco has merely a 5.5% share of the national FDI which, is below its potential in terms of population and GDP. Jalisco authorities should offer non-fiscal incentives to new and existing manufacturing companies to attract them to the region. As we mention further on in the cluster section of this paper, the improvements in customs services, education and infrastructure, among others, should help Jalisco attract more investment.

THE GLOBAL ELECTRONICS INDUSTRY

As shown in Exhibit 9, the electronics industry has been largely dominated by Singapore, USA and Japan. Nevertheless, the industry has become more modular, giving the opportunity to Singapore and China to take the lead in terms of growth and market share. Modularity has lowered the entry barriers for new firms and has opened up new opportunities for parts of the world previously on the periphery of the global electronics industry. However, American-led firms in product-level electronics retain control of product definition and design, continue to lead the higher value-added segments of the industry, and control much of its innovative trajectory (Uchitelle, 2008). Hence, production of standardized, high-volume, price sensitive products like PCs, cellphones, and consumer electronics has mostly already moved out of the U.S. and Japan to countries like China, Malaysia and Mexico.

Mexico's Competitiveness in the Global Electronics Industry

Despite hundreds of maquiladora plant closures in the last two years—500 out of 3700 plants according to New York Times estimates—the electronics companies in Mexico have largely chosen to upgrade their product offering and stay (Forero, 2008). While the migration towards cheaper locations in Asia is certainly tempting, Mexico's unique competitive advantages make it an important hub for electronics production and development, particularly when North America is the final destination. These advantages have been mentioned before: myriad free trade treaties; strong intellectual property protection (courtesy of NAFTA); easy logistics for North-bound products; flexibility and ability to do just-in-time deliveries due to geographic proximity; relatively cheap labor; and shared time zone with the US West Coast, where most research centers and technology companies are located (i.e. Silicon Valley). These characteristics make Mexico particularly well-suited for a specific segment of the electronics industry.

Within Mexico itself there are four key electronics clusters, one of which is in the state of Jalisco. The cluster in Jalisco is primarily based out of the city of Guadalajara, and is often referred to as the “Mexican Silicon Valley” (Hisamatsu, 2005). This particular cluster focuses on high technology industries

and information technology, while other clusters in Mexico focus on household electronics and telecommunications. Jalisco's advantages vis-à-vis Mexico's other clusters are primarily its trained and specialized human capital, high quality universities, well-functioning IFCs, long history with the electronics cluster, comparatively lower employee turnover rates, well-developed logistics companies and superb connectivity to ports and highways, among others.¹

THE GUADALAJARA ELECTRONICS CLUSTER

History

The aforementioned competitive advantages of Jalisco did not come about by chance, and a few of its distinct moments are worth highlighting:

Government policy was largely credited with sparking the electronics clusters in Mexico. Through the 1965 Maquiladora Program, the government encouraged US investments across the Mexican territory. One-hundred percent foreign-owned companies could import duty-free foreign merchandise on a temporary basis, assemble, manufacture or repair it, and then export it. In the expectation of this policy, in 1962 Siemens established a plant outside Guadalajara to produce electric motors and switches. As the margins of US electronics companies became squeezed by Asia, more companies began to move south of the border. Subsidiaries of Motorola and Burroughs established operations in Guadalajara in the late 1960s, and in the early 1970s, the federal government asked the big electronics companies to “relocate outside

¹ According to an interview with Juan José Palacios (see Bibliography), turnover rates in Guadalajara are around 20% per year, compared to close to 100% per year near US border towns.

México City” (Alva, 2009). Not only did the electronics companies move, but their electromechanical suppliers did too. Guadalajara already had three major foreign companies, and it became a city of choice. General Instrument and IBM relocated in 1974 and 1975, and in the subsequent two decades Hewlett-Packard, Shizuki Eletronics, AT&T and many others poured in.

The next major push the Guadalajara electronics cluster received came with NAFTA in 1994 and with the significant peso depreciation that came with the Tequila Crisis. NAFTA was clearly a game-changing phenomenon: a new legal framework, a significantly increased tariff-free market, and an influx of investment like Mexico had never seen before (Palacios, 2008). This, coupled with a severe peso crisis—the Mexican peso lost almost half its value between 1993 and 1994—favored exporters enormously (Pill, 2002).

The late 1990s were a boom period for Guadalajara. Contract manufacturing firms established operations there, joint ventures with local companies became commonplace, and a few entrepreneurial efforts began to give fruit (Palacios, 2008). The IFCs that are still important today became clearly established. In 1992 Canieti, the National Chamber for the Telecommunications Electronics and Information Technologies Industry, launched its Guadalajara branch to promote the competitive development of the industry in that area. In 1997, Cadelec was formed by the “leading electronics companies in Mexico to foster the development of a robust, well-integrated supply chain connecting Mexico with international suppliers. Founding companies include Jabil Circuit, Hewlett Packard, IBM, Intel, Solectron and SCI-Sanmina among others” (Sanchez Proal, 2006).

In the early 2000s, with the burst of the internet bubble, the electronics cluster in Jalisco was hard hit. Squeezed again by their margins, companies began to move to Asia in search of lower labor costs. Exports, investment and employment declined precipitously, and the pre-2001 business model had to change, adjust and upgrade to fit the new circumstances. Companies that stayed diversified into more added-value sectors and strategic niches with better margins: storage systems, medical devices, and aerospace and defense equipment, among others. Additionally, there was a shift towards products of lower volume, higher mix, and more process complexity. This meant frequent set-ups on the assembly line, a

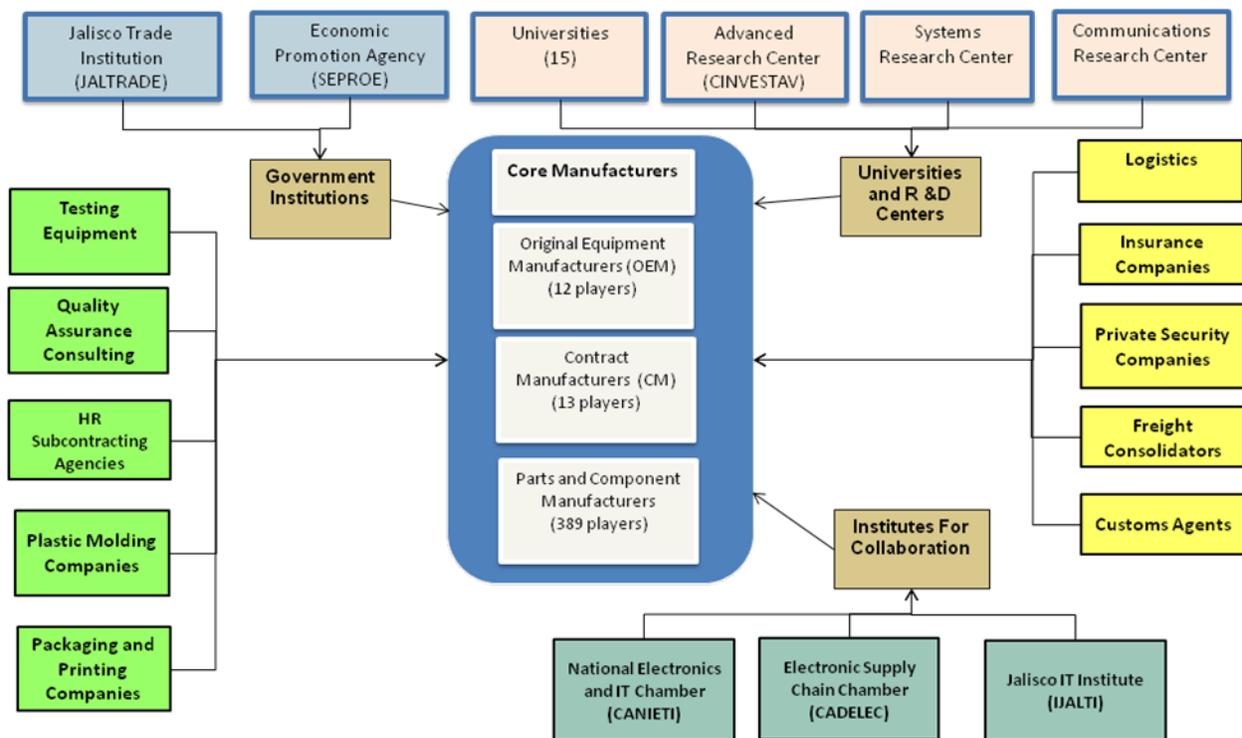
more complex supply chain and better qualified management. Finally, capitalizing on Mexico's strong intellectual property protection and geographical proximity to the US, the cluster focused on attracting projects that would be introducing new technologies or launching new products, and that would require shorter turnaround times, just-in-time deliveries and increased flexibility (Plan de la Industria, 2007). These changes transformed the cluster into that which it is today.

Performance

Today, Guadalajara electronics exports are high and growing. The state of Jalisco exported \$27.1 billion of products, of which \$16.1 billion (59% of exports) were electronics from this cluster. Electronics exports have shown strong growth at a CAGR of 10.0% over the past five years. Employment has also increased rapidly at a CAGR of 10.4% over the past five years and today, the sector employs 78,500 people (Cadelec, 2009). In terms of investment, recovery from the burst of the internet bubble started towards the end of 2004, and more than doubled in 2005 and 2006, reaching a peak of \$375 million. Investment seems to have now leveled off at \$280 million in 2007 and 2008 (Cadelec, 2009).

Trends towards diversification and niche specialization continue, and around the electronics cluster companies in the electronic design, software, and business process outsourcing sectors have begun to proliferate (Plan de la Industria, 2007). The number of small suppliers has grown tenfold since 1994 and the Cadelec has been able to attract some international companies in these areas.

Cluster Map



In terms of cluster composition, Jalisco’s electronics cluster is well developed with many supporting companies along the value chain. There are 12 original equipment manufacturers (OEMs), companies which buy components from contract manufacturers (CMs) but sell the output under their own brand and own the intellectual property (Cadelec, 2009). OEMs focus on product development, R&D, marketing and distribution. These include anchor multinational companies such as IBM, Kodak, HP, Intel and Hitachi as well as strong domestic players such as Pegasus and Resser. There are also 13 key contract manufacturers including world leaders Flextronics and Sanmina-SCI (Cadelec, 2009).

Over 380 specialized suppliers exist in the area including 41 metal stamping and finishing companies, 25 plastics and thermoplastics manufacturers, 17 label and manual printers and 10 cable companies. The cluster is supported by numerous software and information technology companies such as 150 software development businesses, 16 outsourcing companies as well as a handful of software parks and technology incubators. As the cluster evolves to higher value added items, more research and development is being attracted to Guadalajara as evidenced by over 39 new R&D centers (Cadelec, 2009). The core

products manufactured by the electronics cluster can be categorized into seven areas (Plan de la Industria, 2007):

Computers	Docking stations, PCs, printers, servers, super computers and paper handling solutions
Telecommunications	IP phones, cellular phones, telecommunications servers, setup boxes, TV and internet access equipment
Consumer electronics	Cameras, handhelds, jukeboxes
Automotive electronics	ABS systems, air bags, access systems, control boards, entertainment systems, GPS navigation systems, comfort systems, tire pressure monitors
Electronic medical equipment	Telemetry equipment, tomography equipment
IT equipment	Routers and firewalls, storage systems, sliders
Industrial	Measuring and telemetry equipment, control systems, security devices (alarms, sensors)

DIAMOND FOR THE GUADALAJARA ELECTRONICS CLUSTER

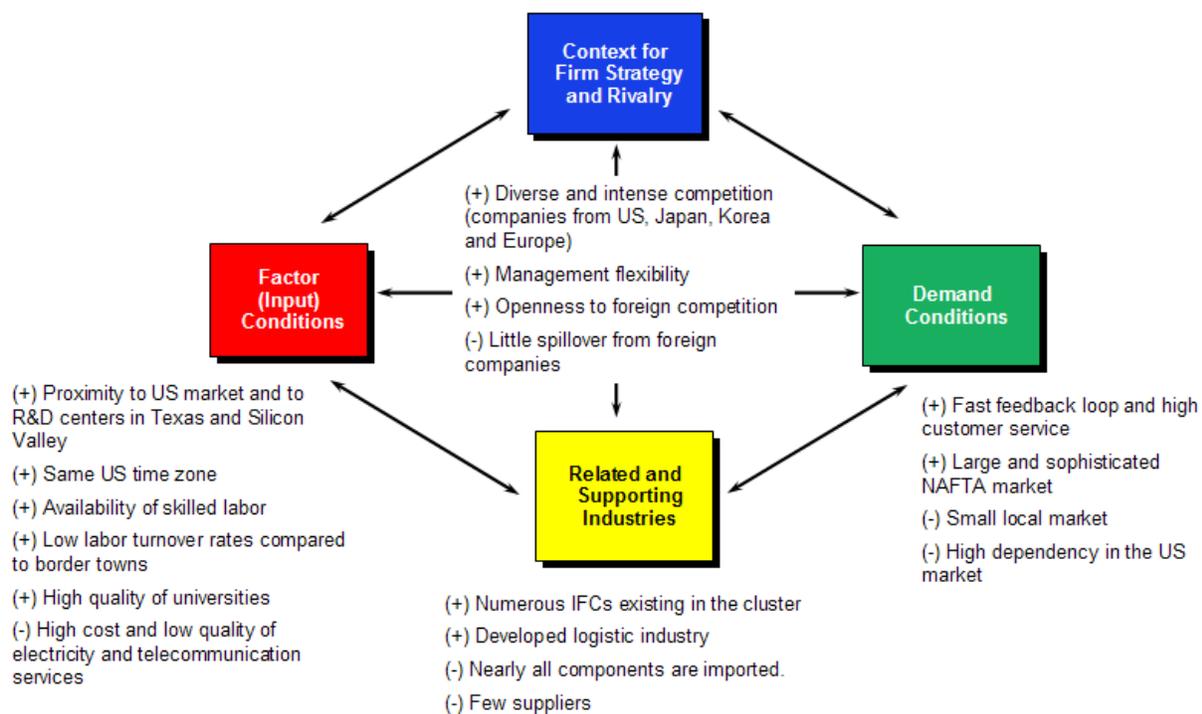
Factor (Input Conditions)

The positive factor conditions of the Jalisco area are well-known: a plethora of universities (specifically Universidad de Guadalajara which is well known in the area of technology), trained and specialized human capital, and good connectivity to ports and highways, among others. In addition, the cluster's geographic proximity and shared time zone with the US means it has a fast feedback loop with its customers.

The negative conditions are less apparent: the electronic cluster has to face challenging issues such as safety, inefficient customs at Manzanillo Port, high cost and low quality of electricity, and insufficient infrastructure. Mexico is now immersed in a tough and maybe long war against drug cartels. Due to declining levels of security, companies must hire security personnel to protect truck shipments from organized crime. In this regard, some measures have been taken by the state of Jalisco together with the private sector to guarantee the privacy of the information about the content of the trucks. Leaking information from transportation and security companies was seen as one of the biggest causes of the

problem. These efforts have proven successful so far in the Jalisco state, although problems remain in the US frontier.

Transportation infrastructure is insufficient because the Guadalajara City area is usually very busy in terms of traffic and particularly the highway that connects the city with the Manzanillo port. Also, customs at Manzanillo port are slow and inefficient, with a long, drawn-out and costly process. Finally electricity problems are still an important challenge for the cluster, which relies in this type of energy for production. The state-owned company provides poor quality service at relatively high cost compared to other countries, which puts the cluster at a disadvantage. Companies thus have to invest in readily available back-up capacity because they don't have a stable supply.



Demand Conditions

Jalisco and Mexico constitute a relatively small local market. Besides the almost 110 million inhabitants, Mexico does not represent a big market, specifically for electronic products. Despite this fact, if we consider the whole free zone as a driver of the demand of the cluster, the market would be now composed of 430 million people and in this case with a very sophisticated consumer base. Sophistication is

very important because it is a driver of innovation and it forces companies to compete and improve. On the negative side of demand conditions, the cluster's dependence on the North American market—70-80% of total cluster exports—means that downturns there will be immediately transmitted here.

Context for Firm Strategy and Rivalry

The Guadalajara electronics cluster has the advantage of being the center of a multicultural set of companies that brings together a broad set of learning experiences to the cluster (90% of the cluster companies are foreign.) There are multiple players across the different cluster levels, which avoids concentration and oligopolistic behavior and promotes competition. Having said that, companies at the end of the product line usually don't compete with each other; they compete in specific electronic niches with other companies in foreign countries.

Managers in the cluster are highly skilled and very flexible. There are a high number of professional managers compared to family owned businesses (which represent a much higher percentage in Mexico), which gives the industry more flexibility to adapt to changes and helps in terms of industry cooperation. Professionals, differently than family managers, have a clearer incentive to increase the cluster prospects and competitiveness.

On the negative side, the cluster has two large challenges; insufficient spillover and lack of entrepreneurship. Companies in the cluster are “foot loose” because they easily pick-up and set up shop elsewhere. If there were more linkages with the Jalisco region, companies would be more reticent to move. One way to increase linkages is by having a very specialized workforce, and that is what CADELEC is trying to do with a team formed by company directors and representatives from the most important universities in the region. They are discussing tailor-made curriculums, and the meetings have been really helpful to discuss the actual and future needs of the industry. While it has been easier for the companies to work with the private universities, it has been challenging to arrange curriculum changes in public universities, which represent 60% of the total students.

The second problem for firm strategy and rivalry is lack of entrepreneurship. Risk-aversion among businessmen is widespread in Mexico and different economic or cultural factors prevent entrepreneurs from starting their own businesses. Corporate employees do not leave their companies for start-ups often enough and one explanation for this could be the lack of venture or angel capital. IFCs and the government have funds designed to give start-ups seed capital, but more time is needed to evaluate the results of this effort. Two incubators have been created inside universities (one in the Universidad de Guadalajara and the other in Tech of Monterrey) and a business accelerator of software incubators with the US. The idea is to launch around 10 to 15 new projects each year.

Related and supporting industries

As we mentioned when discussing the cluster map, there are several industries that support the electronic cluster in Guadalajara. One of the most important support services for the cluster are the universities. The high quality of the education has been a major factor for the development of the cluster in the area and one of the biggest assets for its future success. Another very important asset for the industry are the IFCs that support the industry, being CADELEC and CANIETI the two most important ones.

An additional big plus for the cluster is the existence of a strong and developed logistic industry in the area. Worldwide leaders in logistics installed regional hubs near the Guadalajara airport where numerous cargo airlines operate and even passenger airlines benefited by combining passengers and cargo on the same flights.

Regarding the challenges for related and supporting industries, the most important ones are the existence of few suppliers and insufficient product diversity and complexity. Today, 90% of all inputs are imported. If we consider the assembly of a personal computer, the main components in terms of costs are: the LCD screen, the hard drive and the processor, all of which are imported. If we compare these figures with the maquiladoras in Mexico on average, statistics show that around 96% of the total cost is imported, and the 4% remaining are the labor costs. In the case of the electronic clusters, the 10% left is not only labor but also many other small components and services such as wires, metals, maintaining, finishing services

and packing (Gonzalez, 2009). Although efforts have been made in terms of improving the quantity and quality of suppliers, there is still a lot to be done. To help in this endeavor, the Mexican government has implemented a subsidy for quality certification which provides 50% of the total certification cost for companies and up to 70% in the case of small and medium enterprises. Having said this, the government hasn't provided enough fiscal stimuli to attract international supplier companies. Important companies like Hitachi are still leaving the cluster because of the lack of quality suppliers for essential components of production.²

Another challenge for the cluster is the lack of diversity in terms of products, clients and technologies. This is important because it prepares Jalisco to better weather crisis and more quickly pursue opportunities in new segments. Today, eight companies are responsible for 75% of export volume, and the vast majority of these are in the computer and telecommunication space. Since the 2000 crisis and restructuring, the cluster has been upgrading itself in terms of value added, but more progress needs to be made to guarantee the cluster's sustainability. (Plan de la Industria, p.109).

CLUSTER RECOMMENDATIONS

This section of the project is divided into two parts: first we discuss the future strategic positioning we recommend for the cluster and then we describe the specific actions that should be undertaken to strengthen the cluster and guarantee its continued success.

Strategic positioning

We believe the electronics cluster should foster the growth of the software, Business Process Outsourcing (BPO) and electronic design mini-clusters that have developed around it such that it can transform itself into a "high-tech mega-cluster."³ By leveraging Jalisco's unique advantages and actively

² Hitachi left the Guadalajara cluster in 2007 and laid off 5,000 employees citing supply chain issues as one of the main reasons.

³ The ideas from this "strategic positioning" section draw from a report published by the four Jalisco IFCs called, "Plan de la Industria de Alta Tecnología en Jalisco"

developing niches that require excellence in these four areas, Jalisco can strengthen its value proposition for both existing firms and newcomers.

In order to become a “high-tech” cluster, the IFCs in Jalisco, in collaboration with the local government, must identify anchor companies at the intersection of the electronics, software, electronic design and BPO clusters and encourage them to re-locate. Marketing the capabilities of the region to specific companies worldwide will be a key component to attracting diverse, new business lines. Successful examples to date include medical devices and aerospace equipment. Although Mexico is not the lowest cost location for them, they produce high value-added products that need Mexico’s easy logistics to the US and strong intellectual property protection (González, 2009).

Specific actions

The actions we recommend for the cluster are discussed in two parts: first we describe the cluster’s top four priorities and then we address the actions that specific players need to undertake in order to guarantee both the cluster’s continued viability and its transformation into a high-tech mega-cluster.

Top priorities

There are four issue areas the electronics cluster must quickly address:

- Strengthen the electronics supply chain
- Foster entrepreneurship to increase linkages between the cluster and the region
- Increase the current and future capabilities of the Jalisco workforce
- Encourage research efforts for cluster development and transformation

Supply chain

Several actions must be pursued in parallel in order to attract multinational suppliers and improve the local supply chain. First, national-level policy for electronics manufacturing must be redesigned. On the one hand, fiscal incentives need to be “right-sized” so they can adequately stimulate investments in the supply chain. Today there are incentives for semi-conductor investments greater than \$500m, but the majority of standard-sized plants for components of the electronics supply chain are not eligible because they require smaller investments. On the other hand, R&D incentives for supply chain research must be

opportunities offered. When they were given in 2001, the internet bubble had already burst and the incentives were too late to prevent the decline of the cluster (González, 2009). Although many would argue it is too late now, these need to be given again such that companies can factor their benefits into their medium-term planning horizons.

Second, the region of Jalisco must facilitate access to low interest loans for investments that will help increase the physical and institutional capacity of the electronics supply chain (Palacios, 2009). This will enable existing businesses to upgrade their technological infrastructure and will be a selling point for potential investors. This is important because interest rates in Mexico usually hover around 18-20%, while competing locations offer rates of 4-5% (González, 2009).

Finally, the education sector of Jalisco must offer cutting-edge professional training and certification opportunities to help suppliers meet stringent quality standards and specifications required by OEMs. This is particularly important as industry needs change and Jalisco migrates to new segments in the electronics and high tech cluster.

Entrepreneurship and Spillovers

In order effectively develop local linkages between the cluster and the region, fostering entrepreneurship in Jalisco is of primary importance. Four things must be done in this regard.

First, the Jalisco government in conjunction with local IFCs must create a small business development office with advisors to provide legal assistance, financing guidance, help navigating customs procedures, advice to obtain licenses and other ways of supporting entrepreneurs in the area. Second, they must create a “one-stop shop” where businessmen can expedite all the paperwork necessary to invest and start a business in Jalisco. Third, cluster participants must have patience with the incubator programs and entrepreneurship centers they have started. Results are seldom immediate and the important thing is that if the programs themselves are right, there is continuity of efforts despite initial slow results. Fourth, local IFCs and universities must engage in an extensive marketing campaign to remove the stigma association with start-

up failure. Entrepreneurs usually succeed after several tries and should not be discouraged if their first endeavor performs below expectations.

Competence of the Jalisco workforce

In order to upgrade the skills of the Jalisco workforce, two issues must be tackled. First, academic institutions must respond to the more medium and long-term training needs of the cluster (Plan de la Industria, 2007). This clearly requires more communication and forward planning between businesses and universities. Number of graduates required and hard skills needed often change faster than expected and both parts must have the flexibility to deal with this uncertainty. Second, in public universities frequent management turnover endangers the continuity of tailored electronics curricula because re-approval of programs and methodologies becomes very inefficient. (González, 2009).

Research and development

To foster research and development initiatives in Jalisco, three fronts must be addressed. First, companies and universities must further engage in joint R&D projects. As with medium and long-term curricula, there must be an open conversation about strategic cluster priorities and future needs, in addition to a discussion regarding intellectual property ownership and confidentiality agreements. IFCs could initially facilitate these conversations in the hopes they eventually build their own inertia.

Second, opportunities must be created for firms to engage with universities in technology transfer processes. This can be in the form of internship programs for graduating students or the temporary loan of part-time professors and research staff for short-term projects. IFCs again can take the leading role in this initiative. Finally, universities can and should be at the forefront of cluster development and transformation. To this end, universities must foster research-related efforts by professors and students and aggressively research new technologies and segments in which the cluster can compete. The prospect of a high-tech mega-cluster creates fertile ground for research at the intersection of subclusters and universities and companies alike should take advantage of this.

ACTIONS FOR INDIVIDUAL CLUSTER PARTICIPANTS

The following paragraphs outline the steps we believe individual cluster participants should take to ensure the well-being and future growth of the cluster. Some participants are not mentioned in this section because their responsibilities have been sufficiently described in the preceding sections.

IFCs

In addition to the coordination and promotion roles IFCs Canieti, Cadelec, Ijalti and Coecytal have in the “Top Priorities” section outlined above, they have two additional responsibilities that will undoubtedly influence the success of the high-tech mega-cluster. First, they must devise an efficient knowledge management system across Jalisco to better leverage the expertise and know-how developed in each one of the subclusters (González, 2009). Second, they must create an effective “one voice” that can represent the new high-tech mega-cluster, adequately target and attract potential investors, and coordinate the efforts of new and existing cluster participants (Plan de la Industria, 2007).

Regional government

The state government of Jalisco is responsible for the major infrastructure projects in the region and there are two pressing ones right now: first, the construction of a highway around Guadalajara and second, the construction of a dry port for customs procedures between Manzanillo Port and Guadalajara (Palacios, 2009). The former is important because heavy traffic would circumvent the city, thus allowing for the decongestion of Guadalajara roads and the more efficient transportation of people and merchandise in and around the cluster. This road is a challenge because the land needed for it must be negotiated with each municipality and because its timeframe exceeds that of a governor’s period.

The dry port is important because using the latest information technologies at customs would maximize transparency and minimize opportunities for corruption. In addition, doing customs procedures prior to port would decongest the port and increase its efficiency. Although this is a regional project, it would ultimately be a concession operated by a private company.

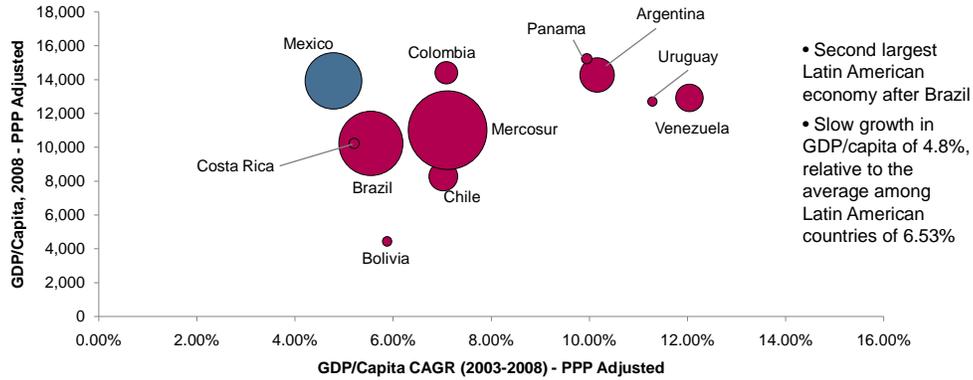
National government

The Mexican Government must address five specific challenges that directly impact the competitiveness of the electronics / high-tech cluster. First, it must endeavor to change the perception (and reality) behind Mexico's recent surge in violence. Second, it must strive to enforce the rule of law quickly and fairly. Third, it must increase the quality and service of its state-run electricity company. Fourth, it must decrease corruption and delays common in its customs procedures. Fifth and final, it must foster the creation of venture capital investments by facilitating bankruptcy proceedings (in writing and in practice) and lifting the current legal restrictions on pension fund investments to increase the liquidity of the stock market.

Exhibit 1

Mexico has a high GDP and strong GDP/capita, however growth in prosperity has trailed other LatAm countries

Prosperity and growth of select Latin American Countries



Source: Euromonitor Intelligence Unit, 2008

2

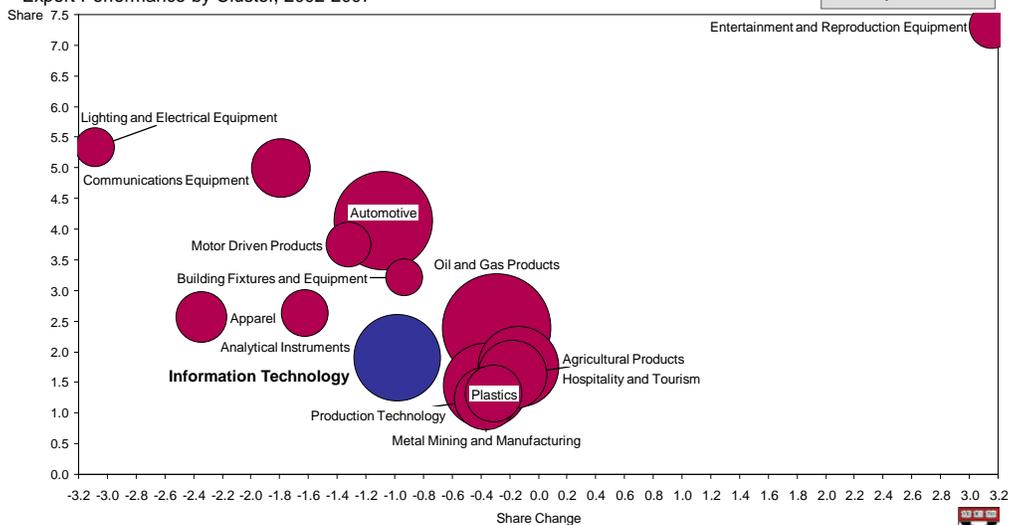


Exhibit 2

Despite an absolute growth in exports, Mexico's top 15 clusters have mostly declined as share of world exports

Mexico's top 15 clusters

Export Performance by Cluster, 2002-2007



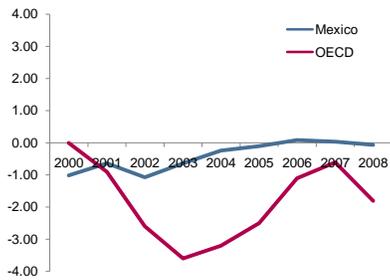
Source: Prof. Michael E. Porter, International Cluster Competitiveness Project, Institute for Strategy and Competitiveness, Harvard Business School; Richard Bryden, Project Director.



Exhibit 3

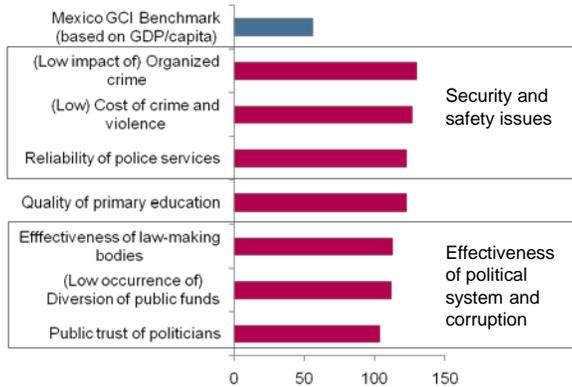
Mexico's government has stable macroeconomic policies, but lags on measures of effectiveness and safety

Budget Balance
% of GDP



- Mexico's government has managed the country's budget well, performing with better stability than the OECD average

Poor performing SIPI metrics for Mexico
Global Competitiveness Ranking of Mexico



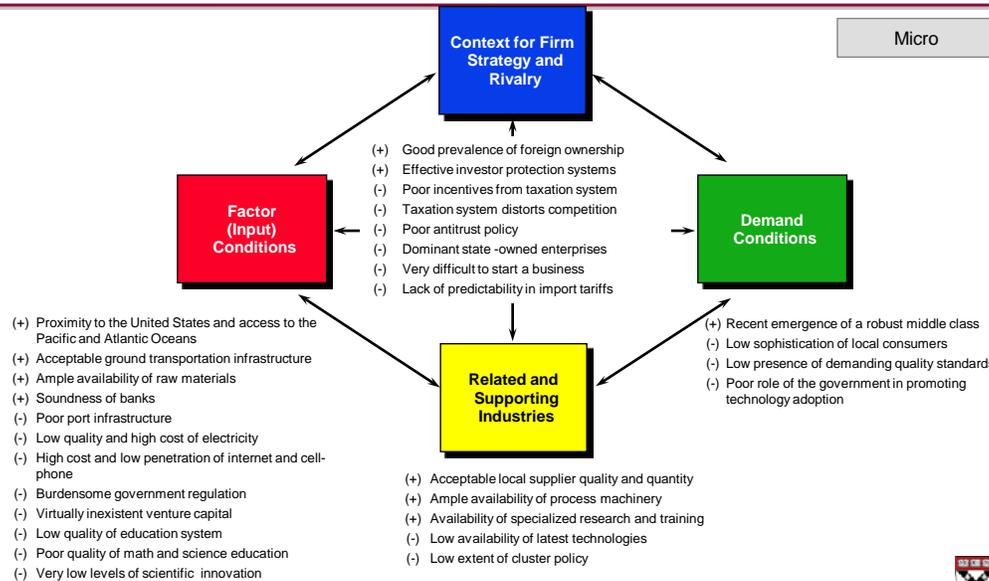
Source: Euromonitor Intelligence Unit, 2008; Global Competitiveness Report 2008

4



Exhibit 4

Mexico is weak on an innovation infrastructure and needs to boost competition among corporations



Source: Global Competitiveness Report 2008

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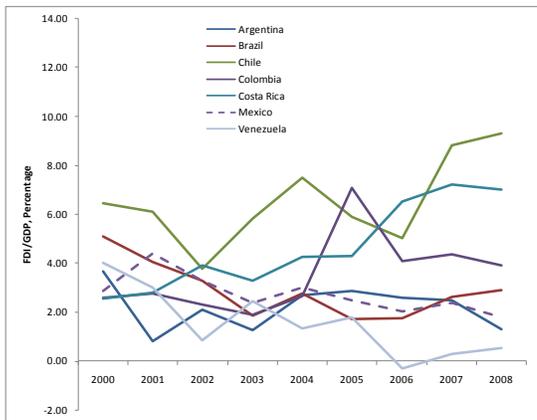


Exhibit 5

Mexico needs to improve the competitive environment, decrease crime and reduce corruption to boost FDI

Recommendations

Foreign Direct Investment / GDP Percentage



Source: Euromonitor Intelligence Unit, 2008; Global Competitiveness Report 2008

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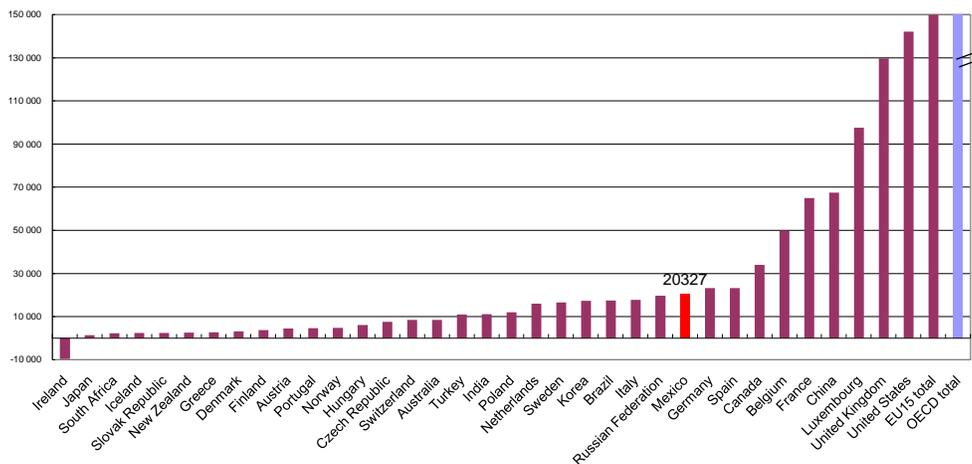


- **Privatize state owned enterprises:** Particularly in sectors such as petroleum, petrochemicals, electricity and many transportation hubs
- **Strengthen anti-trust laws:** End market dominance of monopolies such as Telmex to promote competition
- **Reduce foreign ownership restrictions:** There are strict limits on airlines, insurance, telco and coastal shipping. Many other industries require government approval to exceed 49% such as airports, distribution of petroleum, ports, and cellular communications
- **Improve coordination of local police forces:** Different police forces at the state and municipal levels need to coordinate actions and share information regarding organized crime
- **Increase effectiveness of Agencia Federal de Inteligencia:** Increase funding on intelligence and accelerate the disbursement of US funds for organized crime-related security issues
- **Anti-corruption task force:** Build program to detect and punish corruption within the public sector

Exhibit 6

Mexico is also a big receptor of FDI

Inflows of foreign direct investment
Million US dollars, average 2004-2007



Source: OECD

4



Exhibit 7

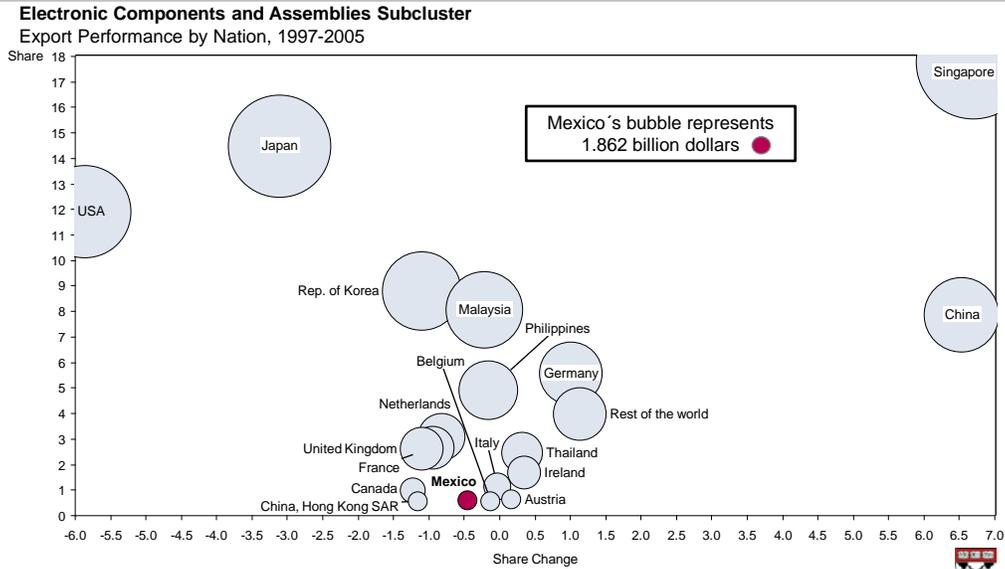
Indicator	Ranking among Mexico's 32 states	Year
Human Development Index	13th	2005
Life Expectancy Index	8th	2005
Margination Index	27th	2005
Benchmarks		
State GDP	4th	2007
Unemployment	4th	2007

Exhibit 8

Manufacturing FDI per State			
State	# of Companies	National Share (%)	Rank
Distrito Federal	2,417	27.20%	1
Baja California	1,219	13.70%	2
México	933	10.50%	3
Nuevo León	677	7.60%	4
Jalisco	478	5.50%	5
Chihuahua	458	5.20%	6
Mexico	8,894	100	

Exhibit 9

Although Mexico's electronic cluster stagnated in the early 2000s, it has renewed its growth and importance since



Source: Prof. Michael E. Porter, International Cluster Competitiveness Project, Institute for Strategy and Competitiveness, Harvard Business School; Richard Bryden, Project Director.

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