Mexico Central Region Automotive Cluster

Microeconomics of Competitiveness

Harvard Business School - Spring 2013

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EXECUTIVE SUMMARY

Mexico is the eleventh largest economy in the world with GDP in PPP terms at $1.7 trillion. Since the 1980s, the Mexican economy has experienced a transformation as a result of economic liberalization and the entry into force of the North American Free Trade Agreement (NAFTA). This has allowed the country to develop a diversified export portfolio, where the automotive cluster plays a key role. An analysis of Mexico’s competitiveness reveals several strengths, including a privileged location, an emerging middle class, strong FDI, and a stable, open economy. Nonetheless, corruption and anti-competitive business environment are key weaknesses.

Though the country is below advanced country standards in productivity, education, and innovation, among other measures, the central region offers signs of strength. The central region automotive cluster has grown to include higher value activities like engineering and design – moving beyond low-skill parts manufacturing to generation of increased prosperity for the region.

Although Mexico is currently a leader in the world automotive industry, certain actions are required to prevent the region, and the country, from loosing its competitive positioning. In order to do so, the federal and state governments must collaborate with the main actors in the cluster to create policies that further reduce any distortions to competition; strengthen the country’s Social Infrastructure and Political Institutions; and contribute to the development of high-value indigenous suppliers. A market diversification strategy is also necessary to mitigate the risk of concentrating in a sole market, in this case the United States.
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Mexico’s Competitiveness Position

With a population of 116.4 million, Mexico is the third most populous country in America and the most populous Spanish-speaking country. It is the eleventh largest economy in the world with GDP in PPP terms at $1.7 trillion (WEF, 2013). Since the 1980s, the Mexican economy has experienced a transformation as a result of economic liberalization and the entry into force of the North American Free Trade Agreement (NAFTA) (EIU, 2008). This adjustment has been particularly notable in the diversification of export earnings away from oil and an increase in foreign trade from around one-third of GDP in the 1980s to close to 70 percent in 2007 (EIU, 2008). In spite of this transformation, Mexico remains the second-poorest country in the OECD after Turkey. Although high compared to other Latin American countries, GDP per capita at PPP (US$ 17,904) is around one-quarter of that of the US (EIU, 2008).

Location and Endowments

With an area of 1.96m sq m Mexico is the 14th-largest country in the world. Located in North America, Mexico is bounded by the United States to the north along a 3,118-km frontier. The country has access to two coastlines: the Pacific coast (7,360 km) to the west and the Gulf of Mexico and the Caribbean coast (2,780 km) to the east. Mexico has abundant natural resources. It is the world’s eighth-largest oil producer, with output averaging 2.96m barrels/day of crude in 2011 (eia, 2013), and has the seventh largest natural-gas reserves (1.45trn cu ft) in the Western hemisphere (EIU, 2008).

Macroeconomic Competitiveness
Monetary and fiscal policy: Mexico’s GDP has recovered substantially since the 2009 crisis, growing 5.5% in 2010 and 4% in 2011 (World Bank), due in large part to sound fiscal and monetary policy and strong domestic demand. Inflation has remained mostly within the target 2-4% range and real interest rates have declined since inflation-targeting policy and a free float exchange rate were adopted in 2001 (Economist 2008, OECD 2001). Fiscal discipline including a balanced budget requirement in force since 2006 has allowed Mexico to maintain a low budget deficit, at 2.5% in 2011, and national debt, at 27% of GDP in 2011 (Fisher 2012).

An open economy, capitalizing on free trade agreements: Mexico has more Free Trade Agreements (FTAs) than any other nation, with 44 in total. The most important FTA for the country is the North American Free Trade Agreement (NAFTA), signed in 1994 with the US and Canada. With the inception of NAFTA, Mexico saw a sharp increase in trade flows (IMF WEO 2013). Exports more than doubled between 1993 and 1995 and imports grew significantly. In addition, NAFTA influenced FDI inflow into the country before it was even signed. As trade talks commenced, confidence in Mexico increased, leading to a tripling of FDI, from 1% to more than 3% of GDP between 1993 and 1995.

The Mexican economy is tightly linked to the US economy. Mexico is the US’ third largest US trade partner in terms of US goods imports after China and Canada. Mexico makes up
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12% of US goods imports and 7% of the value added content imported into the US (OECD 2013). While a majority 73% of Mexico’s exports go to the US, Mexico’s remaining exports have global reach: 7% of Mexican exports flow to Canada, with the remaining share flowing primarily to partners in Asia, Europe, and Latin America. Although US relationship has been an enormous boon to the Mexican economy, it also introduces high risk; over the past twenty years, Mexico’s GDP growth has trended with that of the US, but with consistently larger swings -- higher high’s and lower low’s – than US growth (World Bank 2013). The 2009 financial crisis in the US hit Mexico particularly hard; both countries are still in recovery with Mexican growth exceeding that of the US in recent years.

Social Infrastructure and Political Institutions (SIPI)

Mexico is a federal republic with 31 states and a federal district (Mexico City). All states are autonomous and independent in their internal administration. Areas such as education, health, and law and order are shared competences between the federal and state governments. The country is conventionally divided into three major regions: north, center and south-east. There is a large income disparity among the regions.¹

Political institutions: The country has strong political stability thanks to periodic and

¹ The north, which concentrates one-quarter of the population, generates 30% of GDP; the center, where 60% of the population lives, accounts for 60% of GDP; and the south-east, with approximately 15% of the population, contributes only 10% of GDP (EIU, 2008).
transparent elections. Political parties have alternated power at the three levels of government since December 2000, when the Partido Acción Nacional (PAN) assumed the Presidency after 71 years of uninterrupted rule by the Partido Revolucionario Institucional (PRI).

Traditionally, the country has had a poor record on cross-party cooperation with legislative paralysis preventing structural reform. Nonetheless, in December 2012, the three main parties: PRI, PAN and Partido de la Revolución Democrática (PRD) established a political pact (Pact for Mexico) that formalizes their commitment to passing up to 95 initiatives. The passage of a comprehensive education reform, a reform of the injunction (amparo) law, and a telecommunications reform are the Pact’s recent successes (EIU, 2013).

**Human Development**: Mexico ranks 61st out of 187 countries in the United Nations’ Human Development Index (HDI), which measures three basic dimensions of human development: health, education and income. Between 1980 and 2012 the country’s HDI rose by 0.9% annually from 0.598 to 0.775, placing Mexico above the regional (0.741) and world (0.694) averages (UNDP, 2012).

Mexico has been experiencing a sharp deterioration in the security environment since the 1994 economic crisis. Corruption and criminality in law-enforcement institutions have contributed to the exacerbation of crime in the country. More recently, violence related to drug-trafficking has become a concern. It is estimated that 10% of large firms’ total expenses are security costs (EIU, 2008).

**ECONOMIC COMPOSITION**

**Services-led with trade as a larger share of GDP than of any other large country.**

Services made up 61% of GDP in 2010, followed by industry (35%), and agriculture (4%). Manufactured goods exports for Mexico are approximately equal to those of the rest of Latin America combined. As of 2010, Mexico’s top exports by value include: automotive (~$60B),
Mexico has many emergent clusters, the majority have lost share in the last ten years.

**National Diamond**

**Factor Conditions:** Mexico has a large and relatively inexpensive manufacturing labor force. In 2007, the size of the labor force was estimated at 44.7 million (EIU, 2008). The average manufacturing wage ($ per hour) in 2011 was $2.10 (compared to $1.6 in China) (The Economist, 2012). The quality of labor is nonetheless insufficient given the low quality of education (100th out of 144 countries), especially in math and science (124th) (WEF, 2013). Increased investment in education over the past 20 years has substantially increased the net enrolment rate. However, educational outcomes remain low at all levels (EIU, 2008).

Mexico’s proximity to the US gives the country a comparative advantage in sectors where the “just-in-time-logistics” and transport costs are crucial to competitiveness (such as the automotive industry). Mexico has progressively evolved from being a supplier of cheap manufacturing labor to closer integration in the production and distribution systems of the US industry (EIU, 2008). The country has fairly good transport infrastructure (41st out of 144 countries), though there is still a need for improvement (WEF, 2013). Although highways in Mexico are well developed, some of them carry the highest toll rates in the world. Port
infrastructure has become more competitive following the privatization and FDI allowed by NAFTA. Bottlenecks in the Mexican-US border remain an issue (Barragan, 2005: 44). The steel industry is also a comparative advantage of the country. Compared to countries like Brazil, Taiwan, and Korea, the price of raw materials in Mexico is 15 to 30 percent cheaper (Barragan, 2005: 40). Lack of competition in the energy sector is reflected in the country’s poor quality of electricity supply (77th) (WEF, 2013) and high oil prices (EIU, 2008).

**Demand Conditions:** According to the Global Competitiveness Report, Mexico’s large and deep internal market (11th) is one of the country’s main competitiveness strengths (WEF, 2013). Between 2000 and 2010 Mexico registered a historic jump in the number of people joining the middle class. The country is among the highest achievers in Latin America, with 17% of its population joining the middle class in the past decade (World Bank, 2012). Mexico is also characterized by its young population, the average age being 27 years (EIU, 2008). The Gini coefficient, which measures concentration of income, has been steady falling from 0.543 in 2000 to a still high 0.4828 in 2008. Although increasing, buyer sophistication remains relatively low (50th), particularly when compared to other leading automotive exporters (WEF 2013).

**Context for Firm Strategy and Rivalry:** According to the World Bank’s Doing Business Index for 2013, Mexico is stronger than GDP per capita peers on several indicators including starting a business, resolving insolvency, protecting investors, and starting a business (World Bank 2013). The World Economic Forum Global Competitiveness Index (WEF 2013) indicates Mexico is relatively strong in terms of its market size, macroeconomic environment, and business sophistication. Increased confidence and FDI flows following NAFTA, as well as improving intellectual property protection further enhance the business environment in the country.
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However significant challenges remain. 16% of business people surveyed by the World Economic Forum identified corruption, crime and theft as the largest barriers to doing business in Mexico. A large informal sector and strong monopolies, especially in state owned energy and utilities, and low institutional quality, create additional challenges for competition: limiting government revenues while enabling rent-seeking and raising the cost of doing business. Government bureaucracy and access to financing are also noted challenges, especially for small and medium enterprises. Further, labor market inefficiency, low higher education attainment in the country overall, and relatively low technology readiness are areas for improvement (WEF).

Supporting and Related Industries: The NAFTA agreement supported the growth of an abundance of suppliers in Mexico, especially along the US border. The maquila industry which provides assembly services has grown increasingly specialized in auto parts, electronics, televisions, and textiles (Economist 2008). The country’s strength in labor-intensive manufacturing, combined with relatively high hours-worked per employee and low-wages, has attracted foreign firms and created a growing re-export supplier base. Though across the country there is a low level of innovation, higher human and industrial capacity
concentrated in the central region has allowed firms in Mexico, including suppliers, to building their value-added share of final goods. Mexico’s share of exports of final – as opposed to intermediate -- goods has increased over time: between 1990 and 2011 the share of final goods rose from 32% to 48% (OECD).

A relatively strong banking sector, led by public banks and infused with foreign capital, supports cluster development; Mexico ranks an impressive 33rd on bank soundness according to the WEF, though access to loans and regulation remain challenges. Adding support to Mexican industry, private Chambers of Commerce and industry associations, as well as public export promotion (ProMexico) attract and support businesses across the country.

National Diamond

Automotive Cluster in Mexico

Mexico’s economic performance, particularly in the manufacturing sector, has led to the emergence of a series of important clusters, with large shares of world exports. The automotive cluster is the most significant one, reaching over $64 billion in exports in 2011.
However, in the past decade the automotive cluster has stagnated in terms of its share in world exports, as shown in the bubble chart above. This issue requires attention, and implies that this cluster lags in growth versus other clusters like manufacturing of entertainment equipment, medical devices, or the related cluster of aerospace.

Nonetheless, performance of the automotive cluster in aggregate terms has been robust. Following NAFTA, the cluster experienced strong growth in production, for instance going from representing 15.8% of manufacturing GDP in 2001 to being 20.3% in 2011. As already mentioned, this expansion of economic capacity has been accompanied by increasing exports and imports, which grew from 2005 to 2011 at a CAGR of 9.9% and 4.2% respectively.

The strong performance in international markets has mostly been driven by the US, where Mexican production of intermediary and final automotive products have been gaining share systematically. As a result, in 2008 Mexico became the most important source for US vehicle imports in 2008, and since then it has consolidated its position on top of Canada, South Korea and China. As we will further explore, this external demand has been a key driving force in the development of the auto cluster in the central region if Mexico.

**Analysis of the Central Region**

**Why we are analyzing the Central Region:** The question of location is a tough issue to resolve when describing the automotive cluster in Mexico. First, there are significant production plants for either auto parts or final products in over 14 states (INEGI, 2010.) Second, economic activities are scattered across a broad geographic area, from the southwest of Mexico to the northern border with the US. In order to apply a rigorous and bounded
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analysis, we want to focus on a location that concentrates the most significant activities of the automotive cluster in order to clearly understand the reasons that make this location a better place to invest in automotive production and the forces that result in spillovers and aggregate gains from forming a cluster.

To do this, we use measures of concentration and map them into the Mexican states. First, we use the location quotient\(^2\) to measure employment concentration, and we use a similar metric with GDP to measure value added concentration. This analysis shows that two main clusters have developed in Mexico: the North Region cluster is more intensive in employment, with location quotients ranging from 2.0 to over 5.0; the Central Region cluster is more important in value added, with GDP location quotients of over 5.0 in around Mexico City.

**Location quotient for employment (left) and GDP (right)**

Source: Authors’ calculations using data from Inegi (2010)

Furthermore, we explore concentration of important factor conditions, such as availability of human capital and infrastructure. This analysis shows that the region around Mexico City has the most educated workforce in the country, which implies an important source of engineers, designers, and other high-skill workers (Figure XX, left panel). In addition, the highway

\[ \text{Location Quotient} = \frac{\text{Cluster}_{\text{local}} / \text{State}}{\text{Cluster}_{\text{national}} / \text{National}} \]

\(^2\) The Location Quotient measures the concentration of an industry in a state normalized by the importance of that cluster at the national level. The indices are calculated as follows:
system is concentrated in the Central Region of State of Mexico, Puebla, and Mexico City, which grants efficient connection with ports and airports on both oceans.

**Graduates per working age person (left) and infrastructure (right)**

![Graduates per working age person and infrastructure](image)

Source: Authors’ calculations using data from Inegi (2010) and NORTAD (2013)

Human capital availability and efficient logistics have driven the most sophisticated activities to the Central Region, leading companies to locate their advanced manufacturing and engineering plants there. As a result, the Central Region concentrates most of the engineering and design centers for auto companies, which go beyond manufacturing to provide the highest value added activities in the Automotive Cluster in Mexico. Hence, we will concentrate our analysis in Mexico’s Central Region Automotive Cluster defined as Mexico City, State of Mexico and Puebla.

**Location of Engineering and Design centers in Mexico**

![Location of Engineering and Design centers](image)

Source: Authors’ calculations using data from PWC (2012)
Mexico’s Central Region is comprised by six states: Mexico City, State of Mexico, Puebla, Hidalgo, Morelos and Tlaxcala; however, as stated before, only the first three states (collectively the “Central Region”) are relevant for the purpose of the Automotive Cluster. The Central Region has a significant weight in terms of population: with more than 30 million inhabitants, it holds a quarter of the total population in Mexico. Moreover, the Region has one of the highest indices of urbanization in the country. (INEGI 2012)

In terms of its economic capacity, combined, the three states have an aggregate GDP of US$360 Billion accounting for 30% of Mexico’s GDP. Mexico city alone plays a major role in the Mexican economy, with a GDP of 17% of total GDP. (SHCP 2013)

However, when we analyze GDP per capita by State (PPP), we see an important divergence between states. While Mexico City has a GDP per Capita of US$31,600 (2.2 times the national average), Puebla and State of Mexico lag far behind, with a GDP per capita of US$10,100 (.7 times the national average) (SHCP 2012). In other words, there are significant disparities in the level of development of the three states.

Composition of the economy in the three states also varies significantly. Mexico City’s economy is centered on the provision of services, which account for more than 84% of its
GDP. The State of Mexico, on the other hand, is highly focused on manufacturing, being responsible for more than 15% of total national manufacturing. (INEGI 2013). In Puebla’s economy, manufacturing accounts for 25% of GDP, in which the Automotive Cluster plays a very important role, accounting for more than 60% of the total manufacturing sector (Puebla Economic Outlook Report 2011). In other words, Auto is the pillar of Puebla’s industry.

Economic growth in the Central Region has been fairly stable and positive since 1994, with the exception of the 2009 economic crisis that had a significant impact in the economy of all three states. From 1994 to 2010 Puebla and State of Mexico have increased their GDP per Capita by almost 70%. Mexico City has had less of an impressive growth rate, mainly because its level of development has been significantly higher than the other states for several years.

It is important to emphasize that one of the strategic advantages of the Central Region is Mexico City itself. As we will analyze in the following paragraphs, Mexico City is the main hub of development in Mexico and thus, Puebla and State of Mexico have been able to take advantage of their proximity to Mexico City to develop complementary industries. This situation also becomes evident in the space that the Automotive Cluster occupies.

**Factor Conditions**

The Central Region is Mexico’s education core on several levels. The three states have the highest concentration of higher education institutions, which include Universities and technical colleges. Likewise, they have the highest number of bachelor students. These factor conditions allow the Central Region to provide an educated workforce that can participate in higher skill industries, such as the Automotive, compared to other regions in the country.
In a similar manner, and due to its higher levels of education, the Central Region leads on different research activities. Mexico City, State of Mexico and Puebla are among the top five states in patent registration, and hold the most number of researchers. Mexico City alone, accounts for almost 50% (INEGI 2012) of all researchers nation wide.

Beyond education, the Central Region possess several other factors conditions that are prime for the Automotive industry and which have fostered the development of the Cluster. Some of the most important include strong development of road infrastructure (Report by Ministry of Communications 2010) to connect to the north of the country and the US market, high connectivity to seaports in neighboring states and lower electricity costs than most states.

**CONTEXT FOR FIRM STRATEGY AND RIVALRY**

In regards to CSR, the Central Region has positive and negative factors. On the positive side the Region, and Mexico City in particular, attracts massive amounts of FDI: averaging in the 1994-2010 period more than US$16B annually (SHCP 2012).

Moreover, competition develops under high standards of quality within the region as the three states are among the top 5 in number of ISO9000 certified companies (INEGI 2011). These two factors are of great importance to the Automotive Cluster, as i) most of the
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investments in this sector come from abroad and thus openness to FDI is fundamental, ii) quality of local supplier is important given the nature of skills required in the industry.

On the negative side, the region has shown mixed performance in different competitiveness indicators. For instance, Mexico City and State of Mexico rank among the worst in terms of corruption, (Transparencia Mexicana 2012) which impose high costs to business development. According to several newspaper reports, SME are particularly affected by corruption due to officials in all levels that take advantage of outdated and extremely strict regulations to request bribes (La Razon 2012) (El Economista). In other indicators such as the World Bank’s Doing Business, the Region receives poor rankings on important factors such as contract enforcement and property registry procedures. (WEF 2012)

However, Mexico City scores very highly on important variables such as ease of opening a business and management of business procedures. (EGAP 2010)

RELATED AND SUPPORTING INDUSTRIES

The Central Region has a large base of suppliers in general, measured in terms of the number of companies that are established in the Region. In this view, the three states concentrate about 30% of the 3,551,010 companies in Mexico (INEGI 2012). Specifically to the automotive industry, and as discussed further below in the cluster analysis, a significant number of suppliers are located within the Region. Other supporting organisms to the clusters, such as chambers of commerce and association, are also located in the Region. Moreover, Mexico City operates as the financial capital of the country, which provides strong support for the cluster by easing the access to credit and other financial mechanisms.
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DEMAND CONDITIONS

In terms of demand, the Central Region has several positive factors. The most important of all, as mentioned earlier, is the high concentration of population. This means that the Automotive Cluster is situated very closely to a huge portion of the domestic market. From another standpoint, the higher level of GDP per capita in Mexico City has also increased buyer sophistication, which highly translates into the vehicle market. In this view, the Region plays a significant role in the demand of the Automotive Cluster by accounting for the highest share of new vehicle sold in the country (INEGI 2012).

REGIONAL DIAMOND

Below we present the most important characteristics of the Regional Cluster with the aim of highlighting the major differences with the National context and other regions within Mexico, and thus, all comparisons presented are done versus such units of analysis.
AUTOMOTIVE CLUSTER IN THE CENTRAL REGION

HISTORY OF THE AUTOMOTIVE CLUSTER IN MEXICO’S CENTRAL REGION

The history of the Central Mexican Region automotive cluster dates back to 1925, when Ford established its first manufacturing plant in Mexico City, with 295 employees for assembly of the model T. By 1932, Ford established its first permanent assembly plant, where up to 100 vehicles per day could be produced through a mass production system. In 1935, General Motors, the largest vehicle manufacturer in the world at that time, arrived in the country with only 36 employees and by 1937, GM established in Mexico City its first assembly plant in the country producing 10 units per day. By 1938, the Automex company, which later became Chrysler, began its operations. During the 1950s and 1960s, companies around the world opted to open plants in Mexico, and Volkswagen opened its first plant in Mexico in 1962, in Estado de México. Datsun, which would become Nissan, arrived in Mexico in 1959 and opened a plant in Cuernavaca, also in the central region, in 1966 (see Timeline).
POLICIES RELATED TO THE AUTO CLUSTER

**Import substitution model:** By 1960, 53% of the national demand was supplied by direct imports and 80% of the auto parts value of local production was imported. As part of an import substitution effort, a 1962 decree established a 60% minimum of national inputs and a limit of 40% of foreign property in auto part manufacturers (Fernandez, 2005). Those companies that did not agree with the policy - Mercedes Benz, FIAT, Citroën, Peugeot and Volvo - left Mexico during this stage. The American Big Three (General Motors, Ford and Chrysler) remained along with American Motors, Renault, Volkswagen, Datsun and Borgward (Ordaz, 2012). While in 1965, 96,781 vehicles were produced in the country, by 1970 that number had increased up to more than 250,000 (Vicencio, 2007).

**Export promotion stage and trade liberalization:** However, by 1970, the commercial deficit remained which led to the export promotion decree of 1972. The decree stated that imports had to be balanced with exports, which should have at least 40% of auto parts not produced by the manufacturing company (Vicencio, 2007). This restricted approach ended in 1989, with decrees aimed at starting a new stage of deregulation and economic liberalization. Besides promoting local demand through tax exemptions for small vehicles, the decrees lowered tariffs and decreased the extent of import regulations. Starting in 1994, NAFTA increased the flow of FDI into Mexico’s automotive sector. The “Big Three” in the U.S., Chrysler, GM and Ford, invested nearly $39.1 billion in Mexico in the first years. Manufacturers took advantage of low wages and became more efficient, increasing significantly their production. European and Asian manufacturers took advantage of NAFTA as well, using Mexico as an entry port for the North American market. Recent examples show continued interest in investing: in 2011 Mazda announced a USD $500 million new plant to produce 140 thousand units, in 2012 Fiat announced the building of a USD $400
million new plant as Nissan did the same with a USD $2,000 million plant to produce 175 thousand units, and in 2013 Honda announced a USD $800 million second plant to produce 200 thousand units (Urteaga, 2012).

**Current Policies:** There are a significant number of current policies that have supported the Automotive Cluster, particularly in the Central Region. At the federal government level, there are several mechanisms successfully supporting the development of the cluster, the most important of which are The Sectorial Promotion Programs (PROSEC), the Manufacturing Maquila and Export Services Industry (IMMEX), the Return of Import Taxes to Exporters, and a series of decrees to allow zero-tariff for most inputs in the light-vehicles segment for manufacturers that investing more than 100 million dollars (Promexico, Autoparts, 2012). In addition, there is federal funding provided through several programs such as Fondo PYME (For SME) and PROMEXICO (supporting FDIs) for specific projects (PWC, 2012).

In addition to these policies, in order to obtain funds for the 1968 Olympics and later for the 1970 Soccer World Cup, a tax on car ownership was established and came to be known as “Tenencia”. Until 2012 it remained as a federal tax, and it is now a state tax that some states have already eliminated. However, there is a tax on new vehicles (ISAN) that is still being applied (PWC, 2012).

The Automotive Cluster is also supported by trade agreements with 47 countries. NAFTA (US and Canada) is by far the most important of them in terms of economic outcomes, and it is even clearer in the case of the auto industry, but the trade agreement with the European Union is also an important element, as are those related to Latin America.

**Performance of the Auto Cluster in the Central Region**
An important part of the dynamism of the automotive cluster at the national level is explained by the performance of the Central Region. First, the Central Region market has been growing fast, with vehicles registered expanding at a CAGR of 7.0% from 1995 to 2008, year in which the total number of vehicles registered reached 7.4 million. In addition, the Central Region automotive cluster employs over 100,000 employees, which represents 18.8% of national employment in automotive (Inegi, 2010). Further still, economic production in this region accounts for 43% of national production, the largest of any other region in the country.

As mentioned earlier, world-class manufacturers have established production plants in the region for light and heavy vehicles. This has been complemented by a series of R&D centers concentrated in engineering and design, which has helped the cluster create a diversified export portfolio. In result, in 2011 Mexico’s $64 billion in exports were composed of cars (27%), parts and accessories (17%), cargo trucks (12%), and tractors (7%) (BEA, 2013)

**Factor Conditions**

Mexico’s Central Region has human capital and investment conditions that foster industrial development. As mentioned in the regional context, the three federal entities have high levels of tertiary education that are among the best in the nation, patents and research in universities that are the source for a research driven environment in the engineering and design automotive plants, and relatively low cost of inputs when compared to other states in Mexico, as well as availability of highways and airports that grant ease of access to raw materials and supplies. However, even though Mexico has a buoyant production of raw materials – for instance, steel production reached 17m tons in 2008 (Inegi, 2010) – production is concentrated in the North, which could imply higher costs for local producers of auto parts. Finally, although Mexico City, Puebla, and State of Mexico have lower than national average
cost of electricity, the cost of energy is generally higher than in other countries because of monopolies in natural resource exploitation and utilities, as with Pemex and the CFE.

DEMAND CONDITIONS

The Central Region has the largest automotive market in the country, as reflected in yearly sales of vehicles, for which Mexico City is by far the largest buyer of cars in the nation with 180,000 vehicles commercialized per year between 2000 and 2010 (Inegi 2010). Estado de Mexico is the second largest buyer with nearly 80,000 vehicles per year, and Puebla is the 6th largest with nearly 30,000 cars per year. Further, this is aided by a series of local regulation of vehicle circulation implemented under the Hoy no Circula program in Mexico City, which restricts the use of vehicles that are lagging in environmental conditions and incentivizes the demand of new vehicles.

In addition, this region makes for a sophisticated and highly demanding costumer base. On the one hand, as mentioned before, Mexico City has the highest income per capita in the country giving it ample purchasing power. On the other hand, Mexico City is one of the world’s most automobile-dense, with one car for every two habitants of the city (Barragan, 2005). Vehicle density has continued to increase in the whole country, and it’s above similar countries in Latin America; nonetheless, there is still space to grow, and density still has not reached the levels of OECD countries, where the number of vehicles per thousand people reached 564 in 2011 versus 275 in Mexico (WDI, 2013). The expectations of continued density growth makes for demanding conditions that need to be met by manufacturers.

With regards to environmental requirements for vehicle fuel consumption, the Mexican authorities have set standards that are on par with the US, which has been consistent with the manufacturer’s push for implementing fuel efficiency research in their Mexican plants. However, these environmental standards lag behind those in the Asian and European
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countries, which is a challenge that Mexican automakers will face in an eventual effort to diversify to other regions.

**CONTEXT FOR RIVALRY AND STRATEGY**

Competition in the automotive cluster is fostered by continuous investment, especially from inflows of external investment that is prompted by NAFTA. FDI volumes have shown some volatility in the past years, but investments continue to flow into the cluster ranging from $500 million to $2 billion per year. Investments have been directed both to terminal plants and to auto part production (Secretaría de Economía 2012).

Specifically in the Central Region, investments in the cluster have been recently focused on R&D facilities, in order to add value to production for the US market. Firms are engaging in research activities, particularly in fuel efficiency, and Nissan, Ford, Chrysler, Volkswagen and GM have all installed new design and engineering centers, whose activities are described in the Table 1. Nonetheless, this push for research activities has been almost exclusive of the OEMs, and Tier 2 and Tier 3 suppliers have not shown the same type of investments in innovation, which is a reflection of the relatively informal nature of this supplier base (Barragan, 2005).

In addition, tariffs are still in place for the Automotive Cluster, hindering competition. Even though they have been reduced since 2009, tariffs on imports still remain for intermediate

<table>
<thead>
<tr>
<th>Table 1. Firms are engaging in research activities, particularly in fuel efficiency</th>
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</thead>
</table>
| **Nissan Design Center – Nissan Engineering**  
Toluca, State of Mexico – Mexico City  
High tech modeling machinery for global prototypes  
Gas emission laboratories for fuel efficiency research |
| **Ford Engineering and Design Center, Mexico City**  
Auto systems design, workforce knowledge training |
| **Chrysler Engineering and Design Center, Mexico City**  
Fluid management research for fuel efficiency, advanced manufacturing research |
| **Volkswagen Technology and Part Design Center, Puebla**  
Interior design and vehicle design, development and testing of autoparts, 800 specialized engineers |
| **General Motors Engineering Center, Toluca, Estado de Mexico**  
One of GM 13 global engineering center, specialized in interiors and air conditioning systems |
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(3%) and final products (20%) (Secretaría de Economía, 2012). Mexico has tried to lower tariffs by signing bilateral FTA, but this has resulted in a heterogeneous and complex legal framework for manufacturers, which need to navigate the different regulations for each country of origin in order to determine the most efficient way of importing supplies.

SUPPORTING AND RELATED INDUSTRIES: THE AUTOMOTIVE CLUSTER MAP

The Auto Cluster in the Central Region is a complex set of industries in the region, producing light and heavy vehicles, but also composed of an important supply industrial base. The light vehicle manufacturers in the Central Region are General Motors, Ford, Chrysler-Fiat, Nissan, Volkswagen and Audi. The heavy vehicle manufacturers in the region are Scania, Mercedes Benz-Freightliner, Volkswagen and Isuzu (Promexico, Automotive, 2012).
The auto parts industry is also highly developed, and it is organized into three levels of production: Tier 1 manufacturers are the direct suppliers of the OEMs. They develop components such as engine parts, steering and suspension systems, air conditioning systems and electronic components. Tier 2 producers, are the suppliers of Tier 1. They manufacture equipment and products used in the most advanced and specialized components of the automotive industry: forged and stamped parts, die casting, plastic parts, machined parts, etc. Tier 3 producers provide raw materials to Tier 2 manufacturers. In Mexico there are more than 2800 companies in the three levels and 592 of them are in DF, State of Mexico and Puebla (INEGI, 2012). In fact, 84 of the 100 top auto part companies in the world are established in Mexico (Promexico, Auto parts, 2012). The Central Region is particularly strong in seats, air conditioning, interior components, engine parts, electrical systems, hydraulic systems, stamping and suspensions and metal-mechanic suppliers in general (Promexico, Auto parts, 2012; ISC, 2013).

IFCs have also played an important role. The auto parts manufacturers are grouped in the National Autoparts Industry (INA) with 950 members. The Mexican Association of the Automotive Industry (AMIA) represents the 10 major automakers. The National Association of Bus, Truck and Tractor-Trailer Producers (ANPACT) represents 13 heavy vehicle and diesel engine manufacturers. The National Association of Tire Distributors and Renovating Plants (ANDELLAC) group the main tire producers in the country. The Mexican Dealership Association (AMDA) groups all the major distributors in the country (Promexico, 2012).

Research and Development centers have also played an important role in the cluster. For instance, the research and design centers of General Motors, Nissan, Chrysler, Ford and Volkswagen are located in the Central Region. Universities have been supplying technical workforce and generated shared technical projects with the industry (Promexico, 2012).
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Even though very strict labor regulations could be a factor to inhibit the development of the cluster, unions played a significant role for its performance. The relationship between auto manufacturers and auto parts producers with unions has been generally collaborative.

The Auto retail sector is also a key element of the cluster, since demand is an important factor for the auto industry. By 2008, there were 1664 dealerships in Mexico, and 447 of them were in the 3 states considered in this paper (INEGI, 2012). Retail is supported by the insurance, finance and banking, advertising, infrastructure and the oil, gasoline, diesel and gas industries. For exports and distributions, the transportation and logistics cluster have played an important supporting role, as well as the ports and railroads clusters. Also, the federal and state governments have been developing specific tools and policies for export promotion, FDI and supply chain development (Promexico, Auto parts, 2012).

Finally, there are some clusters that have supported the development of the Automotive Cluster. This is the case of the Business Services cluster, the Aerospace Cluster and particularly the Auto Clusters in Northern Mexico, Bajío and Texas. Other industries could be considered supportive, or even part of the Tier 3 industries, e.g. mining, oil and electricity.

**Cluster Diamond**

<table>
<thead>
<tr>
<th>Factor conditions</th>
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<tbody>
<tr>
<td>Availability of engineers and researchers</td>
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<tr>
<td>Fairly good transport infrastructure</td>
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<tr>
<td>Availability of research and training services</td>
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<tr>
<td>Comparatively secure region</td>
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<tr>
<td>High electricity and oil costs by international standards</td>
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<table>
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<tr>
<th>Context for Firm Strategy and Rivalry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased FDI and TT following NAFTA</td>
</tr>
<tr>
<td>Research and engineering fosters innovation</td>
</tr>
<tr>
<td>FTA with 44 countries</td>
</tr>
<tr>
<td>SME support programs</td>
</tr>
<tr>
<td>Bribery and extortion to SMEs</td>
</tr>
<tr>
<td>High tariff barriers</td>
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</tbody>
</table>

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<tr>
<th>Supporting and Related Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many suppliers are leading subclusters</td>
</tr>
<tr>
<td>Related clusters have developed (Aerospace, IT)</td>
</tr>
<tr>
<td>Important retail industry</td>
</tr>
<tr>
<td>Informal and low technology indigenous suppliers</td>
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</tbody>
</table>

<table>
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<tr>
<th>Demand conditions</th>
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<tbody>
<tr>
<td>Large and deep internal market</td>
</tr>
<tr>
<td>Dynamic demand from Mexico City</td>
</tr>
<tr>
<td>Growing middle class and young population</td>
</tr>
<tr>
<td>FTA with 44 countries</td>
</tr>
<tr>
<td>Significant number of low income population</td>
</tr>
<tr>
<td>High number of used cars from US</td>
</tr>
<tr>
<td>Ownership vehicle tax (tenencia)</td>
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</tbody>
</table>
Mexico is the eighth largest manufacturer (ProMéxico, 2012:6) and the fifth largest exporter of automotive products in the world (WTO, 2012). Although traditionally dominated by US firms, the country has also established itself as an attractive base for European and Japanese producers interested in serving the US market (EIU, 2008). Exports to the US still account for the vast majority of Mexico’s automotive exports (63.55% in 2011). However, firms in Mexico are now pursuing a diversification strategy, without neglecting the North American market, as a result of the impact of the 2009 crisis on the automotive industry (PwC Mexico, 2012:5). In 2011, exports to other markets reached 36%, compared to 15% from 2000 to 2008 and 31.3% in 2010 (PwC Mexico, 2012:5).
## RECOMMENDATIONS

The following recommendations will help Mexico’s central region automotive cluster build competitiveness by influencing the cluster’s Context for Firm Strategy and Rivalry (CSR), Factor Conditions (FC), Related and Supporting Industries (RSI), and Demand Conditions (DC).

<table>
<thead>
<tr>
<th>Diamond</th>
<th>Current state</th>
<th>Recommendation</th>
<th>Action owner</th>
</tr>
</thead>
</table>
| CSR     | Levels of corruption generate high costs to business | • Move forward with National Anti-corruption Commission proposal being debated in Congress  
• Address specific corruption issues at Regional level (Mexico City and State of Mexico) by creating Public-Private Transparency Councils to tackle corruption problems for small and medium business | Federal Legislative branch  
Mexico City / State of Mexico |
| CSR     | Security concerns are affecting the national business environment | • Need of serious work on improving rule of law, especially in terms of security.  
• Implementation of the Penal System Reform that is stalled in Mexico City and Puebla is crucial. | Federal Executive branch (Ministry of the Interior)  
State Executives / Judicial branches |
| CSR     | Contract enforcement problems at Regional level generate risks for all types of companies | • Focus on improving contract enforcement by training judges in commercial procedures | Federal Judicial Branch |
| CSR     | Mexico’s proximity to and FTA with US has been attracting FDI from firms looking to trade with US, which creates high dependence on U.S. economy and generates risks | • Leverage strategic position to attract more FDI from Auto firms that want to serve the US market (European and Japanese firms)  
• Strategy for market diversification is necessary:  
  • Build on current strengths and capabilities for serving the US market, to penetrate other markets through existing FTAs. | Federal Executive Branch (PROMEXICO)  
Cluster (IFCs and 35 manufacturers) |
<table>
<thead>
<tr>
<th><strong>CSR</strong></th>
<th>Import tariffs on both intermediate and final products in the auto industry hinder competition in the local market</th>
<th>• Become part of the Trans Pacific Partnership to significantly grow cluster.</th>
<th>- Cluster / Federal Executive Branch (Ministry of Economy)</th>
</tr>
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<tbody>
<tr>
<td>FC / CSR</td>
<td>Insufficient investment in R&amp;D for international standards. R&amp;D is done by multinationals and at individual level, not covering the Cluster in general.</td>
<td>• Harmonize and gradually decrease tariffs for both intermediate products and assembled cars</td>
<td>- National Trade Representative (Ministry of the Economy)</td>
</tr>
<tr>
<td><strong>FC</strong></td>
<td>Relative to national standards, high availability of skilled human capital relevant to the auto cluster, but quality needs to be increased to reach international levels and higher-value production activities at scale</td>
<td>• Create tax incentives programs for R&amp;D activities and technology transfer.</td>
<td>- Federal Executive Branch</td>
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<tr>
<td></td>
<td></td>
<td>• Establish specialized R&amp;D centers in collaboration with the private sector and universities.</td>
<td>- Cluster (IFC’s)</td>
</tr>
<tr>
<td><strong>FC</strong></td>
<td>High oil and electricity costs arising due to monopolies in natural resource exploitation and service provision</td>
<td>• Emphasis on increasing quality in math and science in primary and secondary education through comprehensive school programs.</td>
<td>- Federal Executive Branch (Ministry of Education / Council of Science)</td>
</tr>
<tr>
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<td></td>
<td>• Increase scholarships and encourage collaboration with business sector in high education by developing specific programs tailored to the Auto cluster needs</td>
<td>- Cluster (IFC’s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Skills development centers to serve specific business needs (automotive technical institutes)</td>
<td>- Cluster (IFC’s) / State Governments</td>
</tr>
<tr>
<td><strong>RSI / CSR</strong></td>
<td>Lack of high-value / high-technology local suppliers. Most Mx-owned suppliers not up to standards (quality, technology, capacity, etc.) of tier 1 auto manufacturers (major international)</td>
<td>• Government-industry collaboration to develop programs that increase and improve small and medium local suppliers. Build IFC targeted to increasing competitiveness among indigenous auto parts suppliers. In collaboration with National Autoparts Industry association (tier 1 IFC): build capacity, upgrade technology, encourage formalization in tier 2</td>
<td>- National and State level Ministries of the Economy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Cluster (tier 1 and 2 manufacturers)</td>
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</table>
brands) who instead source primarily from other foreign-owned firms.

Many informal micro-suppliers distort competitive environment, and may create disincentives for formal firm participation.

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<tr>
<th><strong>DC</strong></th>
<th>Tenencia ownership tax on vehicles remains at state level despite being removed at federal level.</th>
<th>• Carefully analyze impact of tax elimination with possible action to follow.</th>
<th>- State governments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSR / DC</strong></td>
<td>While high at the local level, low environmental standards with respect to global frontier</td>
<td>• Gradually adopt higher environmental standards to foster innovation and efficiency</td>
<td>- Federal Executive branch (Ministries of Environment and Economy)</td>
</tr>
</tbody>
</table>
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