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**OPPORTUNITIES FOR DUTCH BUSINESSES
IN THE MEXICAN AUTOMOTIVE INDUSTRY**

Executive Summary

Mexico's automotive industry in Mexico represents the country's second most important economic sector, accounting for roughly 3.8% of Mexico's GDP in 2019. Worldwide, Mexico is the 6th largest vehicle manufacturer, totaling close to 4 million vehicles in 2019 and exporting over 85 percent. The production value of light vehicles, auto parts, heavy vehicles, bodyworks, and trailers together accounted for US\$143.3 billion last year. Over 40 auto brands are produced by the world's leading OEMs, with Nissan, General Motors (GM) and Volkswagen being the largest players in the country.

A skilled labor force at low costs, Mexico's proximity to the United States of America (US), the tight relations between the two countries -and Canada- under the North American Free Trade Agreement (NAFTA), and its strategic geographical location, are only some of the reasons for the industry's success. Industry dynamics and the political climate in North America have situated Mexico in the center of the global automotive industry, offering a cost-competitive production environment for car makers from Asia, Europe, and North America. Recently ratified trade agreements, in particular the EU-Mexico Treaty, the Trans-Pacific Partnership (CPTTP) and the USMCA FTA enhance Mexico's attractiveness, especially due to Regional Value Content (RVC) requirements. The US-China trade war also increases the attractiveness of manufacturing in Mexico.

Mexico's automotive industry is at a crossroad where it can choose to invest more in R&D and shift from being a value-for-money manufacturing or maquiladora destination to an important player in the advanced manufacturing industry. The opportunity is to start building and positioning Mexico as an innovation hub. Expertise, knowledge, and innovative solutions are required to achieve a smooth adaptation. Local technology suppliers are in demand. Investments towards expansion, innovation, and automation in production centers of OEMs and Tier 1 suppliers are expected shortly, with several investments confirmed in R&D facilities based in Mexico. Fortunately, the country is home to a solid pool of educated talent to cash in on the opportunities.

In a broader sense, there is a clear gap in the Mexican automotive supply chain from Tier 2 and down, on both the production supply side and in investments. Local suppliers do not always meet the standards and volumes of top-Tier suppliers and OEMs, leaving room for foreign companies. Automation levels with Tier 2 suppliers and lower require further digitalization and automatization of their processes. Production machinery and equipment, materials, pre-assembled components, molds and tooling, cutting tools, automation process equipment, raw materials, engineering and design, finished parts, and accessories are all in strong demand. As the industry advances in technology, solutions in big data, wireless technologies, innovation for high production volumes, smart packaging, and track and trace systems in logistics are needed. Simultaneously, the automotive industry in Mexico is becoming increasingly committed to sustainable manufacturing, both in terms of the manufacturing process and their products. Light

weighting shows a promising trend throughout the supply chain, particularly mixed-material body structures of steel and aluminum with polymers and plastics.

Based on a profile of the Dutch automotive industry, the following specific opportunities for Dutch companies interested to enter the Mexican automotive industry are identified:

- Innovation and solutions to support the transition to becoming an advanced manufacturing hub, Research and Development
- Supply to Tier 2 suppliers and lower Tiers, both traditional and advanced manufacturing solutions
- Customization of vehicles
- Light weighting and sustainability
- Market share for European truck brands and heavy vehicle supply chain

Regional opportunities include the state of Guanajuato, specifically for suppliers to Tier 1 suppliers and lower. Queretaro holds opportunities in the heavy vehicle segment, Tier 1, 2 and 3 suppliers, and R&D activities. In San Luis Potosí, there are possibilities for services targeted at the numerous OEMs, while the area around Jalisco has set out to become Mexico's EV hub. Opportunities for partnerships in the fields of research, development, and innovation exist. Puebla is favored by particularly German automakers and emphasizes on sustainability. Some OEMs and Tier 1 suppliers execute R&D in Mexico City and the State of Mexico. Traditionally, the Northern States has been the preferred destination for the industry, due to its proximity to the US border. Chihuahua and Nuevo Leon have numerous research and engineering centers. Opportunities exist in the areas of local tooling production and quality forged components, strong metal sintering capacities and local production of molds for plastic technologies.

Although Mexico is not an innovation leader, but rather a follower, experts agree that the country has the potential to become the leader in Industry 4.0 in Latin America. The electrification trend, although currently in premature stages, will shape the automotive industry in the coming years, as OEMs are announcing plans for electric vehicle production in Mexico. CASE vehicles are the future, creating demand not only on the production and innovation side, but also in related fields such as specific R&D and a nation-wide EV charging system infrastructure and associated technologies.

In Mexico, The Netherlands is perceived as a reliable and innovative partner that offers high-quality solutions. Dutch companies can benefit from this privileged position. Before venturing into a new project, it is wise to execute a thorough investigation. Mexico is a large country with an extensive and growing automotive industry and understanding local and regional dynamics is pivotal for success. Experts advise to look for partnerships with established companies in Mexico, and to incorporate Mexican employees in your teams. Identify what drives your customer and adapt your offer to local demands. Choose a location that is in proximity of your (potential) clients and consider logistics. Establishing a solid network is key to success. Holland House Mexico, the bilateral Chamber of Commerce, can help you set up shop and introduce you to companies in the Mexican automotive industry.

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Introduction

The Automotive industry in Mexico represents the second most important economic sector in the country after the food sector and accounted for roughly 3.8% of Mexico's GDP in 2019. Worldwide, Mexico is the 6th car manufacturer, producing close to 4 million vehicles in 2019 and exporting over 85 percent. The production value of light vehicles, auto parts, heavy vehicles, bodyworks, and trailers together accounted for US\$143.3 billion last year.

A skilled labor force at low costs, Mexico's proximity to the United States of America (US), the tight relations between the two countries -and Canada- under the North American Free Trade Agreement (NAFTA), and its strategic geographical location make Mexico a highly-attractive manufacturing and automotive destination. With the approved United States-Mexico-Canada agreement (USMCA) entered on July 1, 2020, vehicle manufacturing in Mexico becomes even more attractive as the demand for Regional Value Content (RVC) increases.

Furthermore, over the past decade, Mexico has created an attractive production climate for vehicle manufacturers from Asia and Europe seeking to sell to the US, as well. Mexico has more free trade agreements than its neighbors, with Canada having relatively few other trade agreements in place. The US has about 20, whereas Mexico has 45 agreements in place that provides its exports preference in a wide range of consumer markets around the world, including the European Union, in its entirety, and Japan. The recent ratification of the Free Trade Agreement EU-Mexico only reinforces this position. Needless to mention, the trade war between the US and China is likely to attract more Chinese investment for auto parts production to North America. Hence, the arrival of more Chinese companies to Mexico, and more business, is in sight.

Meanwhile, industry experts agree that Mexico's automotive industry is about to enter a new era. For the coming decade, experts foresee that particularly armoring, digital aftermarket, telematics, and logistics are emerging segments. Sustainability, industry 4.0, digitalization and automatization of processes will become continuously more important for the sector. It is likely that the COVID-19 contingency will catalyze a supply chain revolution that was already on its way. Hence, this market research aims to identify opportunities for Dutch companies in this promising and rapidly reshaping industry.

1. Overview of the Mexican Automotive Industry

The year 2020 marks the end of a decade for the Mexican automotive industry. Production records were beaten, sales peaks were reached, and a product cycle came to an end. As the cycle slows down, the industry has moved from less than 3 percent of Mexico's GDP in 2010 to contributing 3.8 percent, totaling 980,000 direct jobs.

1.1 History and industry development analysis of the past decade

Over the past decade, the Mexican automotive industry became one of the largest players in the world (Mexico Business Publishing, 2020). Records were beaten year after year and the economic cycle saw growth and stability. Now, the sector is entering a new global era in which innovation is crucial for players to evolve and thrive, turning challenges into opportunities.

Mexico's automotive industry has historically relied on its neighbor and largest trade partner the United States. An industry leader in automotive manufacturing since the early 1900s, companies such as Ford Motor Company, General Motors and Chrysler have become key world players. The evolution of technology and design innovation have led many brands to move part of their supply chain to Mexico where they can still be competitive in the market at a more cost-effective and efficient rate. (IVEMSA, 2019).

Ford Motor Company has benefited from nearshoring in Mexico since its early stages of production. In 1925, Henry Ford built the first auto manufacturing facility in Mexico. Ford's competitors Chrysler and GM followed suit and begun setting up assembly lines in Mexican territory less than a decade later. Other foreign automotive manufacturers, including Nissan and Volkswagen, joined in by the mid-1960s and opened up factories of their own. By the 1980s, Mexican built vehicles were of inferior construction due to outdated factory equipment. This urged the Mexican government to implement new policies to encourage US automotive manufacturers to open better-equipped facilities with more modern updates that were situated closer to the US/Mexico border. A decade later, The North American Free Trade Agreement (NAFTA) shaped the industry even further.

In 1994, NAFTA was signed by the US, Mexico, and Canada to enable smoother, more efficient, and cost-effective border trade between the three countries. The agreement led to higher investments from Original Equipment Manufacturers (OEMs) to install advanced equipment and technology, allowing factories in Mexico to become of comparable standards as those in Canada and the US (IVEMSA, 2019).

Meanwhile, IMMEX program, or *Decreto para el Fomento de la Industria Manufacturera Maquiladora y de Servicios de Exportación* in Spanish, was updated in 2006 from the former maquiladora program. That is, a *maquila* operation under the IMMEX program is a Mexican subsidiary wholly owned by a foreign parent for contract manufacturing purposes in Mexico. The program allows a company to import equipment, machinery, raw materials, and semi-finished

goods into Mexico duty-free, perform value-added operations, and export the goods back abroad, and, if desired, sell a percentage of goods in Mexico. (Tetawaki, 2017).

DISTRIBUTION OF AUTOMOTIVE FDI (1999 - 3Q19)

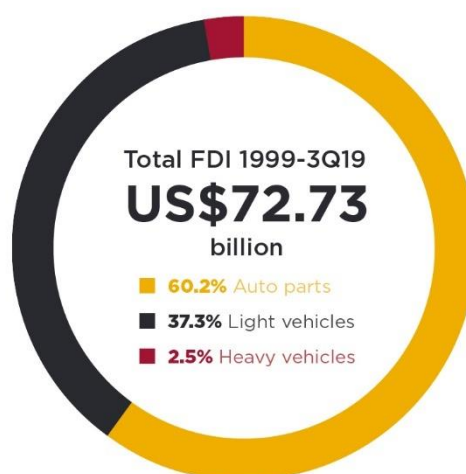


Figure 1. Mexico Business Publishing (2020). Distribution of Automotive FDI from 1999 to the third Q of 2019. Mexico Automotive Review 19/20.

Since NAFTA's ratification in 1994, the Mexican automotive industry has experienced sustained growth in terms of Foreign Direct Investment (FDI). From 1999 to 2019 (3Q), it accumulated a total of US\$ 72 billion. In Figure 1, the FDI distribution of the three top big categories is shown: auto parts, light vehicles, and heavy vehicles.

Regarding political terrain and beyond diplomatic relationships, treaties with specific chapters with emphasis in trade regulations, like NAFTA and other agreements such as the Economic Partnership Agreement (EPA) with Japan, have directly influenced the development of the industry these last 10 years. Since EPA's establishment in 2005, with most of the growth identified between 2014 and 2019, the number of Japanese companies in Mexico reached 1,200. This includes automakers, automotive parts suppliers, logistics and construction companies, and banks.

Back in 2010, with the collateral effects of the Great Recession of 2008, Mexico was a small player in North America: there were only seven OEMs in the country and the total national sales of the year did not surpass one million units. In the past 10 years, however, significant growth in the Mexican automotive industry was achieved year after year. In figure 2, production and export levels are shown from 2015 to 2019 where the automotive industry reached its peaks in both light- and heavy vehicles. The decline starts to be visible after 2017. Yet, in 2019, Mexico doubled its exports to the US, replacing Canada's position by becoming the second-largest exporter to the US, just after Japan. The production from 2010 to 2019 grew 65 percent, the average annual growth for this specific period was 12.3 percent, representing up to 3.8 percent of the national GDP (Mexico Business Publishing, 2020).

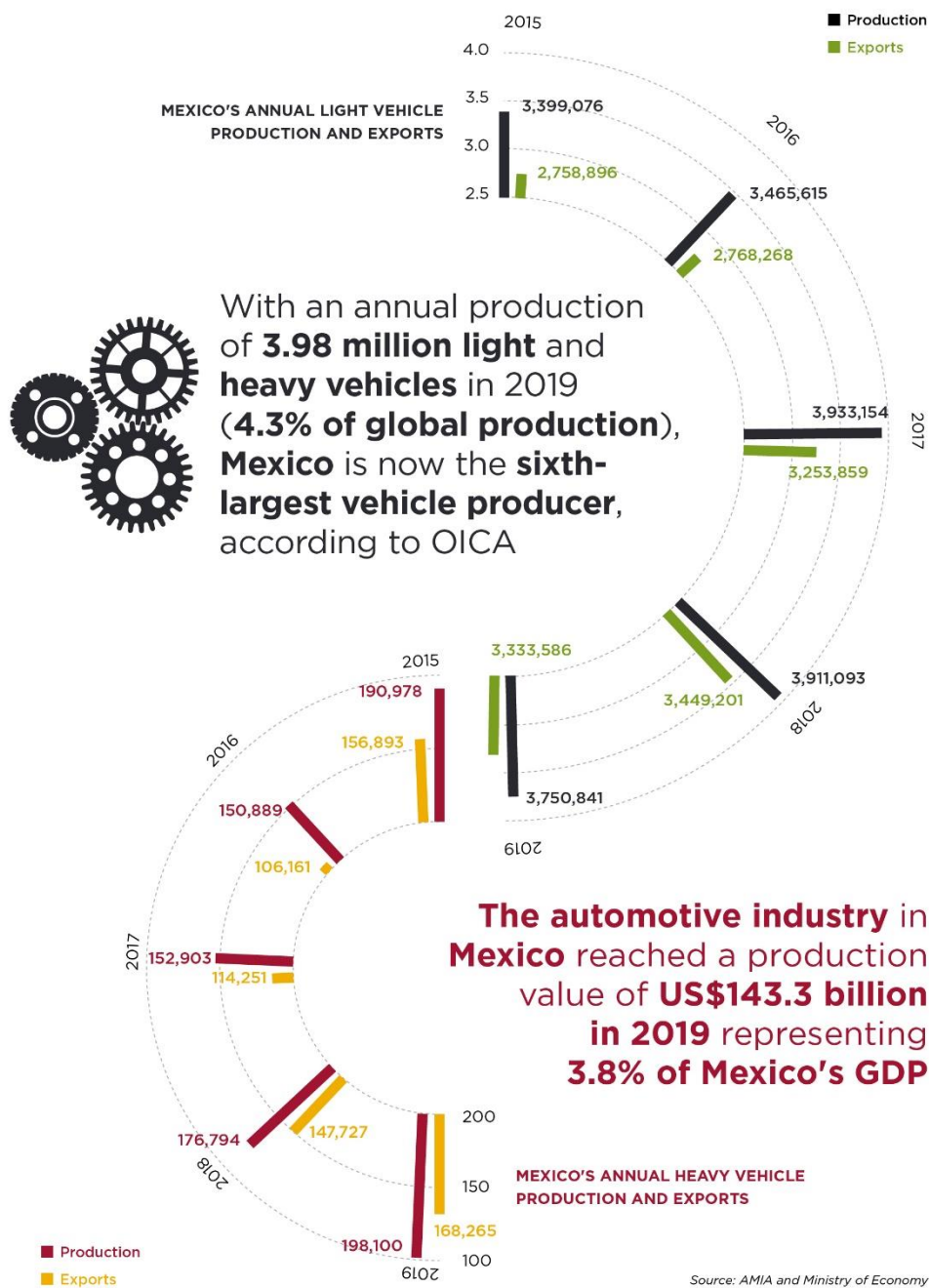


Figure 2. Mexico Business Publishing (2020). Mexican automotive production and exports from 2015-2019 of both light- and heavy-vehicles. Mexico Automotive Review 19/20.

During the past decade, brands such as Mazda, Audi, Kia Motors, Hyundai, Isuzu, HINO, have installed production centers in Mexico. Additionally, key-alliances within the country have been established to ensure and enhance the conditions for long-term investments. An example of this alliance is the creation of the Mexican Cluster Network that incorporates clusters of 11 states with high participation in the automotive industry. The network consists of over 500 companies, including OEMs, Tier 1 and their suppliers.

The growth experience during the last ten years was a combination of a multifactorial scenario: the opening of new manufacturing plants, Mexico's privileged geographic location, and the political and economic position of Mexico in North America; particularly in light of NAFTA/USMCA and regional shifts in manufacturing, sales and aftersales, and R&D in the automotive industry. As the economic cycle concludes, one of the best decades for the Mexican automotive industry has come to an end and new opportunities lay ahead. The COVID-19 pandemic has forced all players and stakeholders to re-think existing value propositions and logistics. The re-build of the industry will be disruptive, as the pandemic sheds light on a new era for the industry.

1.2 Current state and geographic industry distribution

Mexico is the sixth-largest vehicle producer in the world and the largest in Latin America. In 2019, Mexico's automotive sector accounted for 3.8 percent of the country's GDP, up 0.3 percent compared to previous year (Mexico Business Publishing, 2020). Approximately 88 percent of Mexico's vehicle production is for export. The US is Mexico's largest export destination, with 87 percent of Mexico's auto parts production shipped to its North American neighbor (International Trade Administration, 2019).

After a production peak in 2016, Mexico's automotive industry's performance leveled off in the years after, to reach 3.75 million light vehicles and 198,100 heavy vehicles produced in 2019. In the same year, the total production value amounted to US\$143.3 billion, of which 44.2 percent represented light vehicles and auto parts reached a 39.92 percent share of the total production value (Mexico Business Publishing, 2020). Figure 3 shows a breakdown of the industry's segments and their value share.

MEXICO'S AUTOMOTIVE PRODUCTION VALUE IN 2019

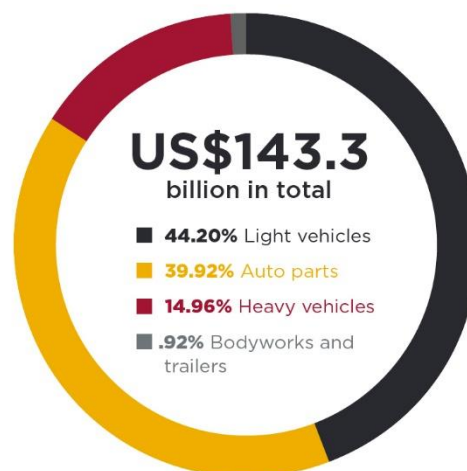


Figure 3. Mexico Business Publishing (2020). Mexico's Automotive Production Value in 2019. Mexico Automotive Review 19/20

Light vehicle industry companies have a total of 18 production facilities located in 11 states of Mexico. Currently, over 48 car and light truck models are produced in Mexico. In terms of heavy vehicles, OEMs have reached an important development level in Mexico, producing a wide range of models to satisfy domestic and export market demand. Currently, 11 commercial vehicle manufacturers and two engine manufacturers for this type of vehicle have facilities in Mexico (Marklines, 2020). Mexico's automotive industry, consisting of a total of 21 OEMs and over 500 Tier 1, 2 and 3 suppliers, can be geographically distributed over roughly seven states and regions (Tetakawi, 2020).

Automotive OEM Assembly Plants in Mexico



Figure 4. Tetakawi (2019). Automotive OEM Assembly Plants in Mexico. Retrieved from <https://go.tetakawi.com/hubfs/Tetakawi%20-%20Map%20of%20Automotive%20Assembly%20Plants%20in%20Mexico.pdf>

Guanajuato

The state of Guanajuato is the epicenter of Mexico's automotive industry and is located in the Central Bajío Region, the heart of Mexico's manufacturing industry. Guanajuato is one of the largest automotive hubs in the Americas in OEM operations and the largest in Latin America. With a favorable location and available work force, Guanajuato's automotive industry received US\$6.18 billion worth of Foreign Direct Investment (FDI) between 1999 and 2019. Of this figure, US\$2.37 billion was allocated for vehicle production, whereas US\$3.81 billion was invested in auto parts production. Six light vehicle OEM manufacturers and one heavy OEM plant are situated in this region, which saw an average annual growth of 44.8 percent of (FDI) in auto parts and vehicle manufacturing in 2010-2019. In recent years, the state has faced challenges from higher land costs and insecurity. These factors, however, have not undermined employment growth in the manufacturing sector (Mexico Business Publishing, 2020).

VEHICLE PARK SIZE IN 2018

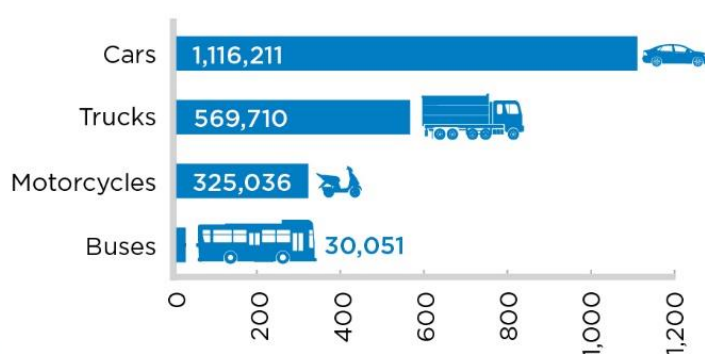


Figure 5. Mexico Business Publishing (2020). Guanajuato's Vehicle Park Size in 2018. Mexico Automotive Review 19/20

Guanajuato foresees a more digitalized automotive industry. The Ministry of Economic Sustainable Development of the State of Guanajuato is trying to anticipate the arrival of autonomous vehicles by attracting investments in electricity generation and talent development. In an effort to improve the ecosystem for all companies, the state's government has shifted its focus from attracting OEMs to boosting the operations of local companies by providing tools that improve their competitiveness and enhance supplier base accessibility.

Guanajuato is characterized by its connectivity in terms of logistics and infrastructure. The state's location in the heart of Mexico means it has access to the country's main ports. Altamira, Veracruz and Tampico on the Gulf Coast and Manzanillo and Lazaro Cardenas on the Pacific Coast, are located less than 600km from Celaya, Guanajuato's automotive center. Celaya is also home to one of the few Mexico's railway intersections. In addition, two of Mexico's most important highways, the 45 and 57, run through the state (Mexico Business Publishing, 2020).

Querétaro

The state of Querétaro, also part of the Bajío Region, is a leading automotive technology hub and is home to three heavy OEM plants and over 100 Tier 1 companies, many of which have R&D and engineering centers at their local factories. Light vehicle OEM plants are scarce in Querétaro, with VUHL, a Mexican sportscar brand, being the only one of its kind (Mexico Business Publishing, 2020).

Auto parts manufacturing in the state has seen US\$1.17 billion worth of FDI since 2015. Engineering operations have been deployed in the state by top Tier 1 companies, such as Brose and Continental. Establishing partnerships with local engineering centers and universities is fundamental for R&D minded companies. This is highlighted by Continental's collaboration with 13 universities in Querétaro. Continental operates R&D centers in Querétaro and Guadalajara, both aimed at the development of technologies for the car of the future. Education and infrastructure are among the priority policies for the state government. The strategy has seen success considering that close to 3000 engineers graduate from local universities each year (Mexico Business Publishing, 2020).

The state is located favorably for Tier 1, 2 and 3 suppliers to support OEM operations in both Guanajuato and San Luis Potosi (Tetakawi, 2018). Querétaro is member of the Western-Bajo-Center Alliance, together with the states of San Luis Potosi, Guanajuato, Jalisco, and Aguascalientes. The objective of the partnership is to maintain Mexico's economic growth exceeding 4.4 percent through collaboration in infrastructure, security, safety, and quality of life. The region accounts for 17 percent of Mexico's GDP and is home to over 20 million people (Mexico Business Publishing, 2020).

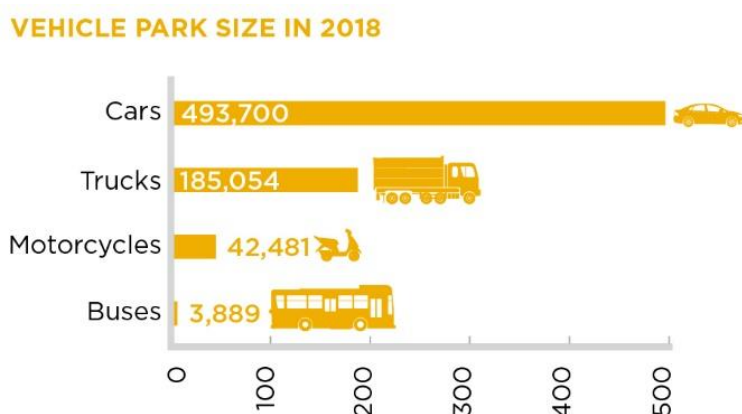


Figure 6. Mexico Business Publishing (2020). Querétaro's Vehicle Park Size in 2018. Mexico Automotive Review 19/20.

Querétaro is characterized by being a strategic zone for the tooling market. Tier 2 suppliers have invested in their in-house tool shops and the state has maintenance, production and re-engineering hubs for molds and dies.

San Luis Potosí

San Luis Potosí's automotive industry, consisting of light-vehicle OEMs, heavy-vehicle OEM Cummins and 235 suppliers, is one of the fastest growing states in the region. San Luis Potosí received US\$1.9 billion worth of FDI in auto parts and vehicle manufacturing between 2015 and 2019, representing an annual 46.8 percent growth rate. With US\$861 million, 2018 saw the highest levels of FDI in San Luis Potosí yet. However, a contraction in 2019 brought this number down by 59.4 percent to levels last seen in 2016. The US, Germany and Spain are the main foreign investors in the state, which in addition to attracting FDI, aims at establishing the country's best tooling centre in cooperation with public and private research centers (Mexico Business Publishing, 2020).

VEHICLE PARK SIZE IN 2018

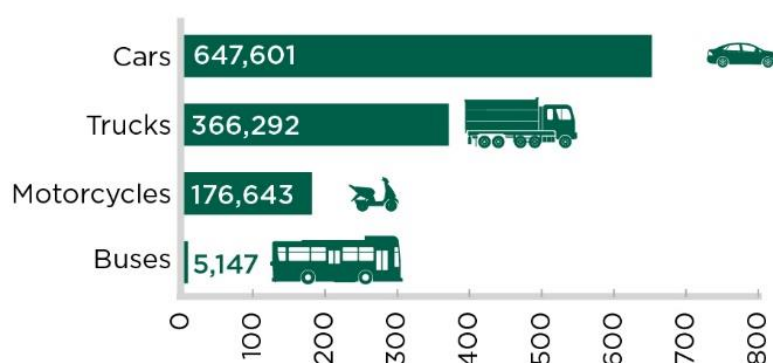


Figure 7. Mexico Business Publishing (2020). San Luis Potosí's Vehicle Park Size in 2018. Mexico Automotive Review 19/20

Within the state, the private and public sectors have a shared vision about sustainable development. New investments developments should consider social and environmental factors, next to economic growth.

San Luis Potosí State Government is in the process of developing a tooling centre in collaboration with public research facility Center for Advanced Technology (CIATEQ). A partnership between Mexican Ph.D. graduates and Portuguese investors, the aim of the collaboration is to implement best practices from Portugal in terms of tooling.

Opportunities for European companies are to be found with the OEMs Kia, BMW and GM and their large growth in San Luis Potosí. Furthermore, San Luis Potosí is characterized by its 8,000km road network, 1,200km of railways, and two airports.

Western States

This region includes the states of Aguascalientes, Jalisco, and Zacatecas. Together, these states account for 11 percent of Mexico's FDI in the automotive industry. Between 1999 and the third quarter of 2019, US\$7.98 billion was invested in the region by foreign businesses. This has resulted in the arrival of 13 global Tier 1 suppliers and the development of Mexico's main technological hub (Mexico Business Publishing, 2020).

Aguascalientes is home to Nissan, Mexico's second-largest producer and an important player for international and local Tier partners in the state. The role of Nissan and its home country Japan in Aguascalientes is pivotal. Japan is the state's largest foreign investor. Between 1999 and the third quarter of 2019 US\$5.46 billion was invested, the majority of which was invested by Nissan (Mexico Business Publishing, 2020).

Neighboring state Jalisco has the potential to be Mexico's EVs hub, according to Governor Enrique Alfaro. The state is also known as 'the Mexican Silicon Valley' and houses approximately 600 technology companies, including IBM, Intel and Oracle, and has 78,000 IT specialists (Mexico Business Publishing, 2020). The region has several public R&D centers focused on IT, as well as a 4.0 Industrial Cluster with approximately 20 companies that work together on topics such as artificial intelligence, IoT, Big Data, and 3D printing. Jalisco has the potential for Connected, Autonomous, Shared and Electric (CASE) vehicles and the government has set ambitious goals for boosting the use of EVs. The state government and the Jalisco Automotive Cluster joint forces to launch an EV supply chain initiative. Automotive suppliers, such as Aisin, Continental and Bosch, are active in the territory and supply an estimated 20 percent of Tesla's components (Mexico Business Publishing, 2020).

Compared to Aguascalientes and Jalisco, Zacatecas is an emerging state in Mexico's automotive industry and is solely focused on auto parts manufacturing. The state is home to 27 automotive companies, divided over Tier 2 and Tier 3 companies and a few Tier 1s. FDI amounted to US\$0.46 billion between 1999 and 2019 (Mexico Business Publishing, 2020).

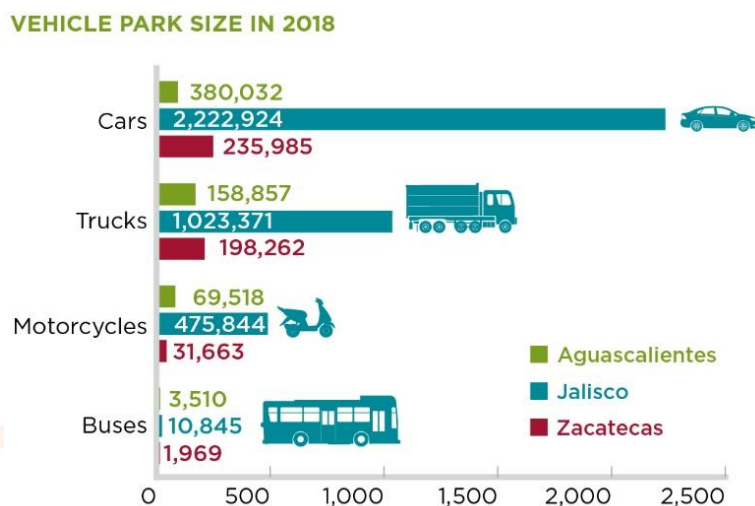


Figure 8. Mexico Business Publishing (2020). Western States' Vehicle Park Size in 2018. Mexico Automotive Review 19/20

Puebla & Tlaxcala

These two states, located in central Mexico, are home to OEMs Volkswagen, Audi, and Zacia. Automotive FDI received in this region amounts to 8.9 percent of total investments received in the national industry since 1999. The region has seen dramatic growth during the past 10 years, with an annual average growth of 226.3 percent and total FDI levels standing at US\$6.50 billion in the period 1999-2019 (Mexico Business Publishing, 2020).

Both states are characterized by their robust manufacturing arms, which have a pivotal role in the industry's supply chain and increased their attractiveness in terms of FDI. The supplier base serving the international OEMs operating in the region, consist mostly out of foreign Tier 1 companies and to a lesser extent local suppliers (Mexico Business Publishing, 2020).

In 2019 in Puebla, automotive production tumbled by 14.0 percent, whereas exports fell 4.6 percent. In contrast, Tlaxcala received record numbers of FDI. Foreign companies invested US\$293.3 million to push the state to a sixth place as a leading auto parts manufacturer in Mexico.

Germany and the US are the leading countries in terms of FDI contributions to the region. Germany's FDI in Puebla amounts to US\$5.40 billion in the period 1999-2019. In the same period, the US invested US\$4.77 billion in Puebla and US\$1.87 billion in Tlaxcala (Mexico Business Publishing, 2020).

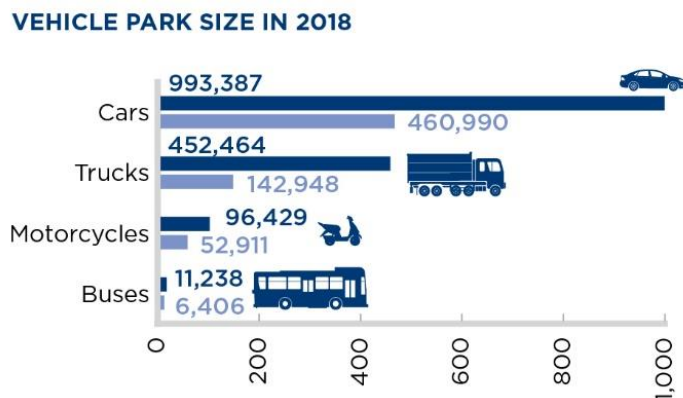


Figure 9. Mexico Business Publishing (2020). Puebla & Tlaxcala Vehicle Park Size in 2018. Mexico Automotive Review 19/20

German automakers Volkswagen and Audi, deliver models from their plants in the region to the US and Europe, and to the entire world, respectively. Audi has a strong focus on sustainability in automotive manufacturing. In August 2019, 50 percent of the carmaker's electricity came from renewable energies and its facilities are waste-water-free. In addition, the OEM uses some of the most advanced robots in Latin America at its Puebla plant. President of Audi Mexico Andreas Lehe, stated: "We want to show that after just five years, Mexico is delivering optimum production costs and quality and that we are prepared to produce more models" (Mexico Business Publishing, 2020).

Mexico City & State of Mexico

Mexico City is home to the headquarters of OEMs and industry associations, as well as to the largest domestic market for vehicle sales, accounting for 18.8 percent of the market in 2019. The State of Mexico houses light vehicle manufacturers GM, Ford and FCA and two heavy vehicle OEMs: Daimler and Isuzu. Light trucks are also produced in the state with plants owned by Volvo, GM, Fiat, Ford, and Chrysler (Mexico Business Publishing, 2020).

The automotive industry is responsible for 9.2 percent of the state's GDP, which is accumulated through the efforts of a total of 286 companies and 56,137 employees. Between 1999 and 2019 Mexico City and the State of Mexico saw FDI levels rise to US\$9.09 billion, which represents a 12.5 percent share of Mexico's automotive industry (Mexico Business Publishing, 2020).

The region is home to 10.8 million cars and 1.3 million trucks. Figure 10 shows the vehicle park size.

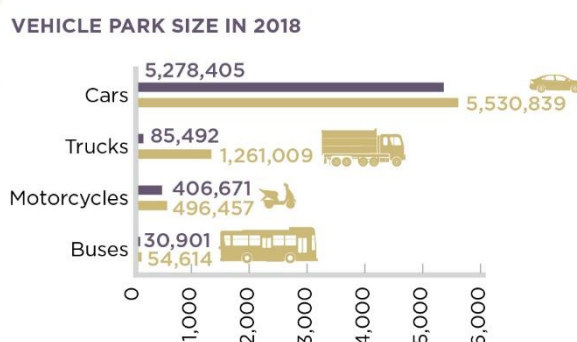


Figure 10. Mexico Business Publishing (2020). Mexico City and State of Mexico Vehicle Park Size in 2018. Mexico Automotive Review 19/20

Innovation and Industry 4.0 are also key topics in Mexico City and the State of Mexico. The Autonomous University of the State of Mexico is using 3D design and simulation software for its academic community to master the Industry 4.0 language. The region is also adopting engineering and technology development. Nissan and Ford's engineering centers are located in the region and DuPont has R&D teams in Toluca and Mexico City. Ford halted production at its Cuautitlan facility in order to refurbish the plant to produce 100,000 EVs in the next years. According to Juan José Zaragoza, Mexico Business and Country Leader of DuPont Transportation and Industrial, this translates into opportunities for solutions to improve resource management. "The industry needs to reduce total production costs, which requires improvements in processes, manufacturing and logistics," Zaragoza concludes (Mexico Business Publishing, 2020).

Northern States

Chihuahua, Coahuila and Nuevo Leon together form a region that received 36 percent of Mexico's total FDI since 1999. The Northern States are home to 10 OEMs, of which 9 are located in the Ramos-Arizpe - Monterrey corridor. Ford is the exception and has an engine plant in Chihuahua city. 81 Tier 1 suppliers have their operations in the region, including companies such as Mahle, Lear and Adient. In September 2019, the region employed approximately 439,150 employees and the total of workers in the manufacturing industry of the three states is higher than in any other state. The region is strategically located to supply the US auto industry and offers logistics advantages, with the US-Mexico border only a few hours away. Data from INA shows that out of all vehicles assembled in North America, 70 percent have a component manufactured in Chihuahua (Mexico Business Publishing, 2020).

Chihuahua is home to five research and advanced engineering centers, three research and development parks, and 56 industrial parks spread across the state in seven cities.

The Chihuahua Automotive Cluster has identified areas of opportunity in Mexico Tier 2 supplier base related to quality forged components, strong meta sintering capacities and local production of molds for plastic technologies. Currently, Mexico still imports large volumes of sensors and robotic equipment, but there is room for local players to develop the technologies (Mexico Business Publishing, 2020).

In Nuevo Leon, The Automotive Cluster of Nuevo Leon (CLAUT) has an innovation centre at the state's Autonomous University. Four universities in the state have embraced Industry 4.0 as part of their programs.

CLAUT identified opportunities in tooling equipment. Mexico currently imports over US\$2 billion worth of tooling components, whereas a mere 5 percent is produced locally. In a response to this CLAUT set up the Nuevo Leon Tooling Cluster, an initiative that brings together key players in the tooling equipment segment. In a partnership between the state government and CLAUT, a training center for molds and dies technicians will be created at the Autonomous University of Nuevo Leon (UANL) technical high school. The center is aimed at supporting OEMs and Tier 1 suppliers that adopt in-house tooling models (Mexico Business Publishing, 2020).

Automotive parts and heavy vehicle products

In 2019 Mexico was the fifth-largest auto parts producer in the world. Furthermore, the original equipment market was valued at US\$79 billion and consisted of 2,500 companies in 2019, of which 600 Tier 1 suppliers. More than 30 percent of the auto parts manufacturers active in Mexico are US companies. 49 percent of all auto parts in Mexico are imported from the US and 87 percent of parts produced in Mexico are exported to the US (Export.gov, 2019). Figure 11 depicts the value of auto parts per segment in Mexico.

Distribution of the value of production, according to segment (2020)

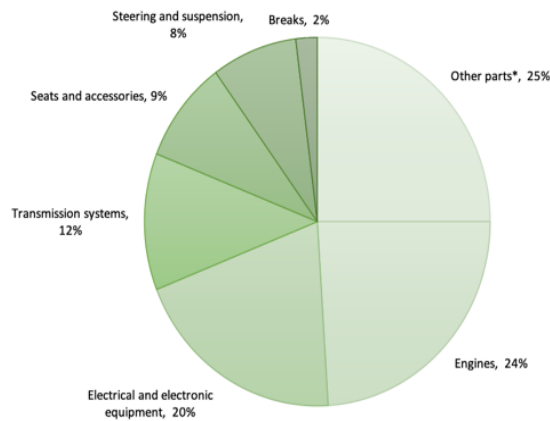


Figure 11. National Industry of Auto Parts (2020). Auto Parts Value per Segment. Perspectives of the Mexican Automotive Industry 2019.

*Other parts include fuel filters, radiators, mirrors, lifts, exhaust pipes, air conditioning systems and other vehicles parts.

Apart from auto parts production, Mexico also has a track-record in heavy and specialized vehicles and parts manufacturing. The country is the fifth-largest manufacturer of this type of vehicles and the sector is focused on tractor-trailers, specialty commercial vehicles, and passenger buses. In the global trucking industry, Mexico is the leading exporter of tractor-trailers, with 58 percent of its exports in transportation vehicles consisting of tractor-trailers. Mexico accounts for 35 percent of the commercial vehicles built in North America, including trucks. Major global manufacturers of tractor-trailers, such as ISUZU, MAN, SCANIA and Volvo, have their facilities in Mexico (Export.gov, 2019). In terms of trucks, Mexico has traditionally been the stage of American brands with long-nosed trucks, however, European brands and their cab-over vehicles are expected to quickly gain market share. The market share of European trucks in Mexico in 2020 is 4 percent. This number is expected to increase to 20-30 percent by 2025, according to Enrique Enrich, Managing Director of Scania México (Mexico Business Publishing, 2020).

In terms of specialized vehicles for the construction and agriculture industries, Mexico also ranks fifth worldwide and exports approximately US\$550 million worth of equipment and machinery to its main markets including the US, South Africa, and Switzerland. John Deere and Caterpillar are the dominant players in Mexico with more than 200 dealers across the country (Export.gov, 2019).

The production of passenger buses has a long tradition in Mexico and is exemplified by the presence of manufacturers as Volvo Autobuses, Mercedes-Benz Autobuses, Scania Autobuses, MAN Latin America, and Isuzu Motors Mexico. The main export destinations for Mexican-built passenger buses include Guatemala, Argentina, Chile, Paraguay, and South Africa (Export.gov, 2019).

Manufacturers of heavy vehicle are situated mainly in northern Baja California, Coahuila, Nuevo Leon, San Luis Potosi, Guanajuato, Queretaro, and Hidalgo.

Repair and replacement aftermarket

Data from the Mexican Aftermarket Industry Association (ARIDRA) showed that the aftermarket industry in Mexico was worth US\$28.5 billion in 2019. There are approximately 32.2 million vehicles active in Mexico with model years ranging between the period 1965-2018. On average, Mexican consumers keep their cars for 15 years. (ARIDRA, 2020). Opportunities include passenger vehicles, SUVs, minivans, pick-ups, and commercial vehicles. Mexico's aftermarket is characterized by a price-driven industry with e-commerce still in its infancy but with promising growth.

With approximately 120 million inhabitants, the aftermarket has vast growth opportunities, says Eduardo Tamer, General Director of Mikel's in an interview with Mexico Business Publishing. Digitalization in the aftermarket is vital for manufacturers and retailers, who will be able to expand operations to other regions and experience efficient operations by adopting digital sales channels, says Tamer. Digitalization in the aftermarket also provides opportunities to large spare-parts distributors.

Armoring

An emerging segment in Mexico's automotive landscape is that of armoring. In an interview with Mexico Business Publishing, Esteban Hernández, President of AMBA, stated that austerity policies by the Mexican government have impacted the segment, which is traditionally focused on executives, diplomats, and government officials. However, a drop in security levels in Mexico has actually made the segment grow (Mexico Business Publishing, 2020).

COVID-19

COVID-19 has had a profound impact on the industry. Production and exports were heavily affected in the spring of 2020. Social distancing and sanitary measurements forced OEMs in Mexico to shut down production in March 2020. Between January and May, light vehicle production fell by 43.3 percent to a 56.8 percent level compared to the same period in 2019. Exports and national sales were affected as well, plummeting 42.5 percent and 30.0 percent, respectively. Figure X displays Mexico's export, sales and import of light vehicles between 2014 and May 2020.

The global economic recession in 2018 and a declining national market, caused Mexico's GDP to contract 0.1 percent in 2019. In 2020, COVID-19 is likely to further affect the economy anywhere between 4.6 and 8.8 percent, depending on the duration of the pandemic and the moment when economic recovery kicks in.

Mexican light vehicle production, export, sales and import (Units)

	2014	2015	2016	2017	2018	2019	Jan.-May 2019	Jan.-May 2020
Production	3,219,786	3,399,076	3,465,615	3,932,119	3,908,139	3,750,841	1,643,766	934,234
Export	2,642,887	2,758,896	2,768,268	3,102,604	3,449,201	3,333,586	1,426,343	822,246
Export / Production	82.1%	81.2%	79.9%	78.9%	88.3%	88.9%	86.8%	88.0%
Sales	1,135,409	1,351,648	1,603,672	1,530,317	1,421,458	1,317,734	533,748	373,608
Import	600,614	717,668	886,842	906,620	929,871	863,453	353,440	232,068
Import / Sales	52.9%	53.1%	55.3%	59.2%	65.4%	65.5%	66.2%	62.1%

Source: Mexican Auto Industry Association (AMIA), Instituto Nacional de Estadística y Geografía (INEGI)

Notes:

1. Production volume represents the total number of passenger cars and light trucks. This number does not include the production and export volumes of Daimler's COMPAS Plant (a joint venture between Nissan and Daimler).
2. Sales volume represents retail sales figures, including imported cars. It reflects the total number of passenger cars and light trucks, as well as a certain portion of medium and heavy duty commercial vehicles.

Table 1. Mexican light vehicle production, export, sales and import. Source: Marklines, 2020.

Mexico's manufacturing operations restarted on May 12 after the industry was determined as an essential sector. Some OEMs were forced to postpone reigniting their production until the end of May and VW's production facility in Puebla restarted production mid-June. Despite Mexico's production being resumed later than in the US and Canada, the sector recovered quickly. An article from 06 August 2020 in *El Economista* (González, 2020), a leading economic newspaper in Mexico, concluded that the automotive industry in Mexico shows figures of full activation in July 2020 after production drops in April and May. Óscar Albin, president of National Auto parts Industry (INA) stated that the market is responding, "We believe that we will be able to meet forecasts and reach the production levels of last year".

1.3 Industry dynamics

Production and export dynamics

The Mexican automotive industry experienced a boom between 2010 and 2019. The arrival of seven new OEMs and numerous suppliers in their slipstream, pushed production levels up by 66 percent and led Mexico consolidating its spot as second-largest vehicle supplier to the US. Total production of light and heavy vehicles reached 3.98 million in 2019 (Mexico Business Publishing, 2020). Figure 2 (in 1.1) shows the production and export cycle of heavy and light vehicles during the period 2015-2019. It clearly indicates that the Mexican automotive industry is at the end of a sales cycle. 2019 also marked a slowdown in national automotive sales as investments dropped due to international trade conflicts.

Domestic vehicle sales in 2019 dropped by 7.7 percent compared to 2018. Nissan and GM kept their places as the two top sellers, with 268,156 and 211,987 units sold, respectively. Volkswagen (143,649 units), Toyota (105,663 units) and Kia (95,539 units) complete the top 5 (Mexico Business Publishing, 2020).

Mexican passenger cars have experienced weakening demand from the US since 2018. This is caused by a shift in demand from US consumers, who prevail SUVs and pick-ups over the compact cars built by Mexican automakers (Global Markets International, 2019).

Approximately 88 percent of Mexico's vehicle production is destined for export. The US is Mexico's largest export destination, with 79.3 percent of light vehicle production and 87 percent of Mexico's auto parts production shipped to its North American neighbor (International Trade Administration, 2019). In 2019, Canada and Latin America accounted for 6.6 percent and 6.1 percent of Mexico's light vehicle production exports, whereas 6.1 percent was destined for Europe. In 2019, GM's Mexican plants exported 95.8 percent of its light vehicles. In the same year, Nissan's total exports amounted to 66.7 percent. Appendix IV demonstrates Mexico's light vehicle production and export by OEM and Appendix V depicts vehicle export by destination.

OEMs, suppliers, and dealerships

The relationship between OEMs and Tiers in Mexico is dynamic. Tier 1 suppliers sell directly to OEMs, while Tier 2 suppliers sell directly to Tier 1 suppliers, and Tier 2 to Tier 3. "However, sometimes a firm may be a Tier 1 supplier to one company and a Tier 2 supplier to another company or supply different Tier levels with different product lines," says Commercial Specialist Monica Martínez, U.S. Embassy in Mexico City (Industry Week, 2016). Essentially all large decisions by the OEMs, including for example strategic and audit decisions, are taken at the central entity of these manufacturers in their home countries. OEMs are trying to decentralize decision-making by establishing certain centers for R&D and excellence for certain platforms. However, progress in this matter is slow. Tier suppliers follow the OEMs, which is the nature of the business (Van Eck, M.; Meyer, R. (2020, 09, 09). Personal communication. Appendix I).

In terms of where OEMs source their car parts, manufacturers in the Bajío area usually rely either on imported parts from far away, or locally sourced parts close by (Tetakawi, 2018). OEMs typically prefer suppliers located close to the production plants in order to optimize just-in-time or just-in-sequence deliveries while minimizing inventory volumes. Providers are required to be ISO and TS certified to comply with OEM procurement policies. Among the most exported items are automotive parts for components for Tier 2 companies. However, according to Export.gov: “opportunities exist for production machinery and equipment, materials, pre-assembled components, molds and tooling, cutting tools, automation process equipment, raw materials, engineering and design, finished parts, and accessories sold through local representatives or distributors” (Export.gov, 2019).

Auto parts manufacturers support OEM operations in other states. For example, Queretaro is located favorably for Tier 1 and 2 suppliers to support OEM operations in both Guanajuato and San Luis Potosi, says Daniel Hernández, General Director of Queretaro Automotive Cluster. Queretaro’s auto parts manufacturers support the assembly lines of BMW and Toyota in the neighboring states of San Luis Potosi and Guanajuato (Mexico Business Publishing, 2020). For example, BMW’s local operations in Mexico are supplied by Brose El Marques plant in Queretaro and each vehicle produced by the BMW Group contains a component sourced from one of the manufacturer’s 220 Mexican suppliers, resulting in a local supplier base that traded US\$2.5 billion worth of value. Asian OEMs are mainly supplied by Asian companies. “The way to overcome this barrier is to deliver cutting edge technology,” says Manuel Guevera, General Manager Queretaro of Brose Mexico’s El Marques plant. Innovation and new developments, together with an Industry 4.0 focus, will aid companies with this challenge (Mexico Business Publishing, 2020).

Tier 1 suppliers, such as Continental, search for partners that have their focus on the development of value-added capacities such as computer science, IT systems, and artificial intelligence. “We look for ways to either acquire these companies or to collaborate with them to generate value for our operations. If Mexican suppliers want to be part of the industry’s transformation, they should be looking for ways to contribute something that does not exist in the global market and that OEMs and suppliers are looking for,” says Jorge Vazquez, R&D Center Director of Continental Automotive

On the dealership side, distributors apt for bundling several OEM brands into their portfolio or choose exclusive partnerships. Grupo Surman and Grupo Uribe, two Mexican dealerships, distribute brands ranging from Ford, BMW, Audi and SEAT, as well as heavy-vehicle truck brand Hino in the case of the latter dealership. Mexican EV brand Zacia and the Italian Tazzari, are sold through digital platform Fast Car. The digital dealership has concessions with the two EV brands, which are only distributed through Fast Car. This type of direct concession from an OEM is the first of its type in Mexico and Latin America. Leasing and online sales are becoming widespread in Mexico for the sale of new and used vehicles. KAVAK and Mercado Libre are market leaders in the online vehicle sale segment (Mexico Business Publishing, 2020).

The role of OEMs in Mexico

“OEMs dictate what is happening in Mexico, and their strategy is to serve the world market. OEMs, such as Volkswagen, are looking into the possibilities to put in place strategies to start with R&D in the US and Mexico, rather than only in Germany. Whether or not this will actually happen, depends on the ability of implementing the required processes and the presence of suppliers that offer fitting technology and innovation. The latter is where Dutch companies can come in.”

– Marcellus van Eck, Head of the German Business Center at EY & Raul Meyer, Partner at EY (Interview Holland House Mexico)

1.4 Identification of main players and stakeholders in the Mexican automotive industry

Mexico is a consolidated and recognized manufacturing hub; many national and international companies are directly or indirectly involved in the processes involved in the automotive industry. Stakeholders have made significant investments in the country in the past, and new investments from particularly OEMs are already scheduled. This translates into an environment with high socioeconomic certainty. At different levels, all stakeholders in the Mexican automotive industry play an important role with specific activities and functions to foster the automotive industry from their own perspectives.

OEMs

Over 40 auto brands are produced in Mexico by established OEMs, in addition to auto parts and accessories production plants. The OEMs and their respective production plants are listed below:

OEM	STARTED OPERATIONS IN MEXICO	LOCATED IN
AUDI	2016	San José Chiapa, Puebla
BMW	2019	San Luis Potosi, SLP
BUICK	1921	Ramos Arizpe, Coahuila
DINA	1951	Ciudad Sahagún, Estado de Hidalgo
FCA(FIAT CHRYSLER AUTOMOBILIES) FORMELY CHRYSLER	1938 (Automex)	Saltillo, Coahuila Toluca. Edo. de México
FORD MOTOR COMPANY	1925	Chihuahua, Chich. Cuautitlán, Edo de México. Hermosillo, Sonora. Irapuato, Gto.
FREIGHTLINER	1969	State of Mexico
GENERAL MOTORS	1935	Ramos Arizpe, Coahuila Silao, Guanajuato. San Luis Potosí, SLP. Toluca, Edo. De México.
HINO	2009	Silao, Guanajuato

HONDA	1995	Celaya, Gto. El Salto, Jalisco
HYUNDAI MOTOR COMPANY	2015	Complejo de Pesqueria, Nuevo León
ISUZU	2011	Cuautitlán, Edo. De México
KENWORTH	1970	Tecate, Baja California
KIA MOTORS	2015	Pesqueria, Nuevo León
MAN	2004	Queretaro, Queretaro
MAZDA	2011	Salamanca, Guanajuato
MERCEDES BENZ Y TRACTOCAMIONES FREIGHTLINER (DAIMLER)	1994	Nuevo León
MERCEDES BENZ-INFINITI	2018	Aguascalientes, Aguascalientes
NISSAN	1966	Aguascalientes, Aguascalientes Cuernavaca, Morelos
SCANIA	1992	Querétaro, Querétaro
TOYOTA	2004	Tecate, Baja California
TOYOTA	2020	Apaseo el grande, Gto.
VOLKSWAGEN	1967	Puebla, Puebla Silao, Guanajuato.
VOLVO	2000	Tultepec, Estado de México

Table 2. Self-elaboration with information of different websites (2020). OEMs in Mexico.

Figure 12 explains market share of the OEMS active in Mexico. Nissan, General Motors and Volkswagen top the list regarding market share in Mexico, due to their production, sales and export activities:

MARKET SHARE OF OEM's IN MEXICO (percentage)

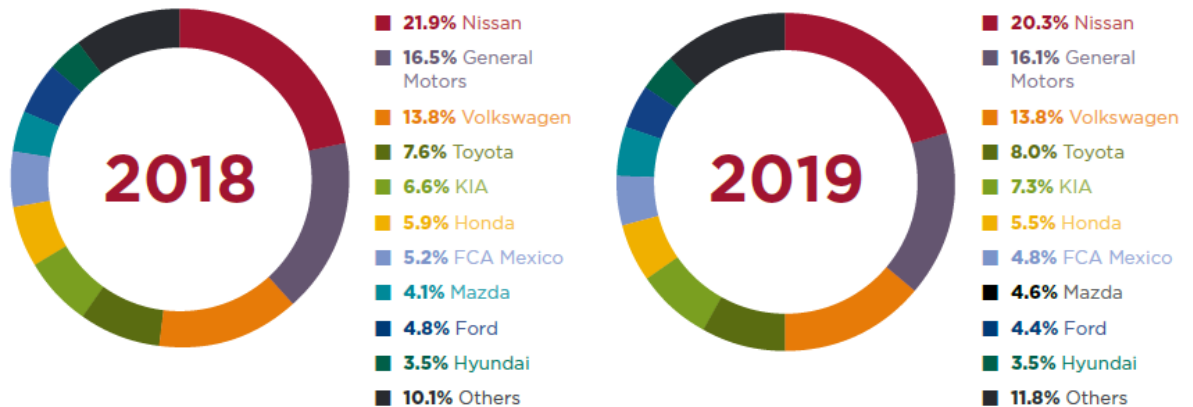


Figure 12. Mexico Business Publishing (2020) Comparison of OEMs market share in 2018 and 2019. Mexico Automotive Review 19/20.

Suppliers

The number of companies involved in the automotive industry supply chain is wide and diverse. According to an online database (Marklines, 2020), there are over 1,500 registered companies as OEMs suppliers in Mexico. Figure 13 shows the distribution of the suppliers. Most of the supply chain activity takes place in the Western-Centre and Northern regions of Mexico:

Location Map



Figure 13. Marklines (2020). Location of the main suppliers of OEMs in Mexico. Retrieved from: https://www.marklines.com/en/supplier_db/#_select_parts_r_62

The Mexican database Directorio Automotriz (Automotive directory) in August 2020, reports 6,167 registered companies. There are 3,990 registered suppliers and 1,835 buyers. It offers a paid service that grants direct and indirect OEMS contacts of component and raw material suppliers, and companies offering manufacturing and process services. Directorio Automotriz has a strategic partnership with the most relevant automotive clusters in Mexico.

Industry clusters

Industry clusters are mainly located in the states of Baja California, Coahuila, Guanajuato, León, Jalisco, Nuevo León, and San Luis Potosí. In general terms, clusters aim to be strategic partners by joining the efforts of OEMs, Tier 1 and 2, universities and research centers, and the government.

Already conformed clusters in Mexico include:

1. Cluster of the Central Region (Puebla & Tlaxcala)
2. Cluster of the State of Chihuahua
3. Cluster of the State of Coahuila
4. Cluster of the State of Guanajuato
5. Cluster of the State of Mexico (interview available in appendix 1)
6. Cluster of the State of Nuevo León
7. Cluster of the State of Querétaro
8. Cluster of the State of San Luis Potosí

One of the most prominent organizations is the National Automotive Industry Cluster Network, which unites the most important clusters. The cluster was created in 2016 comprising the eight clusters listed. The cluster is particularly powerful because it joins regional efforts and agendas into a national network. Together, they represent over 600 companies of the industry.

Within the clusters, there are specialized committees that serve as a platform so that members can discuss ideas or concerns regarding the challenges and/or threats faced by the industry players in order to channel these discussions and sessions to academic and public organizations, and actively coordinate strategies. Manuel Montoya, president of the Automotive Cluster of Nuevo León mentions that clusters should aim at economic integration within their networks. “For example, if a supplier of stamped plastic injection is in Querétaro, he can be a supplier to companies located in Monterrey, those in Monterrey to companies in Guanajuato and vice versa, and so on” (Cluster Industrial, 2019).

A specific example of how strong collaboration through clusters can be beneficial is in the implementation of the rules of origin stipulated in the USMCA agreement. A solid network of suppliers can guarantee the required local percentage of local content when producing the vehicles. This is an opportunity for the clusters to strengthen the positions of their affiliated companies within the supply chain. Among other benefits for the members, the automotive clusters also serve as a starting point for high-quality requirements that companies must meet, particularly those in Tier 1.

Government

The Secretary of Economy (SE) is the Mexican organ entrusted with the country's economic welfare. Their economic promotion strategy is carried out through the Global Economic Intelligence Unit, smaller entities that operate at state and municipal levels; along with the Secretary of Foreign Relations (SRE).

From the Secretary of Communications and Transport (SCT), since 1987 there is the Mexican Institute of Transport (IMT), which promotes technological development and knowledge in infrastructure and logistics matter; systems, and standards applied to the transport industry. The Secretary has developed applied research centers such as the National Experiment Center of Technological Innovation for Vehicular Safety, measuring the dynamic performance of light, medium and heavy vehicles; or the Permanent Monitoring Center for Intelligent Structures (CEMPI) for the study of the integrity and preservation and infrastructure.

As a federal republic, every state has its own constitution and legal framework following the National Plan that is developed by the federal government. Through their local Secretary of Economic Matters, every state aims at fostering their own regions and cities through specific incentives from tax percentages or exclusions, to legal conditions. Every state has its own official website with further detailed information. (Appendix II).

Industry Associations

Industry organizations in Mexico take a central role in the automotive industry, by promoting active cooperation between private companies, state and federal government, academia, and civil society. Table 3 shows the main industry associations.

ORGANIZATION	FULL NAME	MAIN ACTIVITIES
AMDA	Mexican Association of Automobile Distributors	It groups over 2,000 new vehicle distributors in the most important cities in Mexico and offers specific professional services such as: consultancy, industry insights and analysis, among others.
AMIA	Mexican Association of the Automotive Industry	Constituted by vehicle manufacturing companies established in Mexico to represent the interests of their members in relations with government and non-governmental institutions and organizations, and other companies.

AMTM	Mexican Association of Transport and Mobility	It promotes in all sectors and cities of the national territory, actions that guarantee the modernization and implementation of higher quality services to promote mobility, for the benefit of users, citizens, the environment, infrastructure, and urban equipment.
ANPACT	National Association of Bus, Truck and Tractor Trailer Manufacturers	Representing the heavy vehicles industry with specific working committees to foster this subsector.
ARIDRA	Association of Manufacturers, Representatives, Importers, and Distributors of Automotive Parts and Accessories	It integrates manufacturers, representatives, importers, and distributors of spare parts and accessories for automobiles. ARIDRA has a partner directory with a database of over 3,800 records, capable of providing business alternatives, within the aftermarket.
CANACINTRA	National Chamber of the Transformation Industry	It represents Mexico's Industrial Sector and is divided into the corresponding sub-sectors. From the automotive industry it groups ballast manufacturers, clutch pastes and friction materials, auto parts manufacturers, bodywork manufacturers, trailers and semi-trailer manufacturers, as well as bus, truck and tractor manufacturers.
INA	National Auto Parts Industry	Represents companies in the auto parts sector with manufacturing interests in Mexico

Table 3. Self-elaboration (2020). Main industry associations in Mexico.

2. Mexico's position in the global automotive industry

2.1 Global market dynamics and supply chains

The automotive industry is an interconnected global supply chain. In recent years, automakers have been forced to set up final assembly plants in established markets and in the largest newer markets such as Brazil, China and India, to comply with local production goals set by governments. The largest OEM suppliers have followed carmakers to comply with their global presence needs (Sturgeon & Van Biesebroeck, 2011).

Globally, production typically takes place regionally or nationally, with larger and model-specific parts-production in proximity of final assembly plants. Lighter and generic parts are produced further away of the final assembly plant to improve economies of scale. Within regions there has been a shift towards countries and regions with lower operating costs. For example, in Europe, the automotive industry has started operations in Spain and Eastern Europe and in Asia, South East Asia and China have become regions with automotive investments. In the Americas this applies to Mexico and the Southern America region (Sturgeon & Van Biesebroeck, 2011).

Due to the global nature of the automotive supply chain, the market in North America shares regional impact and consequences. The deeper level into the supply chain, the higher the impact of the pandemic.

Figure 14 shows the three prominent regions where the world's automotive production activities are concentrated. The geographical position of the countries in each region allows the flow between OEMs and suppliers conforming a robust supply chain.

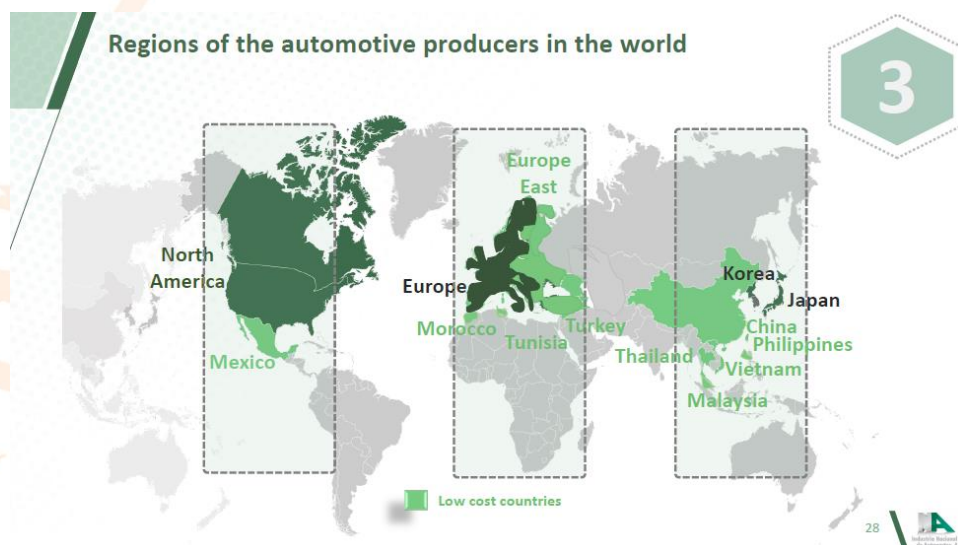


Figure 14. National Industry of Auto Parts (2020). The top three automotive producing regions. Perspectives of the Mexican Automotive Industry 2019.

In North America, important parts of the car manufacturing supply chains have been deeply rooted in each of the countries, as a result of NAFTA and the current USMCA (Detroit Free Press, 2020). Mexico is a key player in the supply chain for the US automotive industry, exemplified by Mexico's second place as largest vehicle supplier to the US, a status it received in 2019 by overtaking Canada and consolidating its place behind the largest supplier Japan (Mexico Business Publishing, 2020).

The automotive industries of the US and Mexico: deeply connected

"The US and Mexican economies are intertwined and very dependent on one another. Mexico exports about US\$ 90 billion worth of auto parts to the US. During the COVID-19 pandemic auto parts production in Mexico was halted. US production came to a complete stop and US President Donald Trump urged Mexico to restart production, otherwise the US would not have been able to produce."

– Marcellus van Eck, Head of the German Business Center at EY & Raul Meyer, Partner at EY (Interview Holland House Mexico)

The disruption of today's global automotive industry is caused by geopolitical, regulatory, and macroeconomic factors. The impact on the global and on Mexico's automotive market and its supply chains is caused by factors such as trade wars, geography and valuation, emission regulation, market volatility, and digitalization (Lincoln International, 2019).

Trade wars

Recently, the trade war between the US and China has caused shifts in supply chains. US tariffs on imported Chinese components have impacted US auto manufacturers, that have been forced to change sourcing strategies. This has led to decreased margins for OEMs as well as the need to move supply chains to other countries. China, in turn, responded by imposing a 25 percent tariff on imported US vehicles (Lincoln International, 2019).

The tariff war between Washington and Beijing has had a notable effect on the global automotive supply chain. Germany in particular has been affected significantly. Exports to China represent over third of the revenue of carmakers BMW, Daimler and Volkswagen. A reduced Chinese demand in combination with US threats for tariffs on European imports led to a 5.2 percent blow in Germany's industrial output in 2019 (Lincoln International, 2019).

The US-China trade war in combination with the USMCA trade agreement have had its effect on Mexico. In March 2019, Mexico surpassed China in terms of value exported to the US (Villarreal, 2020). The changes were also noticeable in Mexico's automotive industry. Mexican exporters of engine filters and vehicle air conditioning units saw their US market share rise in 2019 in the first half of 2019, whereas Chinese competitors experienced a decrease in exports to the US (Financial Times, 2019).

Tariffs have also had its impact on where cars are produced and sold. The trend for manufacturers is to start localizing production. European OEMs have started operations in North America, Japanese manufacturers added Mexico to their investment portfolios, and American car manufacturers, such as Tesla, have started operations in China. In the slipstream of OEMs localizing their production around the globe, domestic suppliers have engaged in mergers and acquisition in order to establish their presence and support car makers in overseas markets (Lincoln International, 2019). In Mexico, the arrival of OEMs such as KIA, Toyota, and Audi, meant an influx of suppliers in the market and production went up 66% (Mexico Business Publishing, 2020).

Mexico's place in the global automotive industry

"Mexico has a competitive advantage compared to other automotive areas. A study published by PWC shows it is cheaper to produce in Mexico than it is in China. The cost of a Mexican worker is about US\$3 an hour, versus US\$ 50 in the US, US\$40 in Canada and about €50 in Europe. This competitive advantage is expected to remain in place."

– Marcellus van Eck, Head of the German Business Center at EY & Raul Meyer, Partner at EY (Interview Holland House Mexico)

Geography and valuation

Geography impacts valuation and performance. According to Lincoln International, China and India represent the highest value because of their domestic markets and the growth potential of their supply chains. North America, Europe and Japan, on the other hand, represent lower values since these are mature markets (Lincoln International, 2019). Figure 15 shows an overview of the enterprise value multiple per country.



Figure 15. Lincoln International (2019). Forward 2019 EV / EBITDA. Retrieved from: <https://www.lincolninternational.com/perspectives/global-dynamics-drive-headwinds-and-opportunities-in-the-auto-industry/>

Emission regulation

Emissions and electrification represent a challenge for the industry. Emission regulations have been tightened across the world. Mexico is committed to the 2030 UN sustainability goals and has aligned its objectives in the National Development Plan (2018-2024). The European Union has introduced restrictions on carbon dioxide emissions and several countries plan to ban vehicles with an internal combustion engine as of 2030, betting on Electric Vehicles (EVs). The US has been working on lowering emissions, although for example states such as California have been trying to raise emission limits. China, on its turn, has stepped up its guidelines to align emission standards with the US and Europe.

Market volatility

Recessions such as that of 2008 and 2020 due to the COVID-19 pandemic have a large impact on the global automotive industry. After the 2008 downturn, the auto industry was forced to become more streamlined, by reducing the number of manufacturers and improving production and inventory processes. Thus, suppliers reacted by improving liquidity levels. The real impact of the COVID-19 pandemic on the auto industry is yet to be seen. Automotive sales in Europe, China and the US are expected to decline between 14 and 22 percent in 2020 (Boston Consulting Group, 2020).

Industry Investments

Together with China, Korea is a large Asian investor that has been of major influence in Mexico's processing and innovation industry. Korea's investment modality is *greenfield*, and its sectorial specialization is directed to the manufacturing industry focused on high technological complex activities, particularly in the automotive industry in Brazil and Mexico. With many companies listed on the stock exchange, for investors it is synonymous with cash flow, as well as a commitment to environmental and social policies.

The global investment dynamics and where these are generated are as follows:

Main investments from/in:

Europe: Southern area of the continent

US: Mexico and Central America

China: Throughout the continent, through mergers and acquisition

Investment sector:

China: agro-industry, power generation, mining and lithium mining, infrastructure and mining

Europe & the US: Similar as China, but with the addition of high-tech solutions (telecommunications in general, software and internet).



Europe and the US are listed as the main investors in Latin America. It is possible for China to be the largest investor in Latin America, but a lack of cohesive tracking of these investments makes it difficult to determine their position. China is often underrepresented when investments are compared, as investments are made through third parties, making it difficult to identify them in the national accounts (CEPAL, 2019).

2.2 Regional market dynamics and supply chains in North America

This chapter explains the integration between Canada, the US and Mexico in the North American automotive industry. Unlike any other country, Mexico has a privileged geographical position with the US at the northern border, and Guatemala and Belize to the South. Surrounded by the Pacific Ocean, and the Gulf of Mexico and Atlantic Ocean on the other side, Mexico has easy access to Asia, North and South America, and European markets. What does this position imply for regional supply chains in North America?

North America integration

In 1925, Ford Motor Company built the first auto manufacturing plant in Mexico. General Motors and Chrysler soon followed, installing manufacturing plants in the country. Over the years, the available technology in production facilities in Mexico has increased, supported through policies implemented by the Mexican government, and trade agreements such as NAFTA. Mexico has leveled up its readiness status, is in the process of becoming an advanced manufacturing hub in the North America, housing more than 21 OEMs and a vast amount of Tier 1, 2, and 3 suppliers.

The country's deep economic ties with its northern neighbors, especially the US, lead to high economic integration and a high interdependence within the supply chains. The area that comprehends Mexico, the US, and Canada is one of the three largest regions of automotive manufacture in the world. Figure 16 depicts how Mexico is at the heart of the supply chain in the automotive industry.



Figure 16. National Industry of Auto Parts (2019). Mexico in the "middle" of the world. Perspectives of the Mexican Automotive Industry 2019.

At the end of 2019, the vehicle fleet in the United States, Canada, and Mexico totaled 315.7 million vehicles (cars, light trucks, vans, SUV's, as well as heavy units), of which approximately 10% (32.5 million) circulated in Mexico: 19.4 million cars, 12.1 light trucks, and one million buses, trucks and tractors (ARIDRA, 2020).

In the automotive industry, in 2019 under NAFTA, the three North American countries accounted for 18% of global vehicle production. According to Eduardo Solís, former Executive President of AMIA, the US imports 52.2 percent of its vehicles from Mexico and Canada. In terms of total car exports from the US, Mexico and Canada received 48.3 percent (Mexico Business Webinar, 2020).

The regional supply chain is one of many players, with a variety of positions. The market is not dominated by few companies, which translates into a more mature market where only the highest competitive players play a role in the industry. Figure 17 illustrates the level of market concentration of the automotive industry in North America.

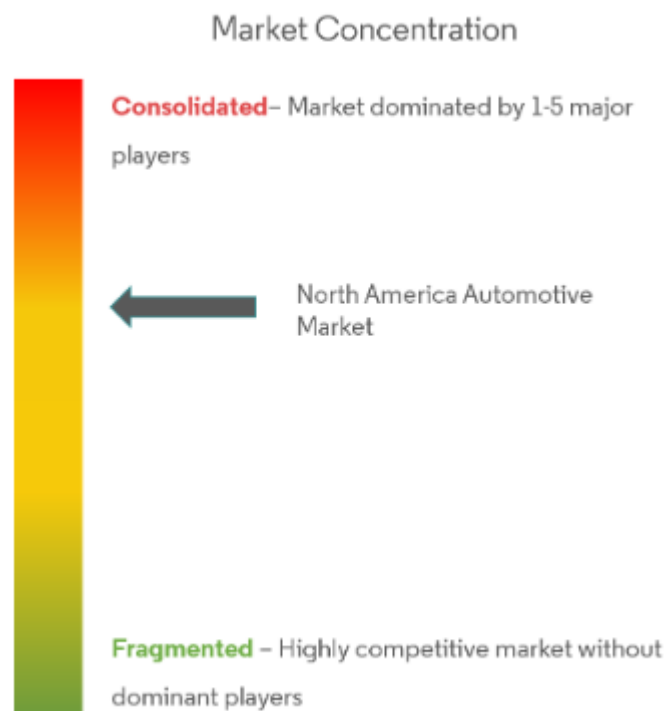


Figure 17. Mordor Intelligence (2020) Market concentration in North America. Retrieved from: <https://www.mordorintelligence.com/industry-reports/north-america-automotive-market>

Canada, US, and Mexico

The interaction between the three territories is the essence of economic integration due to the geographical proximity and the easiness of export and re-export, catalyzed through solid trade agreements in the region, including USMCA. The three countries complement one another in the manufacturing process, as each have different strengths and drivers in the automotive industry. This aids to pinpoint Mexico's unique position in the region.

Canada

The automotive industry in Canada is the largest manufacturing sector in the country, with an annual US\$19 billion contribution to the nation's GDP. The *Great Lakes area*, conformed by regions of both Canada and the US, including portions of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin and the Canadian province of Ontario, houses one of the largest automotive manufacturing clusters in the world. OEMs including FCA, Ford, GM, Honda, and Toyota, together manufacture over 2 million vehicles at Canadian plants (Government of Canada, 2019).

Canada's expertise is on commercial equipment and public transportation manufacturing aimed at national rail networks, and other applications such as mining. Canada is home to a powerful cluster, The Automotive, Transportation, and digital Technologies Cluster. This organization collaborates with the federal government to boost a specialized branch of innovation, science, and economic development in the country. Through the federal government, specific programs and incentives are developed for the automotive industry. These programs include: Innovation Canada, Strategic Innovation Fund, Innovation Superclusters Initiative, Provincial and Regional programs. The Canadian government focuses on incentives towards innovation also through collaborations with local universities and knowledge centers.

Along with high-tech facilities and a skilled workforce, Canada maintains its position as a manufacturer of high-quality products. Nonetheless, the size of Canada's manufacturing capabilities is considerably smaller than those of Mexico and the US.

Canada is the:

- 10th largest vehicle manufacturer
- 8th largest light-vehicle exporter
- 8th largest automotive parts exporter
- 2nd supplier to the US

Canadian manufacturers are particularly specialized in advanced manufacturing and labor quality at competitive prices compared to the US. Canada is a global leader in emerging automotive technologies, such as Lightweighting, safety systems, cybersecurity, software, Artificial intelligence (AI), and CASE vehicles (Canada Global Affairs, 2018).

United States of America

The US is the second largest producer of vehicles in the world and one of the main players in the global automotive industry. It is one of the largest consumers of vehicles in the world. Hence, it is the largest player in the industry in North America. The US is one of the largest contributors to Research and Development (R&D) globally, accounting for US\$18 billion in 2019, with the automotive industry being one of the best represented in the field. Last year, the country manufactured over 10.88 million vehicles, representing a 3.7% decrease compared to 2018. This decline was caused by the changes in the global supply chain and the increasing production costs in general. In 2019, the total vehicle sales in the US were 17.58 million, distributed as follows:

- 46 percent light commercial vehicles
- 36 percent SUVs
- 32 percent of passenger vehicles
- 3 percent medium and heavy commercial vehicles: (Mordor Intelligence, 2020).

Together with Canada, the *Great Lakes* region is key for the automotive industry in North America. To date, the state of Michigan alone, houses research facilities of 46 of 50 top global automotive suppliers. Another 300+ companies in the automotive industry concentrate their R&D activities in the region, representing the R&D for nine out of 10 of the world's largest automakers (Center for Automotive Research - CAR, 2014).

With its broad trajectory and expertise, the US has managed to preserve its lead role of both manufacturer and consumer of automotive products in the region and on global levels. Foreign automakers, particularly from Asia (Japan and South Korea) and domestic and innovative Tesla, are winning market share from the ever-dominant players' Ford, General Motors, and Fiat-Chrysler.

Mexico

Mexico's history in the automotive industry began when the US *Big Three* decided that Mexico was a great destination for cheap manufacturing, due to the beneficial location from the US and cheap labor options. Over time, Mexico has been shifting into a position that is more beneficial to the country, with the automotive industry nowadays being well developed and one of the largest contributors in national GDP. Mexico is the number 1 supplier of the US, and one of the top 5 exporters of automotive parts.

Regional dynamics

The regional automotive industry is organized around the strengths of each of the regions, designed to create the most advantageous position for companies and countries. Particularly USMCA allows for easy access between the three markets, hence facilitation of the regional dynamics. In a recent webinar (Mexico Business Webinar, 2020) Eduardo Solis, former president of the Mexican Association of the Automotive Industry (AMIA), provides a clear example of how the supply chain works in the assembly of a vehicle that includes a piston:

1. Raw aluminum is shipped from Michigan to Ontario
2. In Ontario, the piston is produced, cast and pre-machined
3. From Ontario, it is sent back to Michigan
4. In Michigan, the piston gets additional machining and is sent to Mexico
5. In Mexico, the manufacturing of the piston is finished
6. From Mexico, it is sent to Wisconsin, where it gets assembled with rods and rings. The assembled piston is sent to an engine plant in Michigan
7. The piston is sent to Ontario, to a vehicle assembly plant
8. Lastly, the vehicle travels to the US and Mexico as a "Canadian" export.

Naturally, the names of the countries can be interchanged, pending the product that is being manufactured and assembled. All three countries tend to contribute to the production of one vehicle, and in some cases, auto part.

In a recent interview, Óscar Albin, President of the National Association of Auto Parts (Albin, O. (2020, 08, 26). Personal communication. Appendix I) states that the US and Canada only purchase components from Mexico, whether they are produced in Mexico or re-exported from Mexico. Products from Central America and the Caribbean are dismissed due to political conditions. Components from South America are considered too far away from North America, making it impractical for buyers in the US and Canada. As a result, foreign auto parts manufacturers have established in Mexico, to cater for the demand of their northern neighbors. Figure 18 shows the distribution of foreign participation in Mexico for the auto parts market. Foreign Tier 2 and 3 companies, as well as lower Tiers, are established in Mexico and complying to the demand from the neighbors' countries. The Mexican auto parts companies lead the market, but followed by the US, Japan, and Germany.

ORIGIN OF THE AUTO PARTS MANUFACTURERS LOCATED IN MEXICO

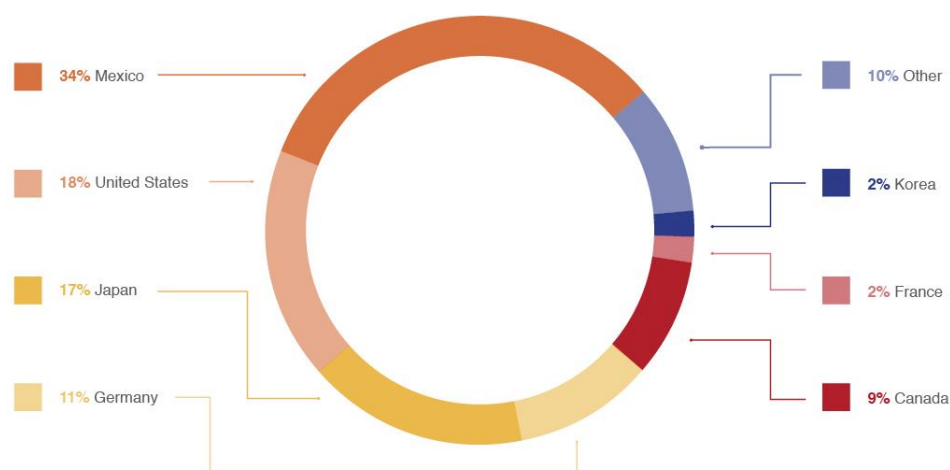


Figure 18. National Industry of Auto Parts (2019). Origin of the auto parts manufacturers in Mexico. *Perspectives of the Mexican Automotive Industry 2019.*

More specifically, Mexico plays an essential link within the auto parts sector, in both manufacturing and assembly. Most of the Mexican imports come from the US, with 49.4%. China, on the other hand, remains the second-largest importer with a 14.5% market share. Note that Chinese auto parts are mostly for the aftermarket segment. (Industria Nacional de Autopartes, 2020). The following chart (table 4) shows in the left column the main imports, which are mostly non-finished goods that will be processed and manufactured to be finally exported as final auto parts – largely all within North America.

Imported by Mexico		Exported by Mexico
1	Stamped parts and accessories of bodies	Harnesses and cables
2	Engines and its parts	Seats for vehicles and its parts
3	Gearbox components	Gearboxes and its parts
4	Harnesses components	Gearboxes and its parts
5	Components for (audio/video) devices	Stamped parts and accessories of bodies
6	Components for brakes	Differential axles and its parts
7	Components for differential axles	Brake mechanisms
8	Components of seats for vehicles	lighting or visual signal devices
9	Components for steering systems	Air bags and its parts
10	Sir bag components	Devices for air conditioner

Table 4. Comparison chart of main imports and exports from Mexico. Source: INA, 2019.

Flow of Goods

The flow of importation and exportation in North America can also be explained by comparing regional import deficits. In 2018, US data reports a goods deficit with both Canada and Mexico, with US\$19 billion and \$80.7 billion, respectively. However, in relation to the US, Canada reported a US\$102.8 billion surplus and Mexico over \$102.8 billion surplus. (Office of the United States Trade Representative, 2018).

The current Free Trade Agreement allows for the US to import products and export these without undergoing a substantial transformation to the other member states, under the American flag. That is, if a company in the US import parts from China, it can resell these on the Canadian and Mexican market as North American content. Nonetheless, Canada and Mexico consider these "re-exported goods" as imports from the actual country of origin. According to the Office of the US Trade Representative:

"Canada and Mexico, however, count these re-exported goods as imports from the actual country of origin. In the same way, Canadian and Mexican export data may include re-exported products originating in other countries as part of their exports to the United States, whereas US data count these products as imports from the country of origin. These counting methods make each country's bilateral balance data consistent with its overall balance but yield large discrepancies in national measures of bilateral balance. It is likely that a measure of the US trade deficit with Canada and Mexico excluding re-exports in all accounts would be somewhere in between the values calculated by the United States and by our country trading partners" (Office of the United States Trade Representative, 2018).

National supply chain dynamics

Mexico's position in relation to the other two countries in north America has had an impact on the distribution of activities within Mexican borders. At national level, the automotive industry concentrates both in the so-called *Bajío* area (31.2 percent), and the Northern region (50.7 percent), the latter particularly due to its closeness with the border shared with the US. Chihuahua's strategic location in northern Mexico offers logistics advantages. "The state is part of a natural automotive logistics corridor targeting the US, with the border only a few hours away by car from the state capital," says Tarsicio Carreón, President of the Chihuahua Automotive Cluster (Mexico Automotive Review 19/20, 2020, p. 206). According to INA, 70 percent of the vehicles manufactured in North America have a component manufactured in Chihuahua (Mexico Automotive Review 19/20, 2020, p. 213).

The following map (figure 19) shows the distribution of the auto parts production throughout the country. The regions with the highest level of development of the automotive industry are marked with the darkest color. The expertise in medium and high-end processes is well-managed by a skilled workforce, and local governments foster the industry with collaborations with the private sector and knowledge centers.

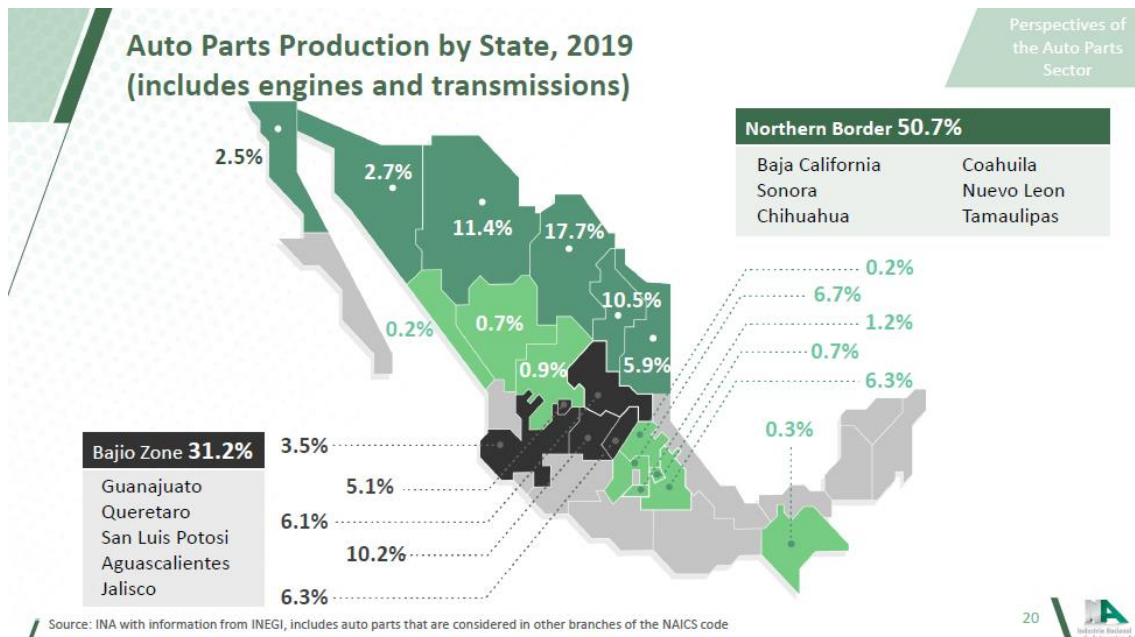


Figure 19. National Industry of Auto Parts (2019.) Auto parts production in Mexico in 2019. Perspectives of the Mexican Automotive Industry 2019.

Experts agree that there is a window of opportunity in Mexico's local supply chain, as not all Tiers are sufficiently represented in Mexico. Óscar Albin (Albin O. , 2020) (Albin, O. (2020, 08, 26). Personal communication. Appendix I) explains that within the Mexican automotive supply chain, there is a lack of alternatives, especially in Tier 3 and below, where most of the raw material and tools are imported, causing large gaps and possible delays in the delivering.

Due to the global nature of the automotive supply chain, lower Tier companies must comply to the standards demanded from Tier 1 and OEMs. Figure 20 shows the current state of the supply chain, the absence and presence of different levels of suppliers. Left represents highly developed industries, whereas the right image represents Mexico. In the first, non-specialized processes and raw material suppliers have a bigger presence to meet the demand. In the case of Mexico, there is a gap in both available FDI and qualified local suppliers of lower Tiers.

Mexico, with the presence of more than 500 Tier 1 companies, needs more players with volume capacity, unique applications, high standards, and workforce in these specific links of the chain. To enlarge the Tier 2 and Tier 3 number of companies could be through Foreign Direct Investment in organizations already established in Mexico, or through partnering with a Mexican company directly in operational phases.

SUPPLY CHAIN

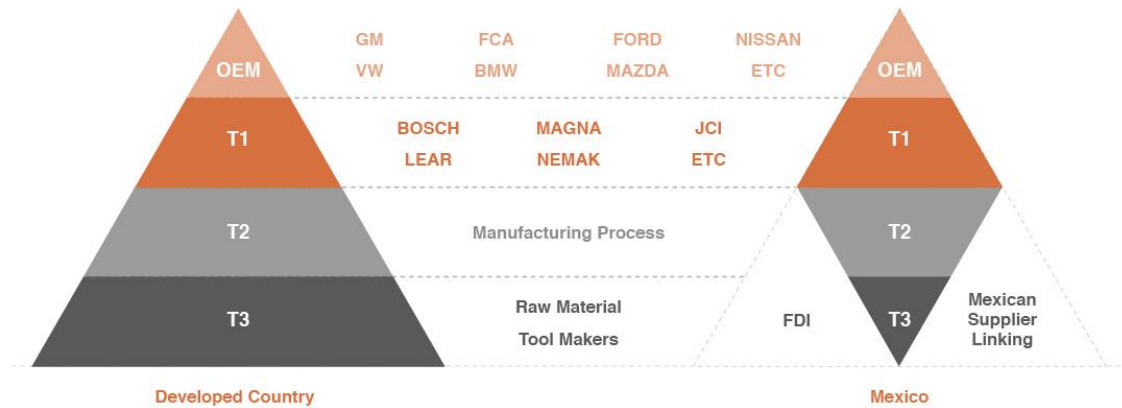


Figure 20. National Industry of Auto Parts (2019). Comparison between the supply chain on developed countries and countries like Mexico. Perspectives of the Mexican Automotive Industry 2019.

. Source: INA, 2020

Expert opinion

“The diamond shape aiming at the triangle shape of Developed Countries: An option could be via Foreign Direct Investment, as the volumes asked by Tier 1 supplier are high and they are asking the Tier 2 supplier to reallocate their facilities into Mexico. I think The Netherlands have an opportunity in Tier 2 suppliers.

Japan is already doing it, by having more Tier 2 suppliers in Mexico. Still, they only supply to Japanese OEMs, and the opportunity here would be to link the Tier 2 suppliers to the other Tier 1 or OEMs in the country, whether they are European or North American companies.”

– Óscar Albin, President of the National Association of Auto Parts (Interview Holland House Mexico)

2.3 International treaties that shape the Mexican automotive industry

COVID-19 and regional dynamics

Mexico represented 20% of the total flows to Latin America and the Caribbean, with US\$ 36.871 million in 2018. The investment in the automotive and auto parts industry by transnationals in Mexico represented 24% of total inflows in the country. (CEPAL, 2019)

The pandemic has put challenges in the regional automotive industry; with the US discontinuing operations in its plants, the supply chain was modified with direct effects on providers with an overstock, continuing fixed costs despite the pandemic, shortage of demand by the consumers. All factors combined led to a slowdown in the industry. However, according to the North America Automotive Market 2020, the industry forecasts 6.63 percent of the compound annual growth rate from 2020 through 2025. (Mordor Intelligence, 2020). With an optimistic medium-term scenario, the three countries will recover from the COVID-19 downturn as the production and sales will start its natural rhythm.

In an interview with HHM, Alex de Kerpel, Political Advisor at the Dutch Embassy in Mexico (De Kerpel, A. (2020, 08, 26). Personal communication. Appendix I) he mentions that the COVID-19 crisis slowed down the industry around 30% in terms of operations, and this undoubtedly changes how companies analyze prospects regarding future operations. The strategy of the US will be in nearshoring conditions, reallocating their operations from Asia to Mexico to shorten their supply lines, says De Kerpel. As the US realizes that it can no longer be dependent on far-away countries, companies are looking for shorter supply chains, with timesaving being an added value. The supply chain will become more consolidated, specialized, and regional.

One of the main pillars behind Mexico's strong automotive industry is the favorable climate created through Mexico's many trade agreements. The Free Trade Agreement between the US, Mexico, and Canada (USMCA) is the most influential, and underlines the strategic dynamics within North America. In total, Mexico has 14 Free Trade agreements (FTAs) with over 50 countries, granting the country access to more than 60% of the world's gross domestic product (Tetakawi, 2020). In addition to USMCA, Mexico has treaties with Europe, Japan, and Brazil, all of which shape the Mexican automotive industry.

USMCA Free Trade Agreement

The USMCA came into effect on July 1, 2020, to replace the North American Free Trade Agreement (NAFTA), which was in place since 1994. The new United States-Mexico-Canada Agreement (USMCA) is a mutually beneficial win for North American workers, farmers, ranchers, and businesses. The agreement aims to create more balanced, reciprocal trade that grows the North American economy whilst raising the standard of living for the people of all three member countries. Experts agree that the Treaty most immediately and strongly stimulates the overall investments in climate, the automotive manufacturing sector, and labor conditions. With USMCA

in place, Mexico has a stronger investment framework and more transparency, clarity and protections for businesses operating in the country (Garza, 2020).

For the automotive industry, one of the biggest game changers in the agreement is the Regional Value Content (RVC). There are three significant changes to the rules of origin as stipulated in NAFTA, as shown in figure 21 (New rules for light vehicles and pick-ups).

LIGHT VEHICLES AND PICK UPS

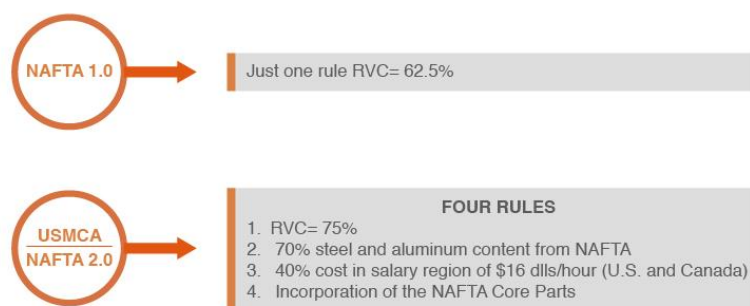


Figure 21. National Industry of Auto Parts (2019). New rules for light vehicles and pick-ups under USMCA. Perspectives of the Mexican Automotive Industry 2019.

1. More original content from North America

NAFTA required 62.5 percent of regional content in all vehicles and auto parts produced in North America. Regional content requirement has been increased to 75 percent by 2023 under the USMCA. The regional value content rule (RVC) includes the following:

Core parts = 75 percent

Principal parts = 70 percent

Complementary parts = 65 percent (Stuart, 2018)

2. Higher wages for workers: the labor value content

For workers, a minimum wage of US\$16 per hour will apply for a certain percentage of the vehicle or auto part. Light-vehicle producers will have a three-year period to comply with 40 percent of the finished product. This share is further divided into a minimum of 25 percent linked to material and manufacturing expenditures, a maximum of 10 percent in high-wage technology, and maximum 5 percent in high-wage assembly expenditures.

Light trucks and heavy vehicles need to comply to a minimum of 45 percent higher waged content. The percentage for high-wage material and manufacturing expenditures is 30 percent. "Salary content requirements will be met in three ways. Companies that are producing engines, transmissions or advanced batteries in high-salary regions have already covered a 5 percent content requirement. If they have R&D operations in these regions, they have another 10 percent covered. The remaining 30 percent can be met with normal manufacturing operations with high

salaries. As a result, the main area of opportunity for the Mexican supply chain is in hogging the other 55 percent” (Mexican Automotive Review 19/20, 2020, p. 24). The labor value content is depicted in figure 22.

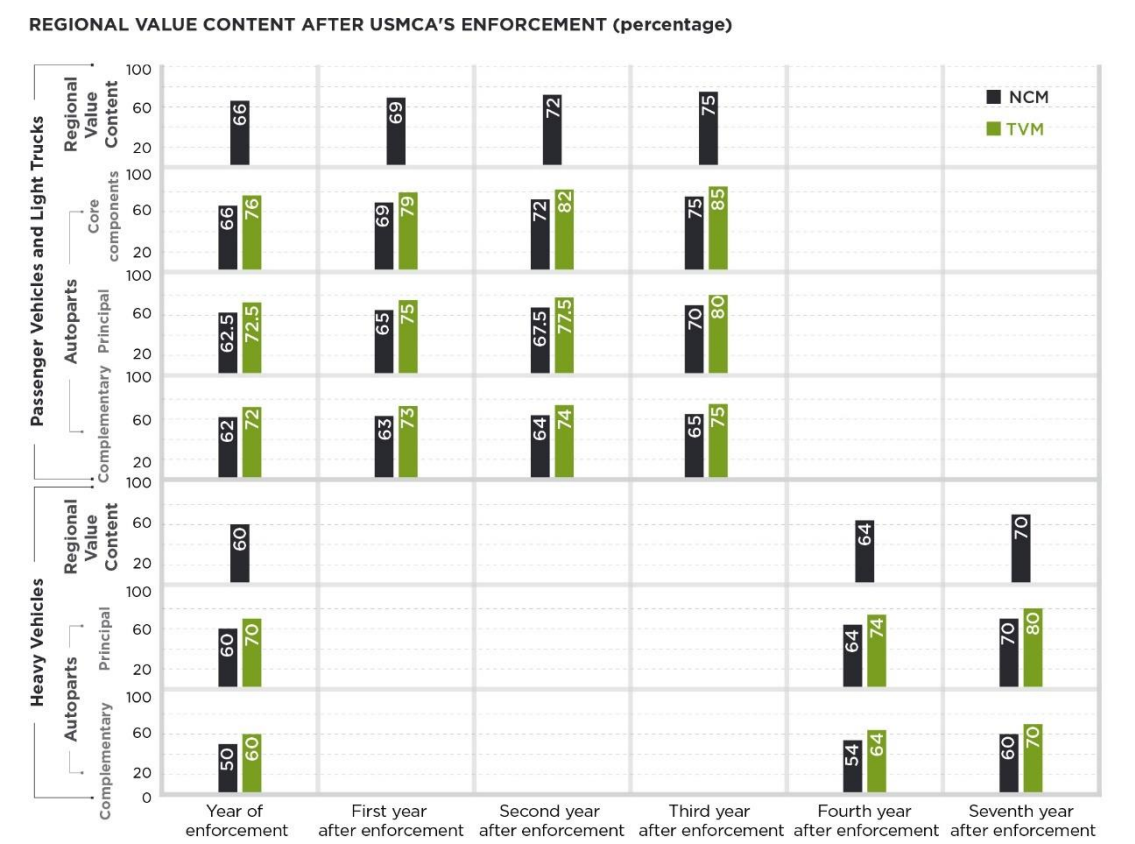


Figure 22. Mexico Business Publishing (2020). Regional Value Content after USMCA enforcement. Mexico Automotive Review 19/20.

3. Local content of aluminum and steel

Automakers need to purchase 70% of their steel and aluminum in North America to qualify for tariff-free trade within the region (Reuters, 2020). With the USMCA, a new rule was added:

For aluminum to be considered regional, except for metallurgical processes concerning the refinement of steel additives, all the manufacturing processes must be in one of the three countries.

SPECIAL REQUIREMENTS FOR STEEL AND ALUMINUM	
Aluminum	OEMs demonstrate that 70 percent of their aluminum purchases come from North America. Ten years after entry into force of the USMCA, countries will reconsider this rule.
Steel	In a seven-year-period, 70 percent of the steel used in all vehicles in North America will be originating. To be originating, all steel manufacturing processes must occur in North America, except for metallurgical processes involving the refinement of steel additives. The new requirement does not apply to raw materials used in steel manufacturing processes.

Source: USMCA

Figure 23. Mexico Business Publishing (2020). Special requirements for steel and aluminum under the USMCA. Mexico Automotive Review 19/20.

In Figure 24, the rules of origin for light vehicles and auto parts is explained in a visually, allowing to clearly identify the rules to be followed:

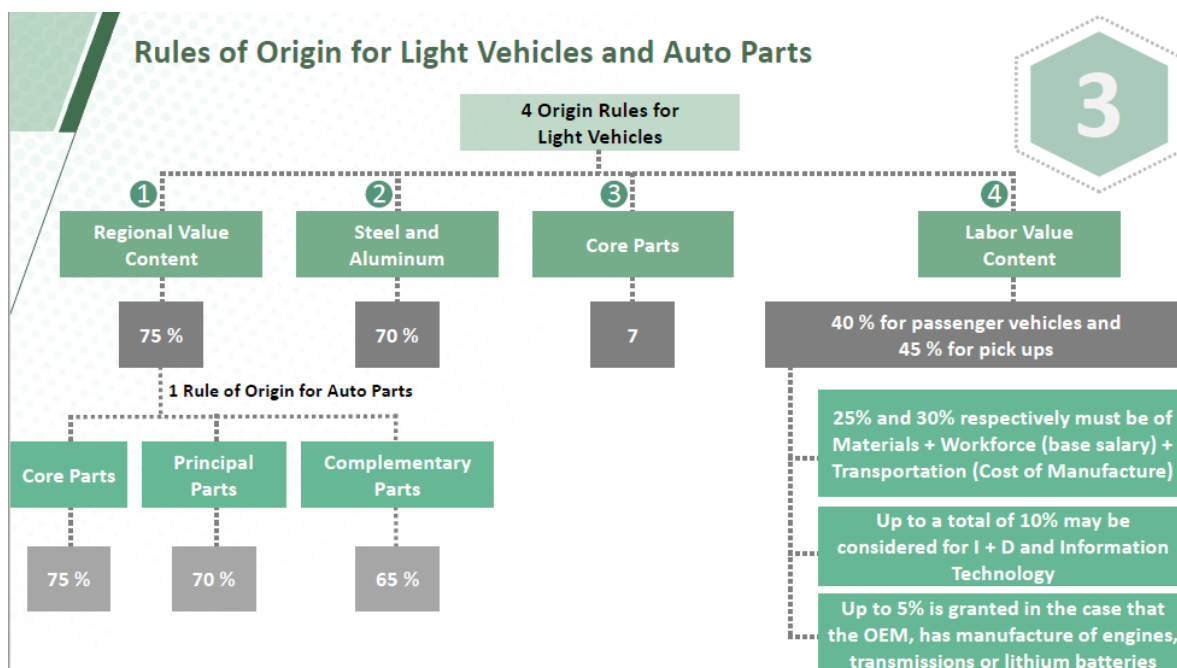


Figure 24. National Industry of Auto Parts (2019). Rules of origin for light vehicles and auto parts under USMCA. Perspectives of the Mexican Automotive Industry 2019.

Oscar Albin, president of the National Association of Auto Parts in an interview with HHM (Albin, O. (2020, 08, 26). Personal communication. Appendix I) explains that failure to comply to the RVC rule compel companies to pay the corresponding taxes depending on the type of vehicle. For light vehicles and trucks, taxes are 2.5 percent, Thornton's and Pickups taxes is 25 percent, and auto parts between 0 and 6 percent.

Although the rules of origin are strict, the treaty allows for a temporary waiver in which OEMs can negotiate a transition period with the importing country. "For instance, OEMs aiming to export to the US will have to sit with the Office of the United States Trade Representative (USTR) and explain how they will meet the established percentages. The original three-year period could be extended up to five years," according to Solís.

The consequences of the USMCA for Mexico are largely beneficial for the industry, although the labor requirement may also have a negative effect. Firstly, the original content rules will strengthen production chains in the region and boost the use of inputs sourced in North America. This represents an opportunity for Mexican suppliers. Mexico will also have the opportunity to fortify European and Asian production chains, and by doing so it is expected that more companies will establish operations in North America. Final assembly plants particularly are expected to continue opening in Mexico. "USMCA's ratification will offer certainty for more companies to invest in Mexico" says Miguel Elizalde, Executive President of The National Association of Bus, Truck and Tractor-Trailer Manufacturers (ANPACT) (Mexico Business Publishing, 2020, Automotive Review page 19).

The rules of origin will also affect the dynamics between Tier 2 companies and higher and the local supplier, the latter in need to be strengthened. “USMCA will force companies to increase their local content. Mexican players can capitalize on these changes and grow as long as they are technologically prepared and meet quality certifications,” explains Daniel Hernández, Director General of Queretaro Automotive Cluster (Mexico Business Publishing, 2020, Automotive Review page 108). In addition, brake manufacturers will start to move their operations from Europe and Asia to Mexico, in response to USMCA’s content requirements, data from GIS’ 4Q19 report shows. On the other hand, salary requirements from the labor value content will impact OEMs and their procurement strategies. Engines, transmissions, and batteries will have to be sourced from high-salary countries. “This will harm Mexico’s attractiveness for the production of those systems,” stated Elizalde (Mexico Business Publishing, 2020, Automotive Review p. 19).

Regional concerns

USMCA is signed and has come into force, exempting Mexico and Canada from import tariffs. Nonetheless, on August 6, 2020, President Donald Trump and his administration announced a re-impose of tariffs on Canadian aluminum and steel. The announcement was made under the guise of protecting national security and the interests of the US aluminum and steel industry. Nonetheless, the US Chamber of Commerce stated that this will only affect the relationship and will not help on the economic recovery, as costs will increase, and production could be paused. The Chamber further urged the government to reconsider the tariffs to reactivate the economy and continue providing competitive vehicles to US consumers and other markets (Laing, 2020). In late September, the reimposition was ultimately cancelled.

Europe-Mexico Free Trade Agreement

Mexico is the largest trade partner of the European Union (EU) in Latin America. The first Free Trade Agreement between the EU and Mexico came into force in 2001. In April 2020, the negotiations for the modernization of the Agreement were finalized, making nearly all trade of goods between the EU and Mexico duty-free (Financial Times, 2020). However, ratification of the Agreement is pending at the time of writing this report. The EU-Mexico FTA is an agreement for an opportunity in the industry. “One of the most complex, robust and broad agreements I have witnessed. This is the gold medal Mexico needs to embrace to exchange ideas, products and services,” says René Schlegel, President of Robert Bosch México (Mexico Business Publishing, 2020).

Under both the original and the new FTA between the EU and Mexico, the automotive sector has been imposed with a 60 percent rule of origin. The law is also applicable to vehicles for the transportation of goods, tractor-trailers, special-purpose vehicles, chassis and bodies. Under MaxNOM regulation, the content threshold is 45 percent, however the percentage is measured differently. MaxNOM is based on the maximum value of non-originating materials, including those of which the origin cannot be determined (El Economista, 2018).

The FTA has its effect on global supply chains as well. The US is Mexico's leading export destination in the automotive industry. European companies can benefit from the EU-Mexico FTA and USMCA at the same time and export goods to the US and Canada duty-free. A 2015 report by BBVA Research explains the process: "For example, under EU-MX FTA, a parent company resident in the EU can export certain components duty-free to Mexico. The Mexican subsidiary receiving the components assembles the product in Mexico, also using components native from the US, which come into Mexico without paying trade tariffs under NAFTA. The product assembled in Mexico is granted Mexican origin status and as such can be exported to the US or Canada without having to pay any duties. The only charge that the Mexican company pays is the 15% value added tax on the value of the components that have come from the EU" (BBVA, 2015). The 45 percent MaxNOM rule, however, does still apply.

As per the implications for Dutch companies under the modernized European Union-Mexico FTA, Mr. Alex de Kerpel mentions in an interview with HHM (De Kerpel, A. (2020, 08, 26). Personal communication. Appendix I) that the regional content requirement for products, parts and raw materials eligible for importation at 0 percent import tariff, remains at 60 percent. Protection of European patents and Intellectual Property is reinforced in the new FTA, through the constitution of tribunals installed to safeguard these issues. Another benefit is that certification processes for importation will be digitalized, hence faster and with less room for error.

Best of both worlds

"The combination of the USMCA and EU-Mexico FTAs provide a window of opportunity for Dutch companies. By constituting a Mexican entity, companies can benefit from both treaties simultaneously, creating easy access to a broad, worldwide supply chain. It is now possible to position a company with an investment project in Mexico, and from there on be part of a broader supply chain through a European or US manufacturer",

- Alex de Kerpel, Policy Advisor Economic Affairs, Embassy of the Netherlands in Mexico

Japan-Mexico Free Trade Agreement

The Economic Partnership Agreement (EPA) between Japan and Mexico entered into force in 2005. In 2012, the Mexican automobile market was liberalized for Japanese imports and allowed duty-free trade of up to 30,000 vehicles each year and duty-free Japanese vehicle exports for up to 5 percent of all cars sold in Mexico (Foreign Press Center Japan, 2004).

One of the consequences of the EPA between Japan and Mexico has been the arrival of Japanese manufacturers Nissan, Honda, and Toyota to Mexico. Since the start of the EPA, virtually all Japanese carmakers have found their way to Mexico and established operations, within their slipstream a long line of suppliers (Inclán, 2016), thereby doubling trade between the two nations. Without the Agreement in place, Japanese auto manufacturers would have been into disadvantage compared to their European and US peers, that benefit from the FTA between Mexico and their respective countries or regions (Foreign Press Center Japan, 2004). EPA has also enabled the establishment of a working committee. The committee brings together key players from both the public and private sector in Japan and Mexico and has met over ten times. The committee provides more certainty to investors. The results are now visible, as most Japanese companies active in the

automotive industry are based in the Mexican Bajío region: OEMs, auto parts suppliers, logistics and construction, and bankers (Mexico Business Publishing, 2020).

Yasushi Takase, Ambassador of Japan in Mexico, elaborated on the importance of Mexico's relationship with neighbor US for Japan in a recent interview (Mexico Business Publishing, 2020, p. 16). Mexico has a privileged location to reach the US, one of the most important countries within the industry, "USMCA will change the business environment for Japanese companies in North America. New rules of origin established in the Agreement will force corporations to find a new strategy to manage their investments and source more components locally. The Japanese government and the private sector have together devised strategies to foster growth among local suppliers and supporting industries in Mexico. We are even bringing in Japanese experts to train Mexican suppliers and increase their capabilities, so they can participate in Japanese supply chains. These companies must meet Japanese quality standards and be capable of delivering components on time and spec," he added.

The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)


Formerly known as the Trans-Pacific Partnership (TPP), newly elected president Donald Trump caused a necessary amendment to the treaty when he decided to withdraw the US from participating in the agreement. The Agreement links eleven Asian-Pacific economies: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam. It is one of the world's largest trade zone with access to a market of over 500 million people. The CPTPP is designed to keep expanding through new members to increase benefits for the signatories to keep growing its scope.

Expert opinion

The geographical position of Mexico can be of great advantage to the nation, as interest from Asia rises. Current developments and international treaties have paved the way for Asian companies looking to offset their products on the US market, within the framework of existing treaties. More Asian companies decide to reallocate their companies to Mexico. As per the position of the Embassy, he mentioned "We will be observing how this evolves in the next years. In this way, Mexico serves as a doorway towards Asian-US operations, not only in trading but perhaps incorporating some added value".

- Alex de Kerpel, Policy Advisor Economic Affairs, Embassy of the Netherlands in Mexico

Mexican products gain access to six new market: Australia, Brunei Darussalam, Malaysia, New Zealand, Singapore and Vietnam by the elimination of tariffs on a wide range of products, making Mexican companies more competitive both in the same country or within the states of the said Agreement. In addition to increasing Mexico's opportunities for exporting goods and services, attracting investment and developing productive activities. As per the automotive sector, it facilitates the integration of Mexican goods and service providers into the global value supply chains within the Americas and Asia-Pacific region.



Depending on with whom business is conducted, automotive companies located in Mexico can opt to comply either to the rules of origin stipulated in the CPTPP or USMCA. The Regional Value content requirements are lower under CPTPP than under USMCA, hence providing a window of opportunity. For example, “If a car assembled in Mexico has components of several of the 11 CPTPP-member countries, it could be exported to Canada under CPTPP conditions rather than those established by USMCA which require a 75 percent of regional content” (Guzmán, 2020). As per the integration of CPTPP countries, Guzmán also added that “CPTPP’s accumulation rule states that inputs from all country members will always be considered equal, as long as they are used to manufacture products in any country that belongs to this trade block”.

Mexico-Brazil Free Trade Agreement

In March 2019, Mexico and Brazil reached a deal on the free trade of light vehicles and automobile components through a modification in the Agreement of Economic Complementation 55 (ACE 55). The Agreement includes a 40 percent regional content requirement. The two countries represent the largest automobile markets in Latin America. Bilateral trade last year amounted for US\$10.93 billion, of which 42 percent related to the automotive industry. Mexico’s trade surplus in the automobile sector with Brazil amounted to US\$868 million in 2018 (Reuters, 2019). In 2019, the trade gap value decreased to US\$324 in favor of Mexico (Global Fleet, 2020).

Free trade of heavy vehicles between the two countries was scheduled to come into effect on July 1, 2020, but has been pushed back to July 2023 (Economic Times Auto, 2020). In Latin America, Brazil and Argentina are also manufacturing auto parts. Nonetheless, they are even more expensive than Spain, and that is why they are not exporting as the prices are not competitive outside their own countries (Albin, O. (2020, 08, 26). Personal communication. Appendix I).

3. Trends and expected innovations in the Mexican automotive industry

With the end of the past decade's lifecycle, the automotive industry finds itself on a crossroad, both at the global and local level. Decisions regarding the long-term structure of established OEMs and Tier 1 suppliers will need to be made between 2020 and 2025. The industry is heavily influenced by the megatrends of climate, demographic, urbanization, and technological change. For the automotive sector specifically, trends can be categorized in a shifting perception of mobility and consumer patterns, and technological innovation (Kuhnert, Telang, & Liu, 2018).

Emerging segments in Mexico's automotive industry include the digital aftermarket, armoring, logistics, and telematics. Connected, Autonomous, Shared and Electric (CASE) vehicles are likely to start to play a role in the near future, with a supply chain revolution underway (Mexico Business Publishing, 2020).

3.1 Current trends and expectations

This section examines the expectations and trends for the upcoming years in Mexico's automotive industry. Production is increasingly aimed at the US market, where a tendency towards SUVs and high-end vehicles is becoming increasingly evident.

Production and export trends

As mentioned, the current production cycle has come to its end. The 2019 production decreased by 4.0 percent to 3.751 million units. Models manufactured in Mexico have trended to become export models, and the ratio of exports to the total production has increased rapidly in the last few years, reaching 88.9 percent in 2019. The strategic importance of exporting to the US is becoming increasingly stronger, with the share of total exports to the US increasing in the past year and the share of vehicles manufactured in Mexico for the US market growing as well.

In accordance with US market demands, manufacturing investments in the country has shifted to SUVs and high-end vehicles. For 2019, all major OEMs showed a decrease in production numbers for GM and Honda due to a recovery from a drop in production in 2018. GM's increasing production volume can be explained by their portfolio which is aimed at the US market and is growing shift to SUV production. Nonetheless, all other automakers are working towards making the shift from passenger cars to light trucks. Examples include Toyota's Guanajuato facility and BMW's San Luis Potosi production center, both newly opened in 2019 to produce export vehicles for the US market (Figure 25, Marklines, 2020).

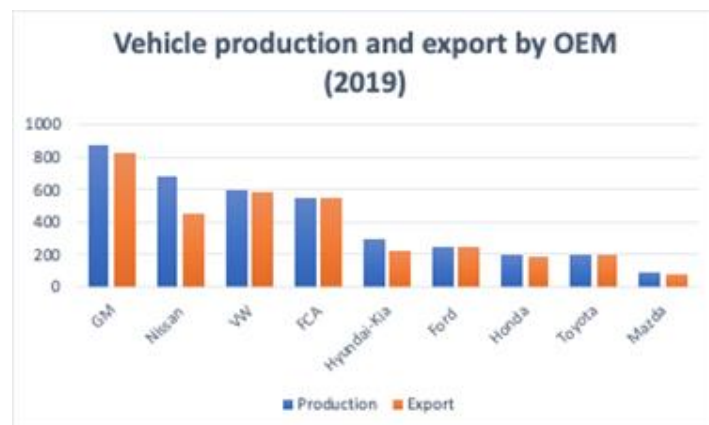


Figure 25. Self-elaboration (2020). Vehicle production and export by OEM (2019) (MarkLines, 2020)

For the top OEMs, the local Mexican market is not a priority. In fact, a trend to import low-priced cars for Mexico's domestic market can be noticed with 65.5 percent of all cars sold in Mexico in 2019 being low-priced imported vehicles, as illustrated in Figure 26 (Marklines, 2020).

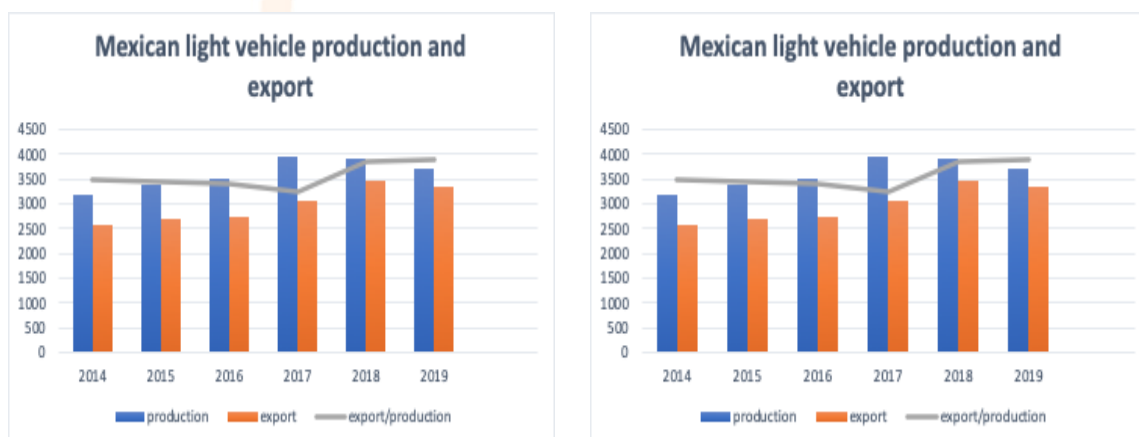


Figure 26. Mexico's light vehicle production and export and light vehicle sales and import (MarkLines, 2020)

The heavy-vehicle industry fared well in 2019, showing opportunity for the coming years. A 2020 interview with Miguel Elizalde, Executive President of ANPACT (Mexico Business Publishing, 2020, page 19) explains that the production and exports of heavy vehicles increased by 19.8 percent in 2019 compared to the previous year. The main reason is the rising demand for new trucks in the US market.

Sales trends in Mexico

Overall, sales of new vehicles in Mexico have shown a decline for the past 3.5 years. Light vehicle market share in Mexico by segment can be viewed in Figure 27. Experts agree that a trend in the local Mexican market is the growing demand for armored vehicles, a demand driven by the overall security issues the country is facing. Challenges for this niche include innovation in weapons and techniques used by criminals, and the light weighting trend that affect the armoring process. In general, traditional combustion engines is expected to continue to be the preferred option in Mexico and Latin America, as fueled-powered vehicles remain highly cost-competitive (Mexico Business Publishing, 2020).

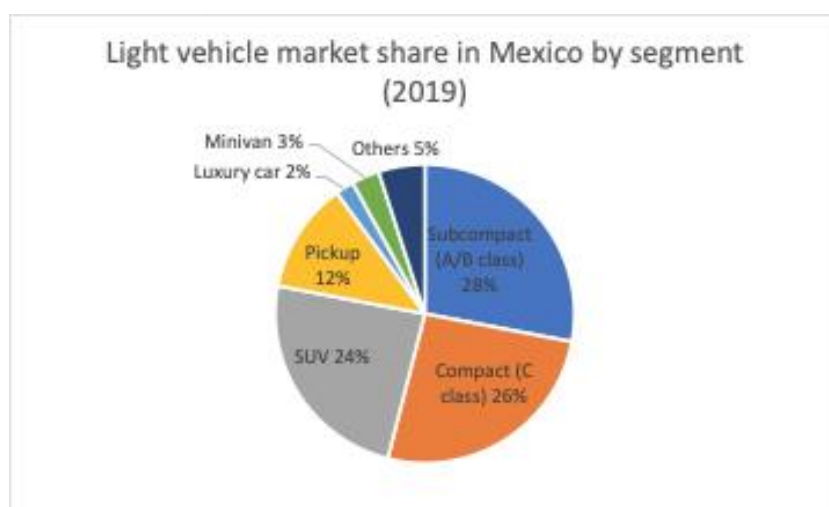


Figure 27 Light vehicle market share in Mexico by segment (2019) Marklines, 2020

For the heavy vehicle market, domestic sales for 2019 ended with positive numbers as well, although ANPACT believes this growth to be only temporary. Since July 2019, all trucks and buses produced in Mexico or imported to Mexico need to meet the Euro V or EPA 7 emissions standards under the NOM-012, hence the increase in sales. Truck robberies, rising fuel prices, and higher vehicle costs caused by new technologies and the volatile exchange rate of the Mexican Peso are reasons to expect domestic heavy-vehicle sales to stabilize and perhaps decline (Mexico Business Publishing, 2020). However, not all sentiments are negative. In an interview with Mexico Business Publishing, Enrique Enrich, Managing Director of Scania México, explains that the NOM-012 provides opportunities for European manufacturers in winning a significant portion of market share. American trucks, for decades the standard choice for vehicle fleets, may no longer provide the best solution for transport companies. In comparable markets in Latin America, there is noticeable a significant shift towards European heavy vehicles, a trend that he believes will become evident in Mexico soon (Mexico Business Publishing, Automotive Review, 2020).

E-commerce and aftermarket

Mexico accounts for one of the largest vehicle parks globally, with over 700 models and 50 brands in the market totaling an estimated 32.2 million vehicles in circulation. Hence, the aftermarket is large and demand remains steady. Both original and spare parts for the domestic market are commonly imported, particularly from Asia (Mexico Business Publishing, 2020). USMCA includes auto parts to meet the same standards as finished vehicles, pointing towards larger production of auto parts in Mexico in the coming years (Martinez & Orta, 2019).

As per sales channels, dealerships and OEMs adapted by steering away from traditional sales channels and moving into online sales. Heavily accelerated by the COVID-19 outbreak, the e-commerce sector in Mexico is showing promising growth. Data from the Mexican Association of Online Sales (AMVO) explains that during 2017 only 7 percent of people used online platforms to make purchases or acquire services on a weekly basis, while in 2018 that figure increased to 38 percent (Leyva, 2019). The country is considered the second leading country in Latin America that has grown in online sales. Worldwide, Mexico shows the highest growth in e-commerce since the COVID-19 outbreak. OEMs agree to the trend. For example, local Chihuahua car dealer Hyundai Penta Triunfo, saw sales from their online platform rose, whereas Peugeot reports consumer desire to buy a vehicle online rose by 40 percent between April and May 2020 (Mexico Business Publishing, 2020).

The online auto parts industry is particularly one to look out for. Mercado Libre, the leading e-commerce platform in Mexico, reports that digital commerce represented 4.9 percent of commercial transactions in Mexico in 2019, and projects 2020 growth to 6.3 percent, reaching 7.3 percent by 2024. To date, Mercado Libre reports 25 million users, who make 22.5 percent million daily visits and complete over 14 million transactions per month, of which 11 percent are related to vehicles or the purchase of parts, components and accessories for their repair and maintenance. The most sought-after parts are LED headlights and bars, tires, wheels, motorcycle helmets / gloves and automotive diagnostic scanners. In Latin America, Mercado Libre reports sales of US\$1.6 billion in the automotive sector, including auto parts (48%), tires (8%), car audio (8%), and accessories (8%) (Mendez, 2020).

Production forecast

LMC Automotive (cited by Marklines, 2020) forecasts in May 2020 that the Mexican light vehicle production volume for 2020 will drop below 3 million units, a 23 percent decline compared to 2019. The drop can partially be contributed to the impact on the production disruption caused by the COVID-19 pandemic, which created a shortage of certain parts in global production lines. Figures are expected to recover to over 3.3 million units in 2021 and 3.8 units in 2023; approaching the 2017-2018 production records. A light vehicle production forecast for OEMs operating in Mexico can be found in Appendix VI. Mexican production is likely to further benefit from the USMCA treaty, given that plant investment in the country has essentially been put on hold during the uncertainty surrounding the dissolution of NAFTA. The only obstacle could be the labor value requirement implied in the new deal.

In the June 2020 Automotive Industry Perspective, Deloitte (Galaz, Yamazaki, Ruiz Urquiza, 2020) sets out a comprehensive projection Mexico of production, sales in the US, and sales in Mexico for the upcoming years, considering the COVID-19 pandemic.

INDUSTRY FORECAST

Mexico's production level in 2019 (3.81 million vehicles) is expected to be reached again in 2024, due to the reduction in sales in the US market (a drop of -4.5 million is forecasted, a figure greater than the - 2.8 million crisis of 2009). For this year the reduction in production in Mexico will be close to 900 thousand vehicles. Vehicle commercialization in Mexico has not exceeded a million units, which could allow its levels to recover from 2019 to 2024.

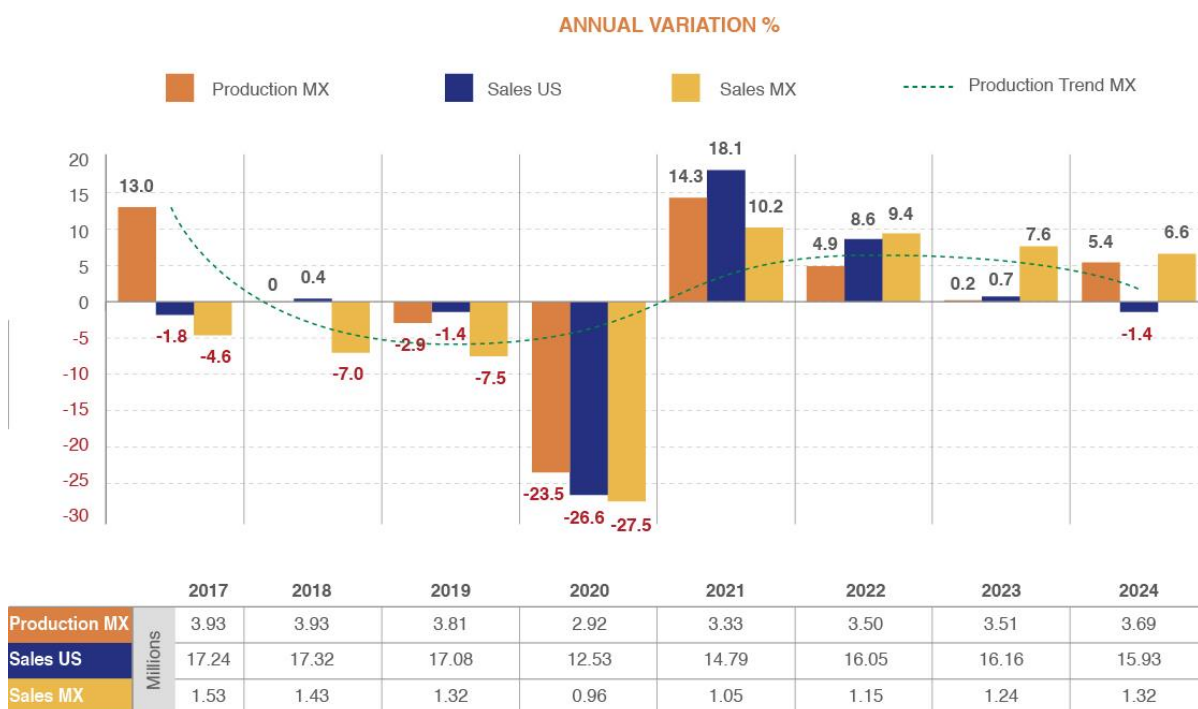


Figure 28. Deloitte, by Galaz, Yamazaki, Ruiz Urquiza (2020). Automotive Industry Forecast and Perspective. Retrieved from:

In generating this report, several experts in the automotive industry were interviewed in August and September 2020 (Full transcripts about the interview can be found in Appendix I). The general consensus among industry leaders is that the automotive industry in Mexico will continue to grow, and that the future looks promising.

3.2 Innovation: Industry 4.0, Green and Smart mobility, CASE vehicles

The future of automotive is connected, automated, redefined, and electric (Ericsson, 2020). In the words of PWC Autofacts: electrified, autonomous, shared, connected, and yearly updated (Kuhnert, Telang, & Liu, 2018). Traditional manufacturers and suppliers are vulnerable in the coming years. They will have to battle against falling margins while making greater investments in electro-mobility and new, customer-oriented innovations. The combustion engine, which for decades was at the heart of the German automobile industry particularly, will become obsolete. Furthermore, new competitors will force their way onto the reshaping market.

A recent study conducted by PWC Autofacts (Kuhnert, Telang, & Liu, 2018) concludes that the future of the automotive industry is based on new perceptions of mobility. A successful value chain will integrate all mobility users. "Suppliers and car manufacturers will need to adjust to much shorter development cycles and improved recycling methods. New sales models will compete and converge with new operating models, autonomous driving algorithms will communicate with central transport systems, and electricity suppliers will attract new customers by advertising traction current and battery capacity. Traditional brands will expand their areas of business, new brands and competitors will attack traditional automobile companies" (p.43). To remain relevant in the face of rapid technology development, companies across the automotive ecosystem are investing heavily in product and manufacturing process innovation.

Figure 29 illustrates the transformation of the automotive industry. (Kuhnert, Telang, & Liu, 2018, p. 12)

MEGATRENDS

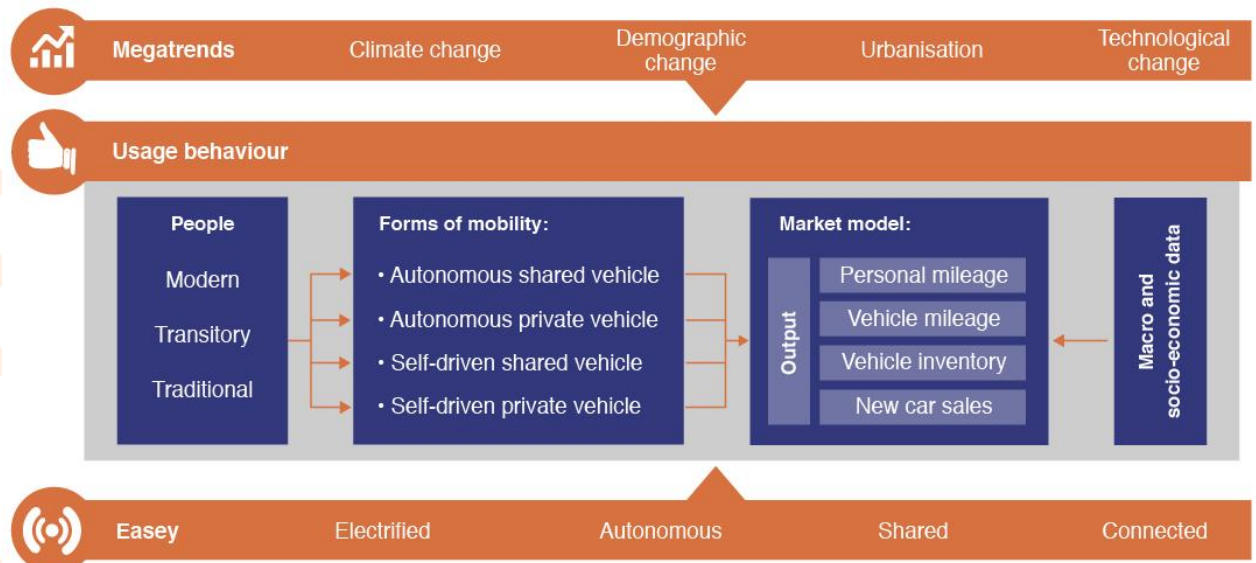


Figure 29. Kuhnert, Telang & Liu (2018). Automotive industry transformation. Retrieved from:

Industry 4.0

Similar to global trends, Industry 4.0 principles are beginning to be adopted in production processes in Mexico's automotive industry. For instance, BMW has applied Industry 4.0 technologies to its two plants in Mexico and several SMEs that are part of the Jalisco Automotive Cluster have adopted IoT in their processes. However, "most Mexican players are still reluctant to try new technologies," says César Chávez the Commercial Development Officer of Keyland. Javier Campos, Director General of FUNAC, argues that Industry 4.0 is still in its early stages in Mexico, with a robot base between 1,500 and 2,000 units, most of which are used at the plants of OEMs and suppliers (Mexico Business Publishing, 2020).

In an interview with Holland House Mexico (Díaz, L. (2020, 08, 18). Personal communication. Appendix I), Lucas Díaz, Managing Director of AWL Automation Mexico stated that the role of robotics will continue to grow in the automotive industry. The USMCA agreement aims to level salaries across North America, meaning that it will be more costly to employ workers in Mexico. This will likely increase local demand for other technologies to compensate, he explains. Mr. Díaz continues to explain that Internet of Things (IOT) is gaining territory in Mexico, although perhaps not at the same speed as in the US or Europe. "I am convinced that one day we will have all machines communicating and connecting with each other, also here in Mexico", he added. Other experts in the field agree that Tier 2 and 3 companies need to integrate industry 4.0 in their processes, in order to adapt to the changing needs of OEMs and remain in the market.

In line with this assessment is Bernard Rhode, General Director of Hannover Fairs Mexico. During the digital conference "Opportunities for Mexico in the Industry 4.0" (July 23, 2020) he expressed that Mexico is on its way to becoming the leader in Industry 4.0 in Latin America, since it has great advantages with regards to other countries in the region. These include its demographic capital of young population, its export capacity, and its advanced processes of digital transformation in the manufacturing sector. In Mexico, the proportion of people who will need to learn new skills by 2030 will be only 10 percent, whilst countries such as Germany rate 33 percent, which is undoubtedly a great opportunity.

According to Industrial Transformation Mexico (IMT):

- By 2021, 40 percent of the region's GDP is expected to be digitized.
- Within 5 years, almost 70 percent of IT spending in the region will be on cloud computing, big data, social business, and mobility.
- Total investment in technology in Mexico is expected to be 21.3 percent of GDP.
- Over 75 percent of companies will create "digital native" IT environments to thrive in the digital economy.

There is more to Industry 4.0 than implementing a piece of software, which is why companies are bringing in new suppliers to complement their solutions. Robotics and automation are part of the Industry 4.0 idea, but it is also an integrated vision that includes manufacturing operations, back office, supply chain, and clients. This opens the door to use Big Data and analytics to understand patterns that allow predictions on when equipment will need maintenance, for example. When OEMs set up a shop in Mexico, they generally bring robots and automation solutions from their home countries. While this is a sound strategy when starting operations, having a local technology supplier goes a long way to reducing related costs and unscheduled production

downtime. “There is demand for local players that design, engineer and put to work the equipment that these companies need,” says CEO of Kesek Automation Luis González (Mexico Business Publishing, 2020, Automotive Review page 257). Having a local team that understands the needs of local customers, backed by the knowledge and prestige of a Dutch innovative company is a winning combination, affirms Lucas Díaz. (Díaz, L. (2020, 08, 18). Personal communication. Appendix I).

Latin America still faces challenges in the integration of digital tools, said Martín Tanco, Director of the Center for Innovation in Industrial Organization (CINOI) of the University of Montevideo during the webinar entitled “Strengthening digital transformation during Covid-19,” from the MIT Center for Transportation & Logistics (MIT CTL). “Changes in the supply chain, distribution and logistics have become relevant due to the pandemic. Issues such as resilience, teleworking and digitalization made a huge leap out of necessity and survival,” he explained. Tanco listed the challenges facing the region for the implementation of technological tools: lack of investment due to the economic crisis as a result of the COVID-19 pandemic, excess capacity due to global decrease in logistics activity, and a price war between companies stemming from this impact on demand. All of this will widen the digitalization gap, he predicts. (Mexico Business Publishing, 2020, Automotive Review, p. 253). Other experts mentioned the main problem for the fast adaptation of industry 4.0 solutions to be lack of profitability. The benefits of investing in technology are often hard to grasp for potential clients, who are often looking for short-term return on investments – a practice not uncommon in Latin America.

Green and Smart Mobility

A market study on green mobility in Mexico (Berbée & Flores, 2020) concluded that despite the size of Mexico’s automotive industry, currently only one OEM produces electric vehicles in the country. Furthermore, the cost of purchase, accessibility of charging points and public opinion, in combination with a lack of sufficient financial incentives from the Mexican government, are causing Mexico to adapt slower to electric vehicles (EVs) than their Chinese and European counterparts. The Mexican government shows a tendency towards electric public transport in major cities including Mexico City and Guadalajara, but innovation is being implemented slowly.

What is the current state of the electric mobility market and what is the outlook?

“To understand the transition to electric mobility in Mexico, it is important to understand Mexico’s entire ecosystem. The transition to electric mobility will start when important actors in sectors such as private and public transportation adopt the technology and when the status quo around electric vehicles is challenged. Globally, the phenomenon of electric mobility transition is already taking place. The pace of transition in Mexico will depend on the transportation ecosystem (February 2020)”.

Francisco Cabeza Santillana, Electric Mobility Manager of Engie and Leopoldo Ruiz Huerta (Automotive Product Specialist, February 2020).

Government policy and public transport

A national strategy for electric mobility has been under development since 2018. National and international efforts have been made to design a proper solution that is adequate to the Mexican conditions. The main goal is to reduce the CO₂ emission with 5 MtCO₂-eq in the year 2030, and to have an electric car fleet of 500,000 light vehicles, and 7,000 public transport electric vehicles (SEMARNAT, 2018). Mexico City has designed the electro-mobility strategy 2018-2030 with the vision of a zero GHG emissions mobility, using electricity produced by renewable energy technologies as fuel (C40 Cities Finance Facility, Carbon Trust, 2018).

The short-term goals in the electro-mobility strategy for Mexico City are to make 20 percent of public transportation electric, 15 percent of new car sales EV, 80 percent of taxis EVs, 30 percent of the utilitarian vehicles EVs or hybrid, 30 percent of the bicycles electric, and to have 1,500 electric charging stations by the year 2024 (C40 Cities Finance Facility, Carbon Trust, 2018).

To date, there is no city in Mexico using only electric buses for their public transportation system. Mexico City and Guadalajara are the only cities that are in the process of recovering the old infrastructure of trolleybuses; buses that run on electricity but are attached to a cable. There are currently 25 trolleybuses running in Guadalajara (0.49 percent of total buses) and 213 (1.79 percent of total buses) in Mexico City (Espinosa, 2019; Ebus Radar, 2020). An agreement with Nissan resulted in a sheer 70 Leafs that were deployed as taxis, 50 in Aguascalientes and 20 in Mexico City since 2013.

Mexico City is one of the frontrunners in innovations for mobility in the country. In March 2020, the local government of the city ventured into a program with OEM Ford, by launching the first edition of City: One Challenge, where citizens were challenged to identify mobility obstacles and find suitable solutions. The winner was the electric trici-taxi, aimed at user from the surroundings of the city.

In order to promote the use of EVs, the Mexican government has implemented some incentives as the exemption of taxes, special license plates, a discount on the toll fee, and the installation of charging points. In the ENME (National Mobility Strategy) 16 new incentives are said to be launched, providing a strong impulse in the EV public transport (SEMARNAT, 2018).

New forms of mobility

A recent survey conducted by industry leaders from Mexico Business Publishing (2020) concludes that a new view in Mexico on mobility is gaining strength. In the MAR 2018 survey, 36 percent of the interviewees expected at least a 10 percent level of penetration for electric and hybrid vehicles in the Mexican market within five years. Meanwhile, 44 percent of the interviewees considered car ownership is losing some importance among Mexican consumers.

As in other countries, the idea of car ownership is changing. Ride-hailing companies such as Uber, Didi and Cabify have revolutionized people's perceptions. Uber has just begun its 7th year of operations in Mexico and currently operates in 21 states and 35 cities with an 80 percent market share, thereby being in the top three of most-important countries for the company. In 2019, one out of every 10 new vehicles leaving dealerships was destined to become an Uber car in Mexico.

Ridesharing not only solves traffic congestion and parking problems in megacities such as Mexico City, but also highlight consumer's needs. Uber mentioned that rather than counting the number of vehicles, the number of seats available is what counts.

Ride-sharing companies also catalyze further innovations in Mexico's mobility, including electrification and autonomous driving. For example, apart from the implantation of mobility systems that rely on electric scooters and -bikes, Chinese giant Didi announced in early 2020 the incorporation of 200 new electric vehicles to cater for the increasing demand in Mexico City. Drivers of electric vehicles do not pay any commission to the platform, whereas hybrid drivers receive large cuts on the commission designated to the platform. Uber Mexico has been hinting on providing services through autonomous vehicles for some years now. Similar to their expansion to food delivery services, we can expect to see innovations in the heavy vehicle and cargo transportation in coming years from the transportation giant (Portella, 2018).

Mobility as a Service (MaaS) is a concept that encompasses all transportation options, public and private, under a single scheme that helps people to move more easily from one point to another. According to Deloitte: "MaaS relies on a digital platform that integrates end-to-end trip planning, booking, electronic ticketing and payment services across all modes of transportation, public or private." MaaS is closely intertwined with shared mobility including: bikes, cars or ride-hailing apps. Just in 2019, the car-sharing market accounted for US\$2.5 billion globally, according to Global Market Insights (Mexico Business Publishing, 2020). Megacities such as Mexico City provide room for innovative MaaS concepts.

EV Charging systems

The charging infrastructure is an important barrier that Mexican cities and municipalities must overcome in order to pave the way for an electric revolution. OEMs BMW and NISSAN have joined efforts by investing 100 million Mexican pesos, around US\$5 million, to install 661 charging locations in strategic places such as shopping malls, hotels, universities, parks, main streets, and some important highways in the country. For the time being, these charging points are free. Anyone that has an EV may charge their batteries for free while shopping for groceries or seeing a movie at the cinema. Up to date information on the location of these loading stations can be viewed at www.chargenow.mx (Chargenow, s.f.)

Apart from this private initiative, CFE, the regulatory body for electricity in Mexico, and initiatives such as Charge Now have installed over 2,500 charging points in Mexico (Cabeza, 2020). The total of installed charging point is approximately 7,000 nationwide. In November 2018, the CRE (energy regulator in Mexico) released an agreement that allows the sale of electricity between private parties in order to promote the sales of electricity for EVs through charging stations. This agreement opens the door for everyone to sell the electricity as fuel for EVs, just like gas stations sell gas today. Anyone in the private sector who has renewable energy power plants, as well as a households that generate more green energy than they consume, can participate in this transaction without a specific permit from the CRE (CRE, 2018).

A critical note often reiterated in the industry is that the electricity provided at charging stations stems from non-renewable energy sources. Mexico's energy supply relies for 69 percent

on fossil fuels, according to a Tweet from 17 May 2020 from Rocío Nayle, Secretary of Energy). The renewable energy utilized in Mexico is divided in 1.2 percent generated through geothermic processes, 2.0 percent nuclear, 4.3 percent solar, 7.5 percent wind, and 16 percent hydroelectric sources.

Sustainable manufacturing

The automotive industry in Mexico is becoming increasingly committed to sustainable manufacturing, both in terms of the manufacturing process and their products. OEMs and their suppliers strive to recycle, power plants through renewable energy sources, and reduce weight on their vehicles and auto parts (Labastida, 2015). “There are worldwide discussions about climate change, CO₂ emissions, and sustainability. As a German company in Mexico, we have the possibility to generate a true impact and make these relevant topics in the industry,” says Andreas Lehe, appointed in 2019 as President of Audi Mexico (Mexico Business Publishing, 2020, p. 8). Audi’s manufacturing plant in San José Chiapa, Puebla, is waste-water-free, with 100 percent of its electricity coming from renewable sources. OEM Nissan recycles 100 percent of water used in their production centers in Cuernavaca and Aguascalientes (Labastida, 2015).

Sustainable operations are not only important for automakers, but also for auto parts manufacturers. Industrial developers are searching for suitable new solutions. “Today, the mindset of most developers has changed, and it is more common to bet on sustainability, not only through marketing but in real terms. Though the investment is high, it is worth the effort. It can be a decisive element to close an investment,” says Francisco Rosete, Executive Director Central Mexico of Amistad Industrial Developers, one of the largest in the country (Mexico Business Publishing, Automotive Review p.8).

Lightweighting

Fueled by the rise of electric vehicles, the search for higher efficiency hence lighter components of vehicles has accelerated in recent years. Higher efficiency is also a request by emissions goals set in both North America and Europe. Corporate Average Fuel Economy (CAFE) standards will require light vehicles to achieve a 54.5mpg (23.17km/l) efficiency by 2025. On the other side of the Atlantic, the European Union is focusing on reduced emission. The Emission Ceilings Directive establishes that the maximum CO₂ emission per vehicle must reduce from 130g/km in 2015 to 95g/km by 2021. In order to achieve this, the US government set up the US Driving Research and Innovation for Vehicle Efficiency and Energy Sustainability (DRIVE) initiative. The private sector created the Coalition for Automotive Light-weighting Materials (CALM).

From global suppliers to SMEs at the bottom of the supply chain, the movement forms a promising trend in Mexico – and hints to ample opportunities throughout the supply chain. Particularly mixed-material body structures of steel and aluminum with polymers and plastics are proving to be valuable solutions, while global steel companies are offering lighter alternatives. The

automotive lightweight material market was estimated to reach US\$89.1 billion in 2019 and is forecasted to exceed US\$127.7 billion by 2027 (Mexico Business Publishing, 2020).

Lightweighting represents an opportunity for innovation in several ways. For starters, lightweight production increasingly requires the use of advanced manufacturing technologies such as additive manufacturing, thin-wall casting, resin transfer molding, and structural adhesives. Particularly companies active in the armoring business, struggle to find a balance between solid armoring without adding too much weight to vehicles.

Nonetheless innovation must go beyond materials. In the CAR Technology Roadmap (Modi & Vadhavkar, cited by Mexico Business Publishing Automotive Review, 2020, p. 217) the authors explained that “The future of materials and manufacturing technologies will depend on multiple factors, such as the availability of enabling technologies and the cost, consumer acceptance, recyclability and supply chain and infrastructure required to support them. Design optimization is the key to balancing performance and cost requirements”.

The heavy vehicle segment is also seeking lightweight solutions to comply to new environmental standards while optimizing their cargo capacity. The trend in the US is to bet on heavier, more robust vehicles, whereas the European offer aims at innovations that integrate lighter components, such as hydraulic systems, to the vehicles. The trend is to become more efficient, lighter, and faster (Mexico Business Publishing, 2020).

CASE Vehicles

Connected, Autonomous, Shared and Electric (CASE) vehicles are the word on everybody’s lips in the industry. Changing consumer and environmental demands drive companies to innovate, breaking with tradition, and urging for new business models that venture into new technology trends. Mexico, although more a follower than a leader, is no exception.

On the KPMG 2020 Autonomous Vehicles Readiness Index (Owen-Vandersluis, 2020), Mexico ranks 28th out of 30 countries most open to the adoption of Autonomous Vehicles (AV), before India and Brazil. In 2019, the country ranked 23rd. Notably the current government’s preference for traditional industries such as oil & gas explain the loss of positions. In comparison, Mexico is assessed as lowest on industry partnerships, that is, partnerships between vehicle builders and technology suppliers essential for AV. The country scored second lowest on AV regulations, pilots and having an AV-focused agency, as well as being the second-lowest on government’s readiness for change.

This reflects that Mexican implementation of AVs, along with other new transport and clean energy technologies, is on hold under the current federal government, according to Ignacio García de Presno, Partner, Infrastructure and Global Group, KPMG in Mexico. “We’re trying to restore what we’ve got, rather than develop new things,” says de Presno. Despite pressure from the private sector, any change is unlikely until the next federal election in 2021. He sees good potential for Mexico to develop use of AVs, given its proximity to the United States. “Sooner or later we will catch up, as we share a long border and are one of its main trading partners,” he says. “The first step has to come from the government, not just in this area but in many others. It needs to lay the ground so that the private sector and universities can work on it” (p. 39).

The Netherlands comes in second, losing last year's first place to Singapore. The full report can be referenced in Appendix IX.

Despite these challenges, the road to CASE vehicles provides ample opportunities for niche auto parts manufactures. A major emerging trend is the increasing use of sensors, for example. As smart vehicles become increasingly more popular, investments of OEMs in these technologies grow accordingly. In the quest towards autonomous vehicles, OEMs are building cars capable of locating themselves in environments, using devices to adapt its behavior to objects surrounding the vehicle. Examples are parking aids and automatic brake systems.

Electric Vehicles

In the period comprising 2016-2019, almost 1000 EVs were sold in Mexico, compared to 51,144 hybrid cars. Table 5 shows an overview of these EV sales. Information from Tesla is not included in this figure, as the company does not report its sales figures. It is estimated that there are currently a little over 3,000 EVs on Mexico's streets, but figures are ambiguous (Cabeza Santillana, 2020).

Units sold per year	2016	2017	2018	2019
EV	254	237	201	231
Hybrid plugin	521	968	1584	1081
Hybrid	7490	9349	16022	18283

Table 5. INEGI (2020). Overview of Electric Cars in Mexico.

In Mexico, a total of 55,221 of both hybrids and EV's have been sold since 2016, with an annual average growth of 35.3 percent to date. In July 2019, a total of 2,068 vehicles of this segment was sold and hybrids recorded the highest amount of sales within its sector, with 1,978 cars. In a minimal proportion, plug-in hybrids (78) and electric hybrids (12) were sold (Deloitte, 2019). The states with most EVs in Mexico are Mexico City (357), Jalisco (118), Chiapas (54), Nuevo Leon (49), and the State of Mexico (41). The states without EV in Mexico are Baja California Sur, Campeche, and Tabasco (INEGI, 2020). EVs currently available in Mexico are expressed in table 6:

Brand	Model
Audi	e-tron
BMW	I3
BMW	I8
Chevrolet	Bolt EV
Jaguar	I-Pace
Nissan	Leaf
Renault	Twizy
Tesla	Model 3
Tesla	Model S
Tesla	Model X
Zacua	MX2
Zacua	MX3

Table 6. Bureau, Motorpasion Mexico (2019). EV's brands and models in Mexico. Retrieved from: <https://www.motorpasion.com.mx/industria/autos-hibridos-electricos-a-venta-mexico-2019>

In terms of production, there is only one OEM producing EVs in Mexico at the time of publication of this report: Zacua. This Mexican automotive firm is a pioneer in the industry, producing the first 100 percent Mexican EV with models MX2, and MX3 since 2016. The range of the car is 160km and it takes 8 hours to fully charge the batteries. The price of each model is \$600,000 Mexican pesos (approximately EUR 25,000).



Photo 1. Taken by Fernando Flores at ZACUA sales floor

Upcoming plans for CASE vehicle production in Mexico

Other OEMs and their suppliers are preparing for the manufacturing of CASE vehicles in Mexico in the near future:

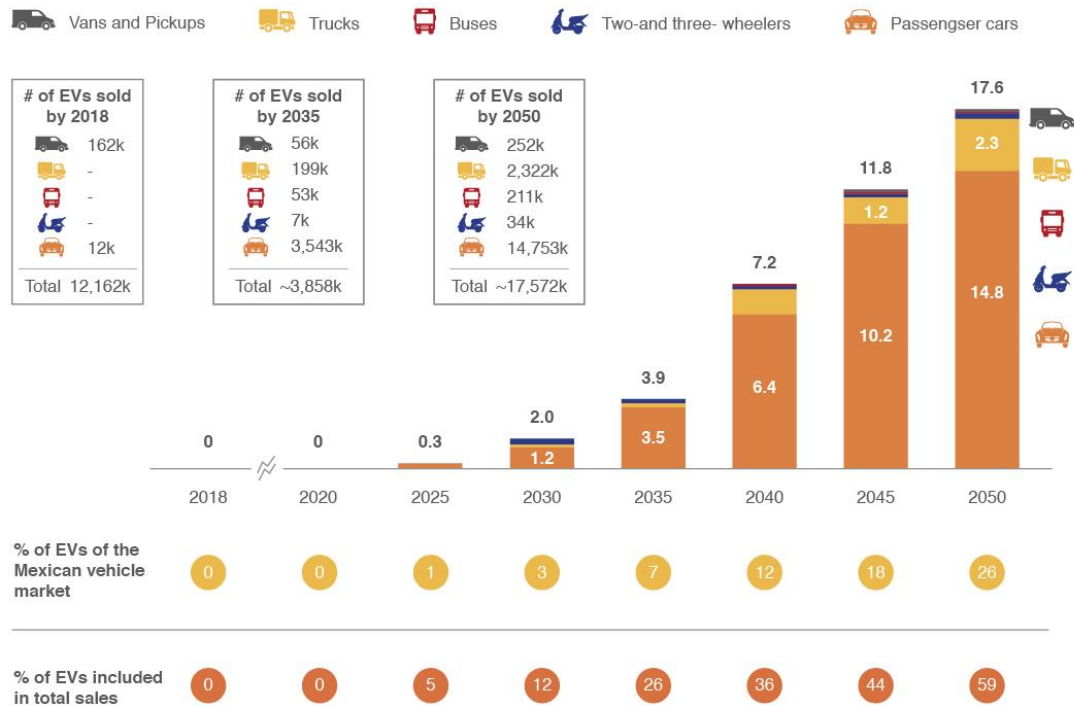
- In May 2020, Ford announced that Mustang Mach-E would be launched in early 2021. Its production will start in October, 2020 in Cuautitlan plant located in the State Mexico. This car is aimed at the U.S. and European market.
- General Motors announced in late July 2020 their intention to produce at least 20 different electrical models by 2023. Mexico is likely to become one of their production locations. Some forecasts believe that GM will modernize its factory in Ramos Arizpe, Coahuila, to begin production of electric vehicles in 2023 . (Bureau, 2019)
- BMW's plant in San Luis Potosí began production of their plug-in hybrid series in April 2019. It is expected to play a key role in the promotion of electromobility in the region (Marklines, 2020)
- After several years of being absent, Smart is preparing its return to the Mexican market with a fully electric offer. No announcements have been made about an anticipated return date.
- In the last four years, Mexican auto parts companies Condumex, Nemark, Rassini and Metalsa together invested around 1,642 million pesos in research and development to create parts for electric cars and establish themselves as major suppliers in the industry in the short term (Sánchez, 2018).
- In a 2020 interview, Magda López, CEO of Renault Mexico announced that "A major expansion in shared EV technologies is planned, along with the development and implementation of advanced autonomous drive systems, vehicle connectivity and new mobility services" (Mexico Business Publishing, Automotive Review 2020, p. 49).

Outlook for CASE vehicle market in Mexico

A 2019 industry study from McKinsey & Company concluded that electric vehicles in the Mexico will start reaching cost parity with internal-combustion-engine vehicles in the current decade, but mass adoption will not fully materialize until after 2030, as per figure 30 (Camba, Ordorica Lenero, & Scott, 2019).

MASS ADOPTION OF ELECTRIC VEHICLES COULD BEGIN BY 2030

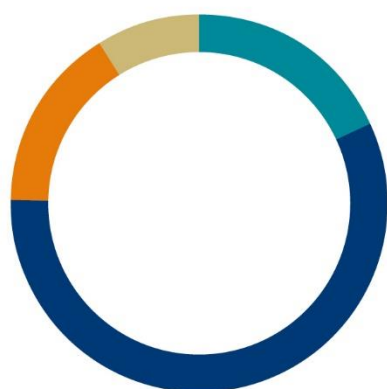
ELECTRIC-VEHICLE (EV)¹ MARKET BY SEGMENT BY 2050 (MILLION VEHICLES)



¹Includes battery electric vehicles, plug-in hybrid electric vehicles, and hybrid electric vehicles.
Source: McKinsey global energy perspective 2019

Figure 30. McKinsey Global Energy Perspective (2019). Forecasted mass adaptation of EV's in 2030. Retrieved from:

A 2020 survey from Mexico Business Publishing (Mexico Automotive Review, 2020) asked contributors about their opinion on the readiness for innovation in the Mexican vehicle manufacturing industry (figure 31).



IN TERMS OF PRODUCTION, HOW READY DO YOU THINK MEXICAN COMPANIES ARE TO PARTICIPATE IN HIGH-TECH COMPONENT MANUFACTURING, SUCH AS ELECTRIC AND AUTONOMOUS-VEHICLE COMPONENTS?



Figure 31. *Mexico Business Publishing (2020). How ready are Mexican companies to participate in high-tech component manufacturing? Mexico Automotive Review 19/20.*

As Jose Roman, Managing Director at Nissan Mexico puts it: “Technology adoption is a matter of time. Similar to the cellphone experience, the electrification trend will ramp up within 10 years in Latin America. EVs will arrive hand-in-hand with technologies such as e-power. An obstacle for new technology, however, is infrastructure development, which should be the responsibility of cities and governments as well as the private sector. The EVs that will arrive in the region will be e-powered units that will not require a large number of charging stations. Autonomous driving will arrive as well. I have driven fully autonomous Nissan models in Japan. The technology is ready, it is just a matter of making it available. Cities must be connected to vehicles, which is why I see this coming in the midterm, and Nissan will have some advantages in this process. This technology also enables advanced mobility for the elderly. When the gap between vehicles and infrastructure disappears, I imagine a Mexico City center full of autonomous vehicles and less traffic. The market will change quickly and profoundly. We should be ready for new customers and technological trends that will shape the future challenges of the industry.” (Mexico Business Publishing, Automotive Review 2020, p. 42).

4. Human Resources, Research & Development in Mexico

With high-capable human capital, a consolidated manufacturing ecosystem and a new treaty (USMCA), Mexico is the place to be for the development of new technologies, products, and the nurturing for engineers in the country with the technical know-how. This is the time for Mexico to move away from traditional manufacturing towards the forefront of technological innovation with potential industrial applications. The country is starting to attract engineering operations from global companies and a skilled workforce is ready for action.

4.1 History & Current R&D

Mexico is historically a manufacturing hub, rather than a center for Research and Development, as comparative data clearly shows. The expenditure of business enterprises in R&D in Mexico are expressed in Figure 32. Data on government expenditure is not available, nor is more recent data.

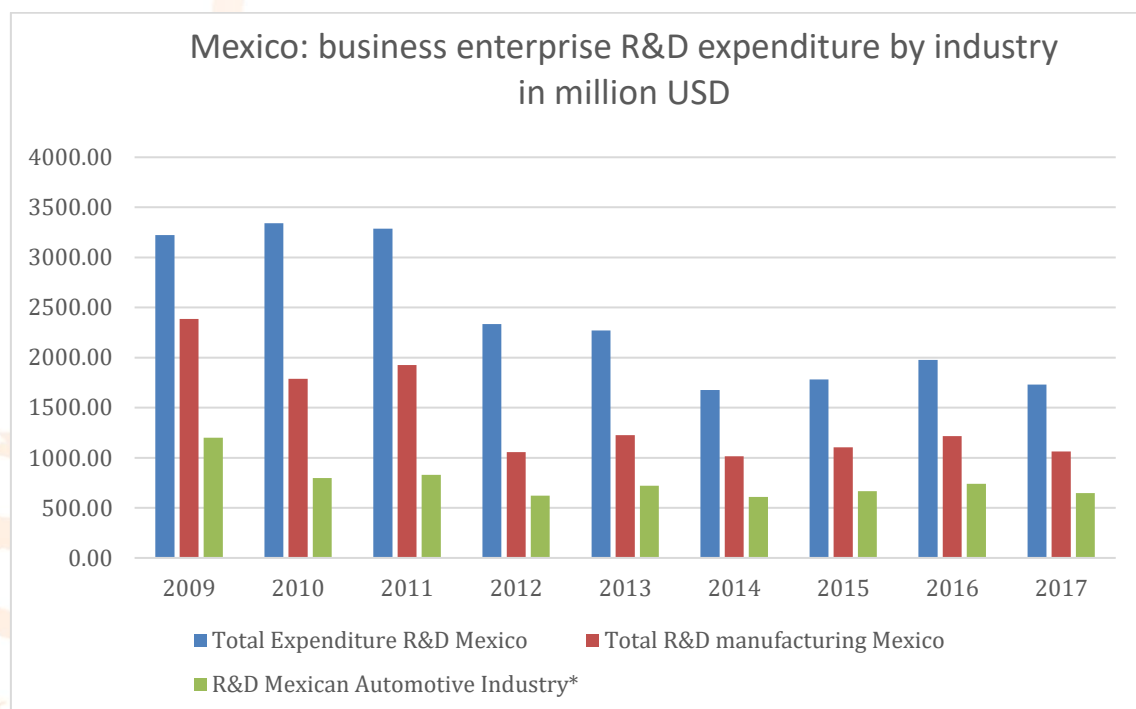


Figure 32 Business enterprise R&D expenditure by industry in million USD (2015 Exchange Rate) in Mexico. *Manufacture of fabricated metal products, computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transport equipment. Source: OECD via <http://www.oecd.org/innovation/inno/researchanddevelopmentstatisticsrds.htm>

When comparing this chart to countries where leading OEMs originate, the position of the R&D sector in Mexico becomes more evident, as per figure 32. Data for both figures can be found in Appendix VII. Another illustration is the R&D capacity in Mexico as seen in figure 33 which compares the Full Time Employees (FTEs) of Germany, The Netherlands and Mexico in Research & Development positions (Crossa, Mateo & Delgado Wise, Raúl. (2020).

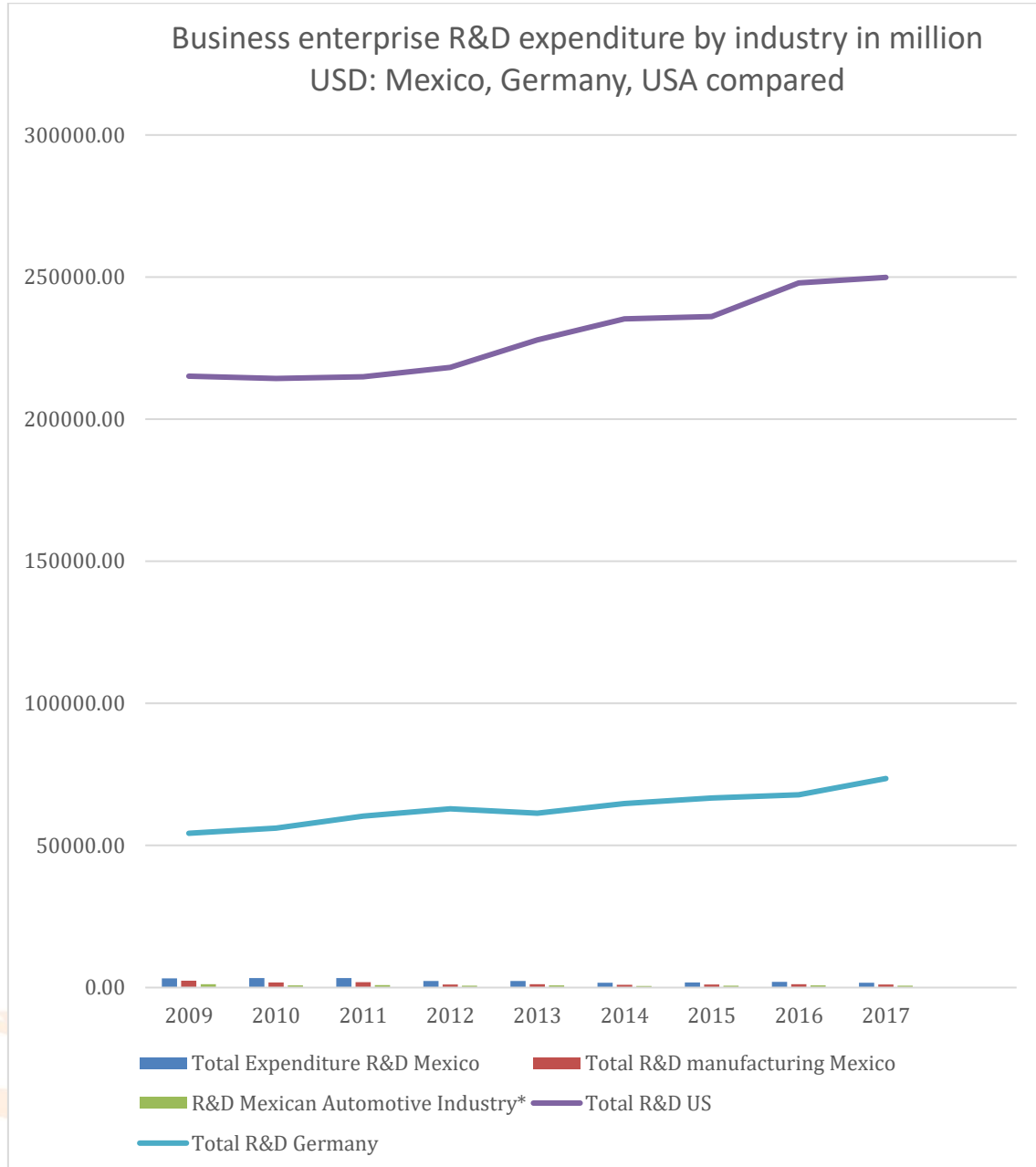


Figure 33. OECD (2019). Business enterprise R&D expenditure by industry in million USD (2015 Exchange Rate) compared. Retrieved from: <http://www.oecd.org/innovation/inno/researchanddevelopmentstatisticsrds.htm>.

*Manufacture of fabricated metal products, computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transportation equipment.

R&D personnel by sector and function, expressed in full FTEs

	2009	2011	2012	2014	2015	2017	2018
Germany	534,975	575,099	591,261	605,252	640,516	686,349	706,557
Mexico	..	73,436	58,849	52,150	57,013
Netherlands	87,874	117,435	122,215	124,065	129,060	135,626	157,389

Figure 34 R&D personnel by sector and function, expressed in full FTEs. Source: OECD via <http://www.oecd.org/innovation/inno/researchanddevelopmentstatisticsrds.htm>

Current R&D centers are distributed throughout the country with a high concentration in the North-Center and Western region. In addition to private and public centers, universities are also active within the research ecosystem; the two most important institutions of Mexico have specialized centers: the National Autonomous University of Mexico (UNAM, public university) and the Monterrey Institute of Technology and Higher Studies (ITESM, private university).

Steps are being taken across the country to expand Mexico's R&D portfolio, both by the private and the public sector. Companies such as Delphi, General Motors, Chrysler, Nissan, already have R&D centers in Mexico. In total, there are currently 31 private R&D centers in the country, of both engineering and design. According to AMIA, the largest user of the general budget of the National Council of Science and Technology (CONACYT) is the automotive industry.

This following depicts the private R&D centers in Mexico:

| AUTOMOTIVE R&D AND DESIGN AND ENGINEERING CENTERS IN MEXICO

ID NUMBER	Private Design and Engineering Centers	Main Design and Engineering tLines
1	Nissan Technological Development Center (CDT Nistec) - Nissan	Product design and development, project engineering and environmental engineering
2	Chrysler Automotive Engineering Center FCA Group	Vehicle tests, emissions tests, materials physics and chemistry and environment and energy
3	Delphi Aptiv Mexico Tech Center - Delphi Aptiv	Component engineering and product design and development
4	Advanced-Manufacturing Research Center (CIMA) - ITESM	Advanced-manufacturing, human resources development, tooling development, product design and tropicalization
5	Technological Center for Vehicle Electronics (CTEV) - ITESO and Soluciones Tecnológicas	Electronic software, software and statics control and high-technology instrumentation
6	Center for Innovation and Development of Competitive Advantages (CIDEVeC) - Metalsa	Product design and manufacturing
7	KATCON Institute for Innovation and Technology (KIIT) - KATCON	Fine particles and fluids analysis, quick prototyping and validation tests
8	Center for the Development of the Mexican Automotive Industry (CeDIAM) - ITESM	Metrology and manufacturing, propotyping and suppliers training
9	GM Toluca Engineering Center - GM	Product development (vehicle interiors, electrical systems and thermal systems)
10	Continental R&D Center - Continental	Self-driving technologies and object-detection software
11	Harman Advanced Engineering Center - Harman Group	Product design (cards and electronic components), validation tests
12	Carso Center for Research and Development (CIDECE) - Condumex and Delphi	Technology development for superconductor cables, optic fiber, industrial design and metallurgy
13	TREMEC Center for Technology and Development - TREMEC	Product design (transmissions)
14	Ford Technological Research and Development Center for the Automotive Industry El Cristo - Ford	product design and testing
15	Visteon Technical Center - Visteon	Software development, product design (components for intelligent passenger cabins)
16	Bosch Innovation Center Guadalajara - Robert Bosch	Hardware engineering, software development (augmented reality, mobility and connectivity and engineering solutions)
17	Cummins Research and Development Center - Cummins	Advanced-manufacturing processes, parts re-engineering and product development for the aftermarket
18	Yanfeng Technical Center for Product Design and Development - Yanfeng	Product design and advanced manufacturing processes
19	Valeo R&D Center - Valeo	Innovation design, development and prototyping
20	Faurecia Seating R&D Center - Faurecia	Product development (Cockpit of the Future systems)
21	Faurecia Interiors R&D Center - Faurecia	Product development (Cockpit of the Future systems)
22	Brose Research and Innovation Center - Brose and UPQ	Advanced manufacturing processes and talent training
23	OSRAM Continental R&D Center - OSRAM and Continental	Integration of lights, sensors and electronics
24	Sisamex Human and Technology Development Center - Sisamex	Mechanical endurance tests, metallurgy technologies, automation and advanced manufacturing processes
25	Macimex i2DEAS Research Center - Macimex	Machining prototyping, mechanical and endurance tests, metallurgy dimensional and electronics tests
26	Pumex Nano-Cellular Laboratory - Química Pumex	Statics and mechanical tests, particle size analysis, ultrasound scattering, response to combustion and thermal insulation tests
27	Quimmco Technological Center - Grupo Quimmco	High-precision machining, tooling and cutting tool design, production and repair
28	DRIVEN CLAUT Innovation Center - Automotive Cluster of Nuevo Leon	Talent development for product development, design and advanced manufacturing processes
29	Nemak Development Center - Nemak	Product development
30	Kostal Engineering & Design Center - Kostal	Product design and engineering
31	Magna Cosma Development Center - Magna	Product design and engineering

Figure 35. Mexico Business Publishing (2020) Research & Development, Design and Engineering Centers in Mexico. Mexico Automotive Review 19/20.

ID	Public R&D Centers	Main Research and Technological Development Lines
▲	Applied Research Center for Competitive Technologies (CIATEC)	New materials, advanced manufacturing and industrial processes
▲	Center for Engineering and Industrial Development (CIDESI)	Automated systems, microelectronic and microelectromechanic systems, energy, joining technologies, surface engineering, advanced manufacturing, oil industry and technology of cold
▲	Center for Research and Technological Development in Electrochemistry (CIDETEQ)	Bioelectrochemistry, corrosion, alternative energies, electrochemical engineering, nanotechnology, water and waste treatment, advanced materials and coatings, environmental engineering
▲	Research Center in Advanced Chemistry (CIQA)	Polymers synthesis, polymerization processes, advanced materials, plastic transformation processes and biosciences and agritechology
▲	Mexican Corporation for Materials Research (COMIMSA)	Project engineering, metal-mechanic manufacturing engineering, environmental engineering and materials engineering
▲	Advanced Materials Research Center (CIMAV)	Materials physics and chemistry, environment, renewable energies, metallurgy and structural integrity, nanostructures and polymeric nanocomposites and computer physics and chemistry
●	Advanced Technology Center (CIATEQ)	Machines and manufacturing processes, measurements and instrumentation, monitoring and control systems, processing equipment, plastics transformation and alternative energies
●	Optics Research Center (CIO)	Optic fibers and lasers, optical engineering, nanophotonics, non-linear optics and non-destructive tests
●	National Astrophysics, Optics and Electronics Institute (INAOE)	Astronomy, astrophysics, physical optics, quantum and statistical optics, photonics and optoelectronics, integrated circuit design, microelectronics, computer learning and pattern recognition and systems engineering
●	Potosino Institute for Scientific Research (IPICYT)	Geophysics, geoinformatics, geology, applied mathematics and advanced materials
●	Center for Innovation and Research in Information and Communication Technologies (INFOTEC)	IT development, innovative management, regulation and appropriation
●	Center for Mathematical Research (CIMAT)	Functional analysis, algebraic and differential geometry, dynamic systems, topology, statistics, computer science and software engineering
★	Aguascalientes Innovation and Technology Transference Center for the Automotive Industry (CITTAA Research Consortium)	Competencies development for auto parts, electronics and it companies
★	Tlaxcala Center for Research and Innovation (CITLAX Research Consortium)	Polymers engineering
★	Consortium for the Development of Infrastructure and Human Resources to Reduce Foreign Dependency on Molds, Dies and Tooling (MTH Research Consortium)	Development of molds, dies and tooling for the automotive, auto parts and metal-mechanic industries
★	National Center for Nanosciences and Nanotechnology (CNyN) - UNAM	Multi-ferroic materials, materials and plasma optics, nanosciences, nanotechnology and chemical surface analyses
★	Center for Research and Development in Engineering and Technology (CIIDIT) - UANL	Nanotechnology, advanced materials, mechatronics and software engineering
★	Center for Productivity and Business Competitiveness (CEPCE) - UANL	Industrial processes, mechanics and digital technologies
■	Center for Innovation and Training for Composite Materials (CIEMC) - UAQ	System development and control, manufacturing and composite materials engineering

Figure 36. Mexico Business Publishing (2020). Public Research & Development Centers in Mexico. Mexico Automotive Review 19/20.

| AUTOMOTIVE R&D AND DESIGN AND ENGINEERING CENTERS IN MEXICO

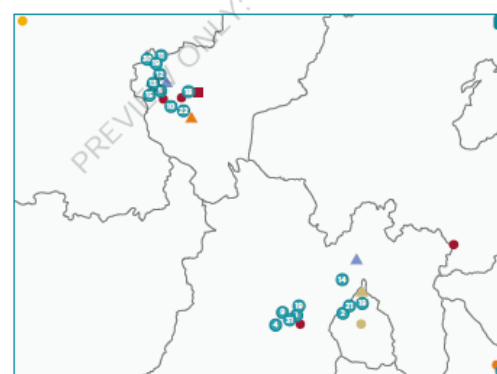
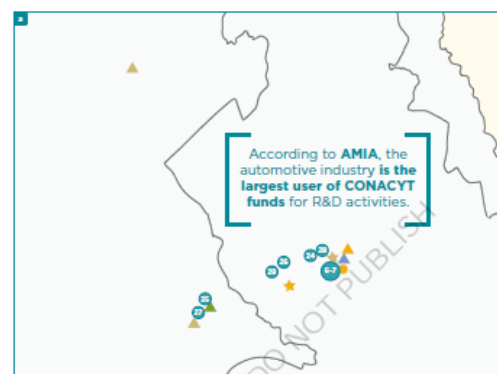
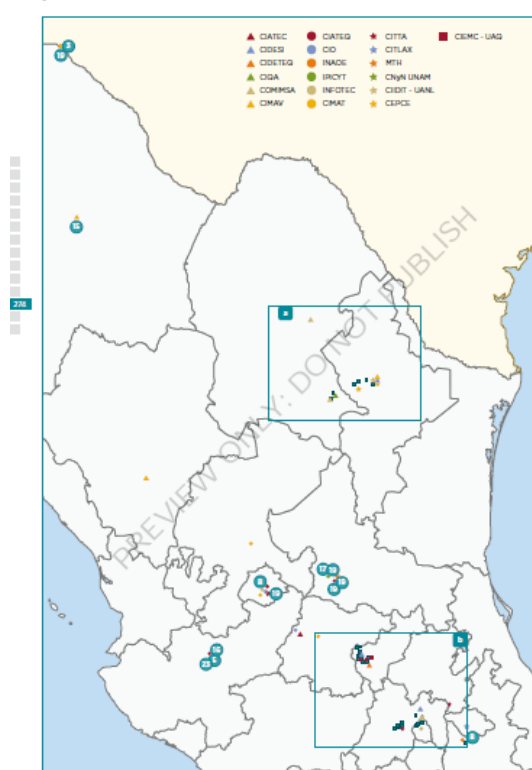


Figure 37. Mexico Business Publishing (2020). R&D centers location in Mexico. Mexico Automotive Review 19/20.

#	ORGANIZATION	NAME OF THE R&D CENTER	DEDICATED TO:
1	Automotive Cluster of Nuevo Leon	DRIVEN CLAUT Innovation Center	Talent development for product development, design, and advanced manufacturing processes
2	Brose and UPQ	Brose Research and Innovation Center	Advanced manufacturing processes and talent training
3	Condumex and Delphi	Carso Center for Research and Development	Technology development for superconductor cables, optic fiber, industrial design, and metallurgy
4	Continental	Continental R&D Center	Self-driving technologies and object-detection software
5	Cummins	Cummins Research and Development Center	Advanced-manufacturing processes, parts re-engineering and product development for the aftermarket
6	Delphi Aptiv	Delphi Aptiv Mexico Tech Center	Component engineering and product design and development
7	Faurecia	Faurecia Seating R&D Center	Product development (Cockpit of the Future systems)
8	Faurecia	Faurecia Interiors R&D Center	Product development (Cockpit of the Future systems)
9	FCA Group	Chrysler Automotive Engineering Center	Vehicle tests, emissions tests, materials physics and chemistry and environment and energy

Table 7. Mexico Business Publishing (2020). Private R&D centers in Mexico. Source: Mexico Automotive Review 19/20.

The Mexican federal government supports initiatives in R&D particularly through the National Council for Science and Technology (CONACYT). Furthermore, it has developed a network of national laboratories which are specialized in specific subjects:

- a) CIDESI/CIATEC - National Laboratory for Research in Cold Technologies
- b) CINVESTAV/ CIATEQ/ CIDESI - National Laboratory of Thermal Projection
- c) **CINVESTAV/ UAEH/ UPP - National Laboratory in Autonomous Vehicles and Exoskeletons**
- d) CINVESTAV/ UG - National Laboratory for Research and Technological Development of Advanced Coatings
- e) **CIQA/ CIATEC/ CIDETEQ - National Laboratory for Innovation and Development of Lightweight Materials for the Automotive Industry**
- f) UAZ/ ITS-EL DORADO/ IT-MORELIA - National Laboratory for Research, Technological Development and Innovation in Embedded Systems, Advanced Electronic Design
- g) UNAM- National Laboratory of Space and Automotive Engineering National Laboratory of Space and Automotive Engineering
- h) UNAM/ITESM - National Laboratory of Additive Manufacturing, 3D Scanning, Computerized Tomography

The **National Laboratory for Innovation and Development of Lightweight Materials for the Automotive Industry**, bases its research in the evaluation of materials and parts used in auto parts by various analysis techniques and standards. Technological consultancy for the replacement of plastic materials, product improvement and development, prototyping with 3D printing, recycling practices, coatings on various materials, corrosion, additives, and technical training.

The **National Laboratory in Autonomous Vehicles and Exoskeletons** focuses on design and construction of unmanned vehicles for applications in aerial, underwater and land surveillance and inspection, as well as mapping and 2D and 3D reconstruction. Furthermore, it conducts experiments on autonomous vehicles and exoskeletons using motion capture systems. Design and construction of exoskeletons for applications in the rehabilitation and expansion of human strength.

The investment through CONACYT and joint efforts from private companies and the academia translate to different R&D centers in terms of research and innovation. In this regard, there are numerous collaborations on state-level between local governments, businesses, and knowledge institutions.

R&D activities of the automotive and auto parts industry range from engineering methods and models to specialized machinery, software and AI prototypes and systems. “To truly have an impact on the industry’s development, research centers must work to make innovations accessible and affordable. The future of the automotive industry is in interconnectivity and sustainability” says the Director of the Engineering and Industrial Development Center (CIDESI). (Mexico Business Publishing, 2020).

Examples of initiatives where the private sector collaborates with knowledge centers are blooming. OEM Audi, established in Puebla since 2014, has specific strategic programs with a long-term vision. The *Dual training system* is a German model in cooperation with the *Technologic University of Puebla (UTP)*. The training combines theory with practice and since the plant’s opening, 210 interns in total are under contract with Audi Mexico. Another strategy is the *EMA program*, for its abbreviation in Spanish (Mexican Students in Germany) in coordination with the German Academic Exchange Service (Deutscher Akademischer Austauschdienst) that helps engineering students to go abroad to Germany through a scholarship.

In an interview with Lucas Díaz (Díaz, L. (2020, 08, 18). Personal communication. Appendix I) Managing Director of AWL Automation Mexico explains how they approach R&D in this Dutch company in Mexico: “In Mexico, we keep track of the innovations in The Netherlands and adapt them to the Mexican market. It is important to bear in mind that the needs here in Mexico are not necessarily the same as in other countries. An example is the E-line, a robotic welding machine specifically designed for the local market. The technology aims to empower local businesses to venture into new business opportunities by making this more affordable and easier. We also work on some developments here in Mexico. Apps for augmented reality for instance. AWL Mexico started as a service company, then evolved into a production center, the next step is to have an engineering department, and afterwards a R&D center”.



Why choose Mexico for R&D?

“Human talent availability is one of the reasons why we continue to focus on promoting innovation and development in Mexico. In addition, we have a competitive advantage in development costs against traditionally oriented countries such as France or Germany. Another important factor that maintains interest in Mexico is the trust of our customers, who allow us to develop their products locally.”

– Francisco Maciel, CFO and Country Lead of Faurecia Mexico (Mexico Automotive Review, 2020, p. 172)

4.2 Anticipated R&D

Experts agree that Mexico is at a crossroad where it can choose to invest more in R&D and shift from being a value-for-money manufacturing or *maquiladora* destination to an important player in the advanced manufacturing industry. The opportunity now is to start building and positioning Mexico as an innovation hub. Considering the manufacturing Tier 1 suppliers and OEMs already established, the country has a tremendous advantage for creating the perfect atmosphere to make the establishment of more R&D centers viable. Between 2013 and 2018, the number of national research labs in Mexico grew from 11 to 72, according to the National Association of Transforming Industries (CANACINTRA).

Where does Mexico stand in terms of its readiness to become an automotive R&D hub?

“Mexico is moderately ready. We have strength in certain areas, but we still need to improve national policies. We know the president is interested in having a Mexican electric car. We need the economic, human and political resources to allow this. There are many groups in Mexico that could be working on such a project, but we have not developed the proper synergies. I see a great deal of potential if we have the right mechanisms for collaboration. The government has announced that it will allow institutions to compete for resources. However, there should be a more elaborated strategy. It is easy to say you want an electric car, but we need a thought-out plan to use our economic and human resources correctly”.

- Julieta Torres, Director General of CIDETEQ, Mexico Automotive Review 2020, p. 273

Mexican federal and local governments, industry associations, and knowledge centers, show increasing interest to capitalize on the opportunity of attracting more R&D to the country. A recent publication (Mexico Business Publishing, 2020) lists the priorities of the main national trade associations for the Mexican automotive industry:

- Creating competitive tax incentives for R&D operations for the automotive industry with multi- annual support
- Creating a sectorial fund for the automotive industry that promotes investments in R&D operations
- Strengthening the linkage and interaction of the industry with academic institutions and research centers with a focus on innovation and technology development programs for the automotive industry

In a 2020 interview with Mexico Business Publishing, Graciela Márquez, Minister of Economy, explains the federal government’s public policy aimed to boost industrial competitiveness. Programs have been developed support the industry in developing human capital, investments, and technology development. The programs have the potential to modernize existing production processes and promote the inclusion of new competitors. These changes in innovation support policy are in line with recommendations made a few years back in an OECD national study. The

shift from passive to active programs to support innovation is vital to promote innovation (Gurría, 2009; Mexico Business Publishing, 2020). Nonetheless, some experts believe the efforts of the federal government still lack a clear strategy to attract more R&D to its territory.

Innovation support policy is needed on regional levels as well. A number of states are betting on increased investment and development for R&D projects and collaboration with knowledge centers, including the Northern states, Querétaro, Guanajuato, and Jalisco. In Nuevo Leon for instance, CLAUT's DRIVEN innovation center has increased the state's attractiveness as a design and engineering destination for over three years. It showcases a good example of how the private sector, government and universities have come together to strengthen the automotive supply chain (Mexico Business Publishing, 2020).


In Guanajuato, the local government focuses on increasing the region's participation in R&D operations in its 2040 Development Plan. Aware of the need to carefully manage this transformation, the state is about to inaugurate the International Competitiveness Center, which will focus on analytics and Big Data. State representatives underline that they also include funding sources as tools for increasing competitiveness in their policies.

In Querétaro, Mexican engineering flourishes as the state has a long-standing innovative tradition. There are over 100 Tier 1 supplier companies in the region, many of which include R&D and engineering activities. The aerospace industry is also flourishing in the state. In a recent interview with Holland House Mexico (Palomé, J. (2020, 08, 27). Personal communication. Appendix I) José Luis Palomé, Managing Director at Bosal Mexico explains: "Bosal is exploring options to bring our R&D center from USA, in Michigan, down to México. We used to have a large facility there, but we heavily reduced our activities there. Our R&D Center is still there because it's close to the 3 big US OEMs. Labor cost will be lower if we move all our operations to Mexico, and we think that the exceptional and experienced labor force in Mexico could make a big difference." Queretaro's Minister of Sustainable Development, Marco Antonio Del Prete, emphasized that education and infrastructure are a priority of the current administration. "Queretaro has made education and infrastructure a priority. "The state government needs to act as a facilitator to meet companies' needs. Foreign investors need to know the local government is making the right decisions," he says in a 2020 interview (Mexico Business Publishing, Mexico Automotive Review 2020, p. 104)

The state of Jalisco provides another successful example of the collaboration efforts between government, knowledge centers, and the private sector. During the previous administration, the local government created a number of institutions that address the IT agenda. The current government headed by Gov. Enrique Alfaro has announced its intention to create 20 more Innovation, Science and Technology Centers (ICT) and has also supported a variety of research projects. There is also a 4.0 Industrial Cluster in Jalisco, which groups over 20 tech companies related to artificial intelligence, IoT, cloud computing, cybersecurity, Big Data, collaborative

In Jalisco, there are several companies that are concentrating on automotive R&D. Currently there 3 German and one American company that are doing R&D in Jalisco. In addition to that, there are also several software companies in Jalisco that will become more important in the automotive R&D. I foresee a prosperous future in that area.

- Mtro. Ernesto Sánchez Proal, Ministry of Economic Development of the state of Jalisco



robots, augmented reality, and 3D printing. Intellectual property has been key for R&D operations as well as spurring innovation in the state, as Jalisco has become the state with the second-most patents delivered in recent years, right after Mexico City. The Governor has expressed ambitious goals for the state. “We are already national leaders in telecommunications and information technology. Now, we want to boost the use of EVs by developing their production chain. We want to have at least one assembler of these types of vehicles,” says Ernesto Sánchez, Minister of Economic Development of Jalisco. The government’s vision is to consolidate Jalisco as a leader in the EV segment, benefitting sectors such as automotive, electronics, metal mechanic, high tech and electric energy. The goal is to “take advantage of automotive suppliers based in the state and the sustainability trend at the global level to provide a direction for the electronic and IT sector toward participating as suppliers for the electric mobility industry,” says Jalisco’s Annual Government Report 2019 (Mexico Business Publishing, Automotive Review 2020, p. 150).

In summary, R&D activities in Mexico shows potential, but still has a long way to go before competing with regions in the US and Canada. Closer cooperation between universities, private sector, and governments have the potential to shape Mexico into an attractive R&D hub, but a clear strategy from the federal government is key to success.

4.3 Human Resource Management and Talent Development

Consensus among industry leaders is clear: Mexico is home to an affordable, highly skilled workforce. At the start of 2020, the Mexican automotive industry accounts for approximately 1 million direct jobs and 5 million indirect jobs. This translates into 21% of all manufacturing jobs available in the country. "In Mexico there is great talent, it is one of the main assets that the industry has in the country. We are global companies and we settle where we see great potential," stated the president of Honda of Mexico, Hiroshi Shimizu (ContraReplica, 2019).

Employment & wages

Data from 2019 shows that out of the 47 million workers in Mexico, only 4 out of 100 (3.7%) earn more than MXN\$15,429 per month, equivalent to 5 minimum wages. 29 out of every 100 Mexicans (29.2%) receive a maximum of MXN\$3,080 pesos per month from their jobs. The minimum wage in 2019 was established at MXN\$102.68 per day, or MXN\$3,080 per month (García, 2019). The average wage in the automotive industry is MXN\$6,000 per month. It's important to note that Mexico has one of the greatest productivity differentials (GDP per worker) across regions (Gurría, 2009). A clear distinction must be made between plant workers and administrative personnel, or blue- and white-collar employees.

A recent analysis by OECD concludes that employment in Mexico is projected to decline only marginally in 2020 and return to pre-crisis levels by the second quarter of 2021. Yet, while still small compared to other OECD countries, the forecasted increase in unemployment rate is significant and above the levels of the 2009 global financial crisis. Without a second wave, the Mexican unemployment rate is projected to peak at 7.2% in Q2 2020, falling back to 5.9% at the end of 2021. The second wave scenario forecasts similar trends for Mexico, but with a peak in unemployment rate of 7.5% in Q4 2020 (Tuccio & Carcillo, 2020). Automotive manufacturers contributed to an increase of 7.1% of employment during the past year following an increase of 5.7% of the average salary in the sector.

USMCA requires that 40 percent of vehicles must originate from regions that pay a minimum of US\$16 per hour to workers. This requirement does not imply an increase in Mexican workers' wages, rather the clause is designed to draw more manufacturing to the US and Canada. So how much do employees in the Mexican automotive industry cost? Companies in metropolitan regions with high demand for manufacturing skillsets should expect to pay more than rural areas with a much more expansive hiring pool. A 2019 publication by Tetakawi provides a solid guide of HR costs. At the time US\$1 was equivalent to MXN\$19.5. The exchange rate is expected to be around MXN\$22.5 in the coming period. Please note in figure 38 that the estimates reflect fully fringed hourly wages, including taxes and social security obligations for the employer (approximately 35-40 percent).

DIRECT LABOR JOB CATEGORIES

Fully fringed hourly wages (in U.S. dollars)



INDIRECT LABOR/SALARIED POSITIONS

Fully fringed hourly (in U.S. dollars)



Figure 38. Fully fringed hourly labor wages in Mexico. Retrieved from:

Current HR challenges

In states with high participation in the automotive industry, the productive apparatus loses its capacity for diversification and the generation of employment is concentrated mainly around automotive manufacturing. The states that have experienced a greater dependence on the dynamics of the automotive industry are Puebla, Morelos, Aguascalientes, Guanajuato, Nuevo León, Coahuila, and Sonora.

Added to this specialization is a growing disconnect between the technological and innovative capabilities of the automotive sector and job well-being. New plants or new work units in old plants create jobs with lower pay and benefits. The well-known paradox of an economy full of innovations and technological development where social inequality is widening at the same time has, in the automotive industry based in Mexico, one of its references. There is a wide socio-economic gap between blue- and white-collar personnel (Arteaga García et al., 2019).

Rotation is one of the main challenges in dealing with blue-collar personnel. As highly skilled yet cheap labor, there is little loyalty between employer/employee. Some of the companies interviewed in this study explained that their workers were very loyal due to the particular efforts from the employer to provide a favorable environment for them. Nonetheless, employers agree that workers switch companies often, sometimes only because the food is better at a different plant.

There is also a gap between the terminal industry and the auto parts industry: in the former, average wages represent 9.9 times the minimum wage; in the second, 4.8 times. Of the total number of workers in the sector, 87.7% are in auto parts (Arteaga García et al., 2019).

Expert Opinion

“We have excellent human resources in Mexico. We have 10 managers that each have at least 12 years of experience with Bosal Group, and I have been with the company for 25 years. We have well-trained and, different to other companies in our industry, low rotation of floor workers. There is a lot of know-how. So much so, that we have people from Mexico give trainings to workers at our facilities in other parts of the world.”

- José Luis Palomé, Managing Director Bosal Mexico

Another challenge some experts mentioned for Human Resources in Mexico is brain drain. In the last three decades, Mexico shows a massive exodus of qualified workforce (engineers and postgraduate) to mainly the US; from 160 thousand in 1990 to 1.27 million in 2019. In a recent study, scholars concluded that most of the highly qualified migrant Mexicans working in US based R&D centers were recruited based upon their work experience in Mexico. The researchers conclude that Mexico has become an exporter of qualified, trained and prepared labor force in the country, where it is unable to find accommodation in the narrow national labor market and, instead, is massively attracted to the most dynamic technological development niches of the US economy (Crossa, Mateo & Delgado Wise, Raúl, 2020).

Oddly enough, many industry leaders mentioned the excellent availability of skilled and qualified workforce as one of the key assets on the Mexican market. Pavel Medina, Finance Manager of ALT Technologies commented: “There are very skilled people in particular at the north of Mexico, with expertise in the automotive industry. At first, our Dutch office trained Mexican people in The Netherlands, because they thought the people here would not be prepared. They have now realized that we are well-prepared” (see Appendix I to read the the full interview).

Shifting demand in HR

Advanced manufacturing industry is highly different from the previously conceived manufacturing paradigm: a filthy, dangerous, and obscure plant. Production plants in the Mexican automotive or aerospace industry are the opposite of that notion.

Mexico manufactures highly sophisticated technological products at greater levels than the average of OECD countries, and comparable to those in Korea and Japan; this has developed generations of skilled production plants directors, operators, engineers, among others, with the potential skills needed to assimilate new technology and the best international practices aimed to create high value added from Mexico. Talent and access to disruptive technologies, best international practices, and a world-class manufacturing industry; the ingredients needed are here, only the strategy is missing.

Mexico is home to highly qualified computer experts and workforce. Unlike traditional manufacturing facilities, advanced manufacturing does not rely on low-cost labor force and high production volumes; but it is an industry that relies on skills and creativity to manufacture highly complex products. In addition, it is not composed by an isolated group of companies, but a network of engineers, business developers, entrepreneurs, scientists, financial managers, and other highly experienced professionals that collaborate and bring their creative potential together around innovative solutions for users and customers, thus moving into advanced manufacturing (Arteaga García et al., 2019). As the automotive industry in Mexico changes, so must the workforce.

"We are creating a technology development hub at our new headquarters in Mexico City. We will also create a human resources hub that will provide service to the Americas and supply all the talent that Nissan needs on the continent. If any Nissan employee has a problem, a Mexican will take care of it."

- José Román, President and Managing Director of Nissan Mexicana, Mexico Automotive Review 2020, p.43


Education

In Mexico, 100,000 engineering and technical students graduate each year and there are 900 graduate programs related to engineering and technology in Mexican universities. This ranks the output of qualified and skilled workers above countries such as Japan, Italy, and Germany.

To understand the education level of the Mexican workforce, it is important to bear in mind the large gap between the "average" Mexican and those that have the social and financial capabilities to study a university degree. OECD reports that 20 percent of Mexicans complete university level education. The average level of schooling of a person of 15 years or more in Mexico is equivalent to 9.1 years, that is, a little over the second year of high school (INEGI, data from 2015). More recent data is not available from INEGI (2015) but compared to 2010 this indicates an increase of education level of the average Mexican population. In 2016, 17 percent of adults between 25 and 64 years old had completed a university degree. The gap between the best and worst performing states is wider in Mexico than in other OECD countries. The country has the largest regional disparities in tertiary education rates in the OECD (Gurría, 2009).

An encouraging finding about education in Mexico is that the country has one of the highest proportions of students entering higher education in the field of science among OECD countries. In 2015, 32 percent of students new to higher education chose areas related to science, technology, engineering and mathematics, 5 percentage points higher than the OECD average. This places Mexico among the top six OECD countries with regard to students choosing careers in the field of science. There is no distinction in Mexico between universities of applied sciences and research universities.

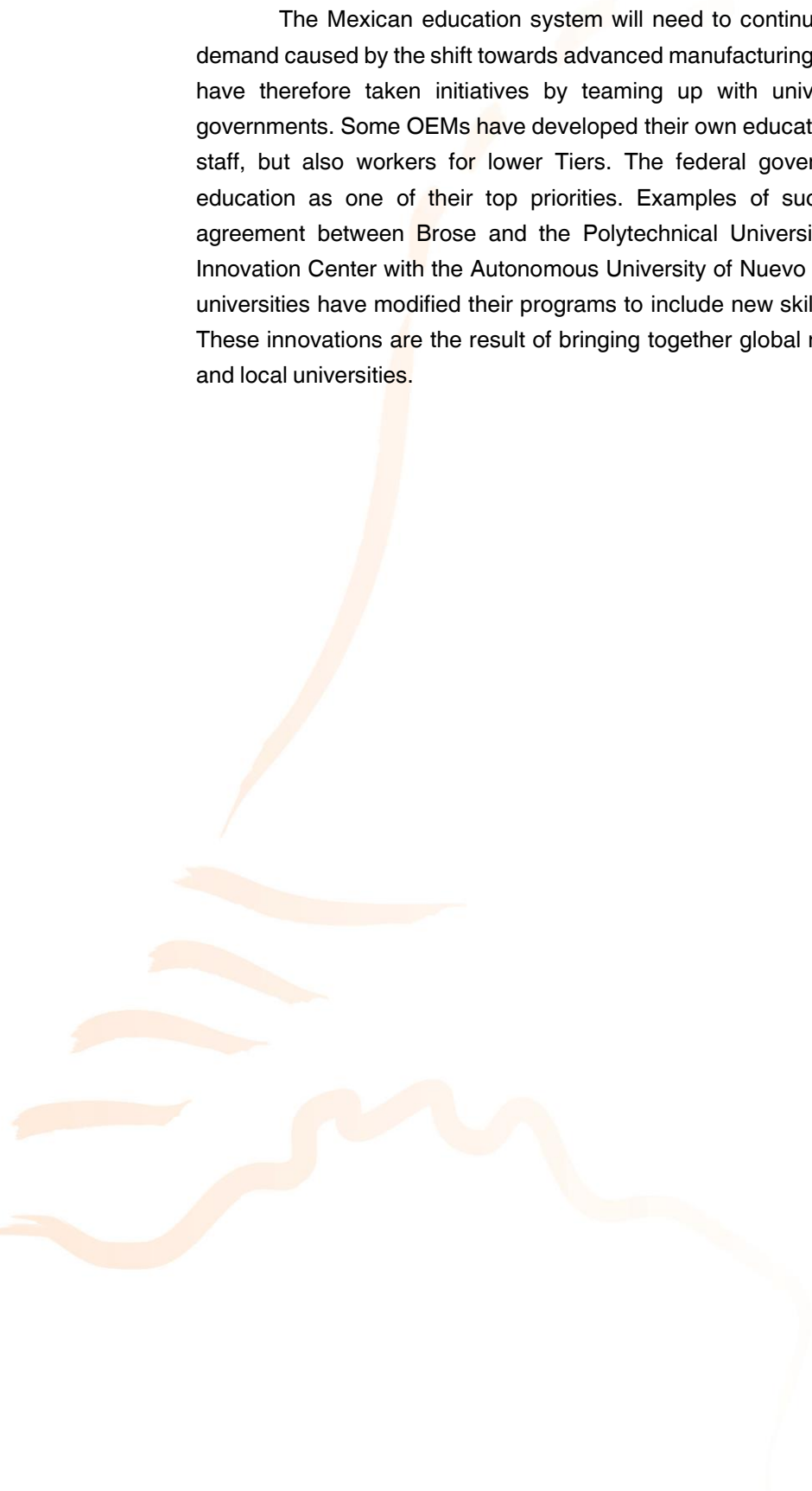
Furthermore, more young people are now enrolled in technical training programs while finishing their high school studies, something the OECD attributes to the Mexican government's educational policy to promote technological education. "As a result of this policy, 15 percent of young people aged 15-19 in Mexico were enrolled in technical upper secondary education programs in 2015, compared to the OECD average of 25 percent. This represented more than a



third of total enrolment in upper secondary education in Mexico, compared to the OECD average of 46 percent (Garrido, 2017).

In summary, blue-collar workers can be expected to have completed primary school and some years of secondary school. White-collar workers have received training comparable to international standards. Mexican universities compete on international level, with UNAM and the Politécnico (IPM) being the best public universities. Excellent private institutions include the ITESM (Tecnológico de Monterrey), UAM, Iberoamericana (UIA), UDLAP, UDG, UP.

The Mexican education system will need to continue to adapt to cater for the growing demand caused by the shift towards advanced manufacturing. Several OEMs and Tier 1 suppliers have therefore taken initiatives by teaming up with universities, often supported by local governments. Some OEMs have developed their own educational programs to train not only their staff, but also workers for lower Tiers. The federal government has mentioned specialized education as one of their top priorities. Examples of successful collaborations include the agreement between Brose and the Polytechnical University of Querétaro, and the DRIVEN Innovation Center with the Autonomous University of Nuevo Leon. In this same state, four major universities have modified their programs to include new skills and ideas related to Industry 4.0. These innovations are the result of bringing together global representatives of major companies and local universities.



5. Opportunities for Dutch companies in the Mexican automotive industry

There is no doubt that the Mexican automotive industry will continue to grow in the coming years. This chapter aims to clearly identify what opportunities are implied in the industry for Dutch companies.

5.1 Opportunities and challenges in the Mexican automotive industry

Opportunities

Opportunities on macro-level:

1. The Mexican automotive industry will continue to grow in the upcoming years and decades.
2. The worlds' leading OEMs manufacture in Mexico require short supply chains, hence creating opportunities for suppliers nearby.

The implementation of the USMCA FTA secures further growth for the automotive industry in North America due to Regional Content requirements.

3. The US-China trade war and CTPPT make Mexico a very attractive production location for Asian companies in the industry, including for the manufacturing of auto parts.
4. European companies can simultaneously benefit from the EU-Mexico FTA and USMCA and export goods to the US and Canada duty-free.
5. Mexico is committed to the 2030 sustainability goals.

Opportunities on meso-level:

6. Mexico's automotive industry is at a crossroad transforming from a traditional manufacturing destination into an advanced manufacturing hub. Both innovation and knowledge are required.
7. Investments towards expansion, innovation, and automation in production centers of OEMs and Tier 1 suppliers are expected shortly.
8. Local suppliers below Tier 2 often do not meet international standards, leaving a clear gap to be filled by foreign companies. Furthermore, automation levels with Tier 2 suppliers and lower require further digitalization and automatization of their processes. Local technology suppliers are in demand.
9. North American consumers are expected to increasingly demand customized experiences; in armoring, security, and specialty equipment.

10. The automotive industry in Mexico is becoming increasingly committed to sustainable manufacturing, both in terms of the manufacturing process and their products.

Opportunities on micro-level (niche):

11. Relatively low R&D costs due to local salary levels.
12. Light weighting shows a promising trend throughout the supply chain, particularly mixed-material body structures of steel and aluminum with polymers and plastics.
13. As Mexico advances in technology solutions in big data, wireless technologies, innovation for high production volumes, smart packaging, and track and trace systems in logistics are needed.
14. Production machinery and equipment, materials, pre-assembled components, molds and tooling, cutting tools, automation process equipment, raw materials, engineering and design, finished parts, and accessories sold through local representatives or distributors.
15. Mexico is a leader in heavy vehicles and parts manufacturing of tractor-trailers, specialty vehicles for the construction and agriculture industries, and passenger buses.
16. Digital aftermarket, e-commerce of vehicles and auto parts.
17. There is a demand for automated, operator-dependent, interconnected, and reconstructed machinery for production and assembly plants.
18. Interpretation of Big Data and strategic development.
19. Shifting perception of mobility, particularly in larger cities; ride-sharing and smart mobility is rising
20. Electric public transport in major Mexican cities.
21. Multiple OEMs have announced their plans to begin producing EVs and hybrid plug-in vehicles in Mexico.


Anticipated opportunities for the coming years:

22. Mexico has the potential to become the leader in Industry 4.0 in Latin America.
23. CASE vehicles are the future. OEMs are working on advanced technologies for the assembly of electrified and self-driving vehicles in Mexico.
24. Nation-wide EV charging system infrastructure will be required.

Challenges

Challenges on macro-level:

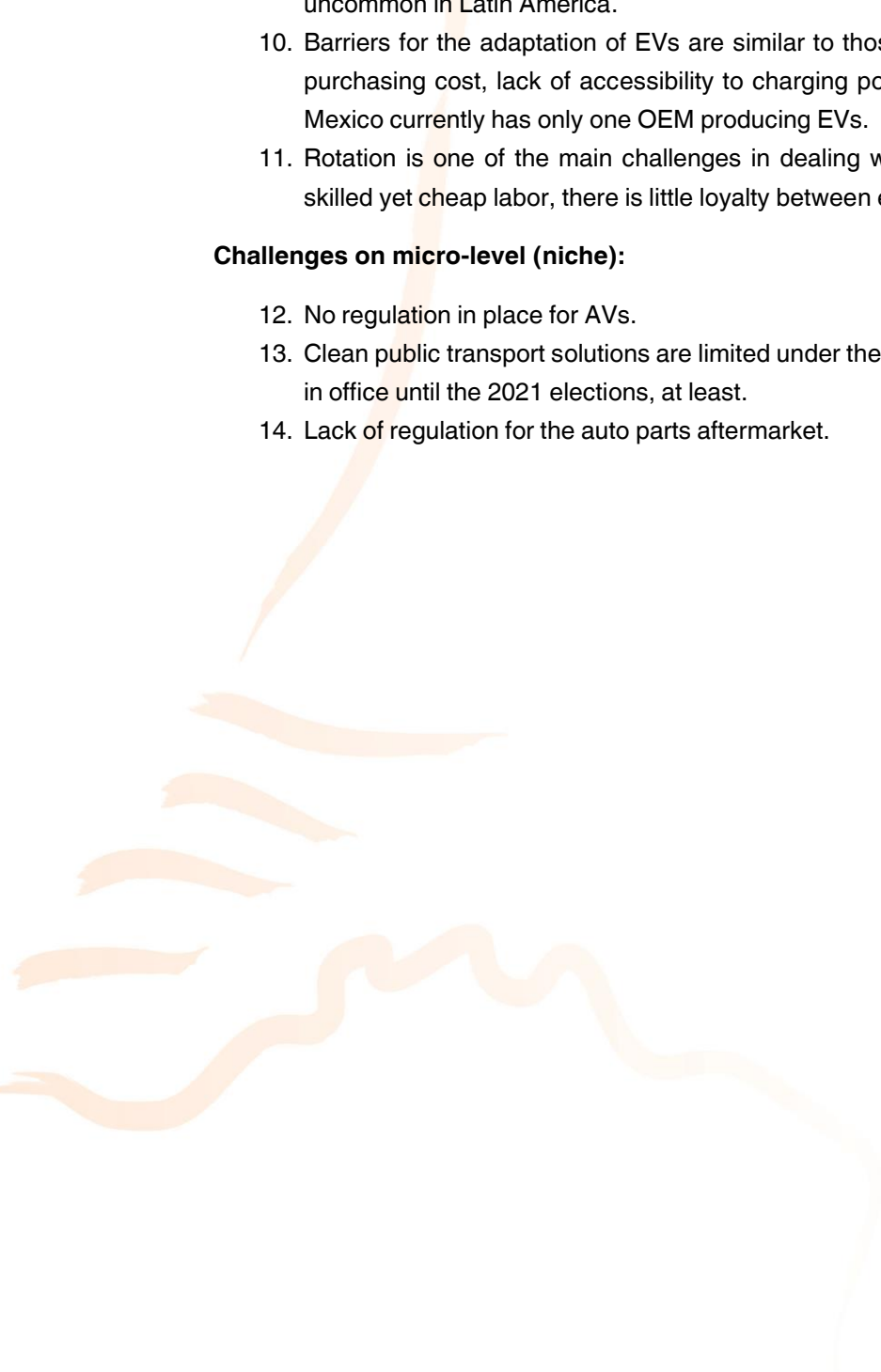
1. Mexico is currently still a manufacturing hub and thus an innovation follower, not a leader.
2. The transformation into an advanced manufacturing hub could be threatened by a lack of collaboration between universities, government, and companies.
3. R&D activities in Mexico show potential, but still have a long way to go before competing with regions in the US and Canada.
4. Education disparity and security levels in Mexico.
5. The influence of Mexico's government on the foreign investment climate.

- 
6. The adoption of Industry 4.0 faces the challenges of economic downturns that cause a lack of investment, excess capacity due to a decrease in logistics activity, and price wars due to lower demands form a threat and widen the digitalization gap. Cyber security is an important challenge for the implementation of Industry 4.0

Challenges on meso-level:

7. The political agendas of each of the USMCA members may create a threat on how the original content rules in USCMA are met. For example, the 10 percent tariff on aluminum imports from Canada by the US government.
8. USMCA's minimum wage requirements could affect Mexico's transition from *maquiladora* to advanced manufacturer, since higher wage content can be added in any of the participating countries.
9. The benefits of investing in technology are often hard to grasp for potential clients, who are often looking for short-term return on investments – a practice which is not uncommon in Latin America.
10. Barriers for the adaptation of EVs are similar to those in The Netherlands, namely high purchasing cost, lack of accessibility to charging points and public opinion. In addition, Mexico currently has only one OEM producing EVs.
11. Rotation is one of the main challenges in dealing with blue-collar personnel. As highly skilled yet cheap labor, there is little loyalty between employer/employee.

Challenges on micro-level (niche):

12. No regulation in place for AVs.
 13. Clean public transport solutions are limited under the current administration, which will be in office until the 2021 elections, at least.
 14. Lack of regulation for the auto parts aftermarket.
- 

5.2 Overview of Dutch expertise in the automotive industry

The Dutch automotive industry represents a significant share of the Dutch economy. According to the report Automotive Roadmap 2020-2030 published by High Tech Systems & Materials (HTSM), the strength of the Dutch automotive sector, which consist over 300 companies, is the 'early recognition of theme/trend related needs and their front runner position in translating future needs to innovative solutions driving the economical perspectives'. The Dutch automotive industry is, therefore, recognized within Europe and on a global level.

The Netherlands tops the list in terms of innovation, disruption, and technology matters. The country comes in second in KPMG's Autonomous Vehicles Readiness Index (AVRI), a report that assesses the readiness of 30 countries in terms of autonomous vehicles (Owen-Vandersluis, 2020).

The Dutch high-tech industry, of which its automotive industry is part, is internationally positioned as high value, high mix, and high complexity. The general focus of the industry is on niche markets through offering technological excellence and small production quantities.


The automotive industry in The Netherlands is centered around heavy-duty vehicles, such as trucks and buses and niche segments for vehicle applications. Additionally, the Dutch automotive industry is an important supplier to the European light vehicle industry.

The Netherlands has a long history when it comes to electronics, high-tech materials, and data innovation. In an interview with Holland House Mexico, (Hendrix, B. (2020, 06, 26) Personal Communication. Appendix I). Bram Hendrix, Manager of Smart Mobility & Internationalization of RAI Automotive Industry NL, lists the different technologies the Dutch industry develops. These include lightweight materials and composites, new AI technologies, charging infrastructure, robotics for high-end manufacturing production facilities for OEMs (including for a Tesla plant), and solutions for the integration of smart and sustainable manufacturing.

The Netherlands is strong in terms of green mobility, smart mobility, and manufacturing of materials. For example, Dutch chipmaker NXP is the number one manufacturer in terms of automotive chips, with nearly every car in the world having an NXP chip. In terms of green mobility, The Netherlands is a frontrunner in smart charging infrastructure, of which an extensive and high-quality network is present in the country. Dutch companies do not produce electric vehicles, but rather they supply the parts. There are several companies producing electric heavy duty vehicles, like busses (VDL and Ebusco) and Trucks (VDL and DAF Trucks)

Currently in Mexico, there are several Dutch companies active in injection molding, robotics, 3D printing of titanium and steel, light weighting, exhaust pipes, airbag system seals, and in the car modification segment.

Through research programs, the Dutch are developing state-of-the-art components as thin film electronics, solar panels and heat-resistant polymers . Research is also being conducted in the field of autonomous driving. The Netherlands has living labs to test innovations related to autonomous driving. Between the cities of Eindhoven and Helmond, a kilometer-long real-life test environment has been developed providing for operational testing of vehicles, as well as traffic and



roadside system testing. The Delft University of Technology (TU Delft) has installed several living labs to test autonomous driving in public domain conditions. The labs include the Urban Mobility Observatory (UMO) to observe mobility and travel behavior, and the Research Lab Automated Driving Delft (RADD), aimed at testing products, concepts or models and to observe traffic.

The Netherlands is characterized by cooperation and partnerships between OEMs, suppliers and knowledge institutions. An example of this is the cross-sectoral cooperation within the HTSM cluster, of which the Dutch automotive industry is part. The cluster collaborates in areas such as semiconductors, photonics, embedded systems (such as powertrain control), high tech materials (advanced high strength steel), smart industry (additive manufacturing), solar (roofs of busses and storage), and components and circuits (application of micro- and nano-electronics in sensors and micro electromechanical systems. (Hendrix, B. (2020, 06, 26) Personal Communication. Appendix I).

Another example of cooperation within the industry is that of the International Connected Automated Driving Initiative (ICADI), which is an open partnership of prominent and notable organizations, such as TNO, TomTom and NXP, from the automotive supply and knowledge domain. The partnership is aimed at fostering the collaboration in the (ultra-big) data, knowledge and technology areas. This ranges from standardizing data formats from vehicles, data accuracy in time and space, data-reduction and scenario-building, to functional safety and homologation aspects.

During the past decades, the Dutch automotive industry has increased its presence in Europe and on the world, although Europe remains the main sales market. In terms of international cooperation in innovation, the Dutch automotive sector cooperates with European partners such as OEMs, Tiers, knowledge institutes and cluster organizations. International strategies of Dutch companies and organizations include that of searching to co-innovate with innovation hubs around the world, including those of Paris, Munich, and Michigan. (Hendrix, B. (2020, 06, 26) Personal Communication. Appendix I).

Further information about the Dutch automotive industry can be found in the HTSM Automotive Roadmap 2020-2030.

5.3 Identification of possibilities for Dutch businesses in the Mexican automotive industry

It is evident that the Mexican automotive industry provides ample opportunities for Dutch companies, in both traditional manufacturing and in the technological revolution industry which has begun. The following list highlights a number of these tangible opportunities.

1. Innovation and solutions to support the transition to becoming an advanced manufacturing hub, R&D.

Dutch companies can participate through contributing value-added innovations and development focused on Industry 4.0. Capacities such as computer science, IT systems and artificial intelligence are what OEMs and Tier 1 companies in Mexico pursue. Linking the gap of a limited robot base in Mexico with the strength of the Dutch automotive industry mainly in robotics for high-end manufacturing production facilities, provide solid opportunities. The opportunity applies to all fields related to successful implementation of Industry 4.0 solutions, including R&D. The future will be in the demand of EV's, hybrids, autonomous vehicles. The next step is to strengthen Mexico's capacity to produce these vehicles, and partner with global leaders

2. Supply to Tier 2 suppliers and lower Tiers, both traditional and advanced manufacturing solutions

The lack of knowledge and standardization of processes and products of local suppliers point towards opportunities for Dutch companies in both automation and knowledge, and traditional supply for lower Tiers. Establishing local operations is key to success.

3. Customization of vehicles

The growing importance of customer experience opens opportunities for companies dedicated to digitalization, armoring, security, and specialty equipment.

4. Light weighting and sustainability

OEMs and their suppliers increasingly require lighter solutions to maximize vehicle efficiency and are raising efforts to become more committed and engaged to the sustainability of production processes.

5. Market share for European truck brands and heavy vehicle supply chain

Recent trends point towards a shift from the historical preference of American heavy vehicles to European models. This opportunity extends to the full supply chain of the heavy vehicle market.

Regional opportunities

Mexico's states and regions are characterized by different features that could translate into opportunities for Dutch companies in the automotive sector. **Guanajuato's** role as the central automotive hub of Mexico combined with its location, available workforce and infrastructure make it a top destination for suppliers. The state's government has shifted its focus from attracting OEMs to boosting the operations of local companies.

Queretaro is a heavy-vehicle manufacturer base with several R&D centers owned by top Tier companies, and the state is characterized by its strategic location as a tooling market. Queretaro is located favorably for Tier 1, 2 and 3 suppliers to support operations of OEMs in neighboring states.

San Luis Potosi is characterized by its connectivity and the presence of light-vehicle OEMs. The large growth of these OEMs represents an opportunity for Dutch (and European) companies. In addition, the state's government is developing a specific focus on the automotive sector, for example, through a tooling center in collaboration with a public research facility.

The Western States are marked by Jalisco's potential as Mexico's future EV and CASE vehicle hub. The region could prove as an important destination in Mexico in the electrification of the automotive industry and has numerous R&D centers with a focus on IT and Industry 4.0. In addition, the region is characterized by the presence of Japanese OEMs. This is attested by large investments in Aguascalientes from Nissan, and the focus on auto parts manufacturing through a network of mostly Tier 2 and Tier 3 companies in Zacatecas. Opportunities for partnerships in the fields of research, development, and innovation exist.

Puebla and Tlaxcala are characterized by a strong manufacturing hub with international OEMs and mostly foreign suppliers. The region has a strong emphasis on sustainability in automotive manufacturing, setting a high standard for newcomers in the supply chain.

Mexico City is home to the OEM's Mexican headquarters and the largest domestic vehicle market, which could translate into opportunities for suppliers focused on the aftermarket. Several OEMs and Tier 1 suppliers have their R&D centers located in Mexico City and Mexico State, opening doors to possible partnerships for innovation between Dutch and local players.

The Northern States' proximity to the US make them strategically located to supply the US auto industry and offer logistics advantages. Chihuahua and Nuevo Leon have numerous research and engineering centers. Opportunities exist in the areas of local tooling production and quality forged components, strong meta sintering capacities and local production of molds for plastic technologies.

Future opportunities

CASE vehicles and all related innovation and technology, including charging infrastructure, are still in the early stages of development in Mexico, but the choices OEMs will make in upcoming years may quickly transform promises into tangible opportunities. The way the Mexican government chooses to comply to the 2030 SDGs may also translate into opportunities for Dutch companies.

6. Cashing in on the opportunities: Dutch companies entering the Mexican automotive industry

Once the opportunities in Mexico are clear, it is time to convert them into business. This chapter provides a practical approach to cash in on the opportunities, including advice from companies who have already stepped on to the Mexican market and a brief overview of legal matters to consider.

6.1 Overview of relevant trade shows and events

A number of trade shows and fairs are organized for the automotive and advanced manufacturing industry in Mexico. You can find an overview of the largest events in Appendix III: Overview of trade shows in the automotive and advanced manufacturing industries in Mexico. Most of these events are organized by the private sector, through organizations such as INA and the National Congress of the Automotive Industry. Germany also organizes a Hannover Messe Latin America in Mexico. The first digital edition of this show is planned for October 2020. The focus will lie on the development of Industry 4.0 implementation and innovations in Mexico and Latin America. Many events concerning new artificial intelligence developments, or innovative projects in general, take place in the US, where much of the regional R&D is conducted.

6.2 Relevant legal framework for Dutch companies operating in Mexico

From a legal perspective, Dutch companies have full access to the Mexican automotive industry and no major barriers exist. Besides the rules under the USCMA and EU-Mexico FTA, there is no local content requirement for partnerships or projects between Mexican and Dutch companies. Content requirements only exist for government contracts, for example in aftermarket

sales. In addition, no registrations are required to become a supplier of an OEM (Valles-Zavala, 2020).

The most common vehicle for foreign suppliers to participate as a supplier to an OEM is through a Mexican subsidiary. Therefore, the main regulation relevant to Dutch companies operating in Mexico is the IMMEX scheme (Valles-Zavala, 2020).

This chapter highlights the legal framework that Dutch companies need to take into consideration when operating. A full report on the legal framework can be found in Appendix VIII.

Auto Decree

The legal framework in Mexico is focused on manufacturing, investment, competitiveness, and efficiency. The policies are depicted in The Decree for the Support of the Competitiveness of the Automotive Industry and the Promotion for the Development of the Domestic Automotive Market (The New Auto Decree). The New Auto Decree provides for the registry of new automotive production companies. The requirements for OEMs to register in Mexico are depicted in this Decree (Baker McKenzie, 2011).

IMMEX Decree

The main legal scheme for foreign suppliers to participate in Mexico's supply chain is the IMMEX, which stands for Program for the Promotion of the Manufacturing, Maquiladora and Export Services Industry.

The IMMEX Program is the modern version of what was previously known as the Maquiladora Program. IMMEX offers companies temporary duty-free imports on raw materials, exemptions on import duties, and value added tax refunds (Torres Landa, Romero, & Corcuera Bain, 2019).

There are five different types of IMMEX registrations. According to Tetakawi, these include following:

1. **Holding Company IMMEX:** This allows for one entity to hold IMMEX registration that encompasses the manufacturing operations and one or more of its subsidiaries. Holding companies will be required to submit more detailed records, including minutes from shareholder meetings, and contracts between the subsidiaries and parent companies that detail contracted obligations.
2. **Industrial IMMEX:** The most straightforward approach, this registration covers a manufacturer that is using imported goods in an industrial process to produce or transform a product that it will then export.
3. **Services IMMEX:** This registration covers companies that provide necessary services to support the export of relevant goods under IMMEX registration. For example, legal entities, recyclers, software developers and certain other service companies might be registered in Mexico under the IMMEX Services Program. Registration is granted at the discretion of the Department of Economy.

4. **Shelter IMMEX:** A registered Mexican company can serve as a legal entity that assumes all legal risk and liability for manufacturers operating beneath its IMMEX registration. Foreign entities gain the advantage of an experienced partner's knowledge of the local requirements and can thus focus on the manufacturing work they do best.
5. **IMMEX Outsourcing Program or Third-Party:** If a certified company does not own the facilities necessary to perform its production processes, it can manufacture through a third party registered in its program. However, the companies performing the outsourcing accept joint liability for the temporarily imported goods. The Ministry of Finance and Public Credit must approve the outsourcing program as a certified company (Tetakawi, 2019).

According to the 2011 Supplying a Growing Industry report by Baker McKenzie, specific benefits in the IMMEX Program include the following:

- Statutory exemption of the foreign principal from a permanent establishment exposure in Mexico for manufacturing activities
- Additional tax deduction equivalent to 47% of the fringe benefits paid to employees
- Assessment of taxable profit under special transfer pricing rules issued for maquiladora companies (Baker McKenzie, 2011)

To have access to the benefits granted in the IMMEX Program, companies need to meet the following requirements:

- Export (physically or virtually to another maquiladora or OEM) the entirety of their production;
- To limit their income to productive activities (which implies that they should have separate entities for domestic commercialization and for production)
- To utilize materials, machinery and equipment owned by their foreign principal
- The foreign principal of the maquiladora company shall be a tax resident of a country with which Mexico entered a tax treaty (Baker McKenzie, 2011).

Figure 39 shows an overview of the typical supply chain structure of IMMEX.

STRUCTURE OF IMMEX

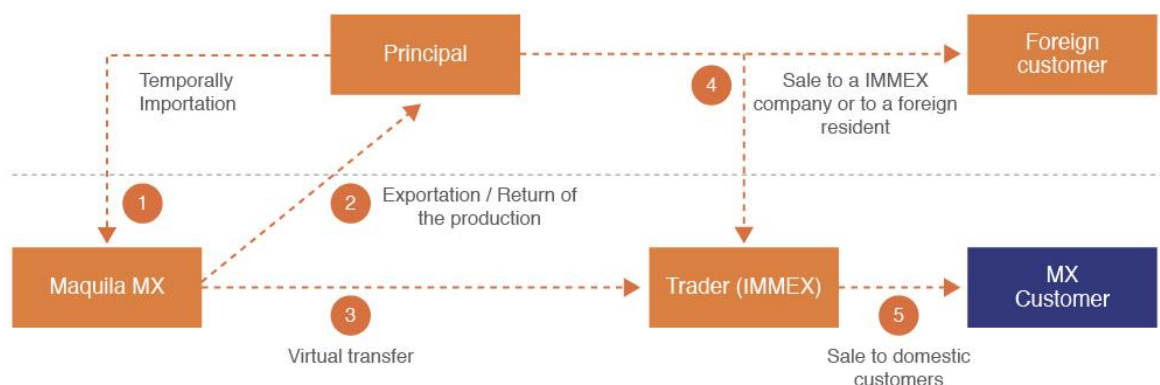


Figure 39. Baker McKenzie (2020). Typical supply chain structure of IMMEX.

Customs Transfer of Goods

Foreign Tier 1 suppliers need export certificates, or Transfer Certificates, to supply goods to OEMs. Tier 2,3,4 and companies further down the supply chain do not supply the OEM directly and therefore do not use Transfer Certificates. Instead, these suppliers fall under the IMMEX or Maquiladora scheme, where the transfer of goods falls in the category of virtual import-export declarations, also referred to as *pedimentos* (Valles-Zavala, 2020). The main difference between Transfer Certificates and virtual import-export declarations lies with liability and value-added tax on the goods.

A 2011 report by Baker McKenzie describes the difference in detail: 'Transfer Certificates are used to formalize the transfer of goods from the maquiladora to the OEMs. The maquiladora company assumes the liability of changing the customs regime (i.e. paying the applicable import duties, value added tax and complying with tariff and non-tariff requirements) of the transferred goods that the OEM includes in vehicles that are destined for the domestic market. In contrast, when virtual import-export declarations are used, the OEM assumes the liability of paying any applicable duties and taxes' (Baker McKenzie, 2011).

Product Safety and Liability

Safety and environmental regulations concerning automotive-related products, which include technical and quality standards regarding safety and emissions, are depicted in Mexican Official Standards (NOMs). The document (Torres Landa, Romero, & Corcuera Bain, 2019) states that the most relevant NOMs in Mexico are the following:

- NOM-194-SCFI-2015 will regulate minimum security measures for new light vehicles, including provisions on the technical requirements for many parts of the vehicle such as tires, ABS, braking lights, reverse lights, evaluation methods, and verification procedures. This NOM will become fully enforceable by 2019.
- NOM_042_SEMARNAT_2003, NOM_044_SEMARNAT_2006 and NOM-076-SEMARNAT-1995 regulate vehicle emissions such as the maximum emission levels for vehicles, evaluation methods and verification procedures; and
- NOM-079-SEMARNAT-1994 and NOM-082-SEMARNAT-1994 which regulate the maximum noise level for vehicles and the evaluation method thereof.

Product liability in the case of defective products lies with the manufacturer or "any other person in the production chain whose actions or omissions result in damage". (Torres Landa, Romero, & Corcuera Bain, 2019). Figure 40 displays the different manufacturing structures and their corresponding levels of complexity, profitability, functions, and business risks (including liability).

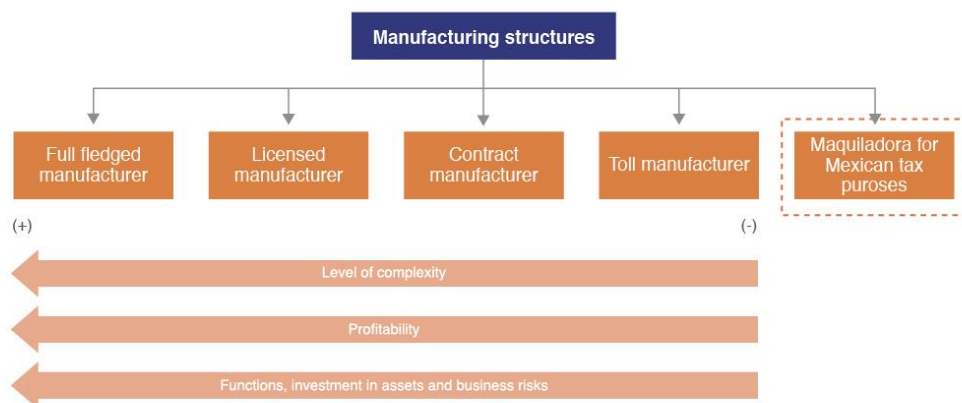


Figure 40. Baker McKenzie (2020). Restructuring of Maquila Operation.

In the case of aftermarket sales, the entity acting as distributor or importer is liable before customers to provide the necessary warranty, which is mainly to replace the part. In addition, in the case of defective parts or components on the aftermarket, under the Federal Law of Consumer Protection, there is a mandatory recall process. Under this process, one is required to post a public notice to allow customers to contact the distributor or importer for replacement. The Federal Law of Consumer Protection provides that in the case of a foreign manufacturer, the campaign process must be carried out by the importer or distributor. (Fernández, I. (2020, 09, 15). Personal communication. Appendix I),

Environmental Concerns

To operate an automotive or auto parts plant, an environmental authorization permit is required at the State level. In terms of wastewater, permits need to be secured from the National Water Commission (CONAGUA) if the wastewater flows into a federal water system. If wastewater is released into a municipal sewer system, a permit needs to be granted by the Municipal water authority. Air emissions are regulated on a federal level and permits are to be obtained from the Ministry of Environment and Natural Resources (SEMARNAT). Coating operations need to comply with Mexican Official Standard NOM-121-SEMARNAT-1997 regulations. Lastly, hazardous waste streams must be recorded before SEMARNAT (Baker McKenzie, 2011).

Since July 2019, all trucks and buses produced or imported to Mexico need to meet the Euro V or EPA 7 emissions standards under the NOM-012.

Labor Matters

Under Mexican Labor Law, there are two main type of labor unions: company and national industry unions. It is the right of the employee to choose a union, however, it is not compulsory in Mexico to enter into a collective bargaining agreement. Mexico's automotive industry also does not have a binding collective bargaining agreement.

Value Added Tax Considerations

A value-added 16 percent tax is applicable to OEMs that import vehicles or parts into Mexico. However, according to the report Supplying a Growing Industry (Baker McKenzie, 2011) companies have the option to apply for a 'certification to obtain an advanced credit of value added tax to be applied against their payment obligation, mitigating the possible financial cost of paying value added tax upon importation'.

A 16 percent value-added tax applies in the following events i) importation; ii) rendering of services; iii) sale of goods; and, iv) lease of goods. Exportation, however, is not subject to value-added tax.

This difference also applies in the case of Transfer Certificates and virtual import-export *pedimentos*. Transfer Certificates are subject to a 16 percent value-added tax because goods are either sold to an OEM, or the goods remain in Mexico and are therefore permanently imported. Under the import-export *pedimento* scheme, a 0 percent added-value tax rate apply since the goods are exported either physically or virtually. Mexican Customs Law considers virtual export the same as physical (Baker McKenzie, 2011).

Real Estate Matters

Foreign entities are permitted to invest in real estate property, although restrictions exist for the Restricted Zone, which applies to the area located within 50 kilometers of the coastline and 100 kilometers of the borders. Only wholly owned Mexican corporations can own non-residential real estate in this area.

Free Trade Zones

The only zone with a preferential tax treatment in Mexico is the Northern border strip with the US (limited to the municipalities bordering the United States). Within this zone, companies receive a preferential tax treatment through a reduced income tax rate, which is equivalent to the reduction of 1/3 of the effective tax rate for income tax purposes. Furthermore, companies receive a preferential value-added tax rate, which is reduced to 8 percent instead of the regular 16 percent. However, the preferential tax treatment for income tax purposes is not available for companies with a IMMEX *maquiladora* operation for tax purposes. Mexico's Special Economic Zones have been repealed and they are no longer promoted.

6.3 Advice and recommendations for entering the Mexican automotive industry and conducting business in Mexico

This chapter highlights specific recommendations from players in the Mexican automotive industry for Dutch companies. The full interviews can be found in Appendix I. General pointers on cultural differences when conducting business with Mexico can be found in Appendix X.

In Mexico, The Netherlands is perceived as a reliable and innovative partner that offers high-quality (but probably expensive) solutions. Dutch companies can benefit from this privileged position. Before venturing into a new project, make sure to execute a thorough investigation. Mexico is a large country with an extensive and growing automotive industry and understanding local and regional dynamics is pivotal for success. Make sure to include the following in your research:


- Understanding industry dynamics with the US and Canada enables to map a regional growth plan
- Understanding the regional political climate of the area you intend to establish the business in. What is the local government's position on FDI? How is their collaboration with knowledge institutions?
- The availability of skilled workforce in the area you plan to establish the business
- The training of skilled personnel in the area and possible collaborations between the private sector, universities, and government
- Legal and fiscal opportunities and limitations in your area. Seek reliable legal counsel.
-

Where possible, look for partnerships with established companies in Mexico, whether foreign or Mexican. Several of the interviewees also pointed out that operations were initiated in Mexico because their client specifically requested them to open a facility in their proximity.


Identify what drives your customer and adapt your offer to local demands. What may be the reasons to choose your solution in The Netherlands, at it may be perceived very differently in Mexico. Some experts refer to this as the “tropicalization” of your business proposal.

Choose a location that is in proximity of your (potential) clients. Consider logistics; the costs and time to move goods and people between your clients and your facility.

Once you open the business, make sure to incorporate Mexican employees in your teams. All Dutch companies interviewed mentioned that having local employees in all levels of their operations greatly contributed to their swift expansion on the Mexican market. Pay attention to the creation of loyalty between the employees and employer. This strategy can help avoid high rotation amongst particularly blue-collared workers.



Establishing a solid network is another key to success. Lessons can be learned through the experiences of others. Furthermore, trust and a personal relation are of very high importance for conducting business with Mexicans. Dutch organizations such as the Dutch Embassy in Mexico, the bilateral Chamber of Commerce Holland House Mexico, and The Netherlands Business Support Office can help you get started in Mexico. They can provide guidance, practical advice, soft-landing services, and an open door to a solid network in the automotive industry and beyond. National industry organizations and clusters form another solid foundation on which to grow your local network.



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APPENDICES

Appendix I: Interviews

ALT Technologies

Interview with Pavel Medina, Finance Manager ALT Technologies.

1. Can you tell us about your current activities in Mexico and how they came to be?

ALT Technologies started a market research to explore our possibilities in Mexico in 2017, out of aspirations to continue to grow our business. In 2018, we received our first pre-order which resulted in the start of production in January 2019. We started out with only 5 people, and today employ 47 people, including operators on the manufacturing floor.

ALT has production centres in The Netherlands, Romania and China. In Mexico we produce the same products and deliver to our customers in Mexico and the US directly.

2. Why is Mexico an attractive market for you, and Chihuahua in particular?

Back in 2017, we researched our options in both the US and Mexico. We also looked at other cities in the north of Mexico and decided to stay close to the US border. Many of our principal customers are located here, and we are close to our US customers.

Many decisions, such as whether we would buy or rent a building, the general business model, etcetera, were taken in The Netherlands. Actually, ALT first looked at Mexico City when thinking about opening up shop in Mexico. But Mexico City is different, it has a different culture than the north. Even the legal guidance that ALT initially received, from Mexico City, proved different to what we eventually needed in Chihuahua. It cost us double the money, something we could have avoided by obtaining guidance from regional law firm.

3. What is your outlook for the automotive sector; in general, and for ALT Technologies specifically? What do you expect of the current decennium?

I expect growth for the entire sector, as well new clients, new products, new challenges. We produce a lot for the US, and they consume a lot! This will certainly secure an increasing demand in our products.

There is a lot of talk about a shifting perception of mobility, but I don't see that happening so much in Mexico, at least not in the region of Chihuahua. It is not uncommon that families own three or four cars. They are not really replacing their personal vehicles with ride suppliers such as Uber. People will continue to want to own their own car, I think.

4. What are your plans for Mexico for the coming years?

In the long term, we want to expand and cover all of the Americas. In the meantime, we are working on new projects and developing new products. We notice that our customers expect more from ALT than we are producing now. That is, we produce the same as our plants in other parts of the world, but in Mexico we have demand to produce new products, developed only for the Americas. ALT is always looking outside of the box. We would like to see if we can introduce our products in the aerospace industry.

5. Can you tell us about your R&D projects in Mexico? How do they compare to other regions?

ALT does R&D in Mexico and The Netherlands. We have two engineers here who develop products together with our customers. They work together with the R&D department in The Netherlands, an ideal combination. We don't have all the experience to do everything here because we are a young company in Mexico, so it works very well to have the support from The Netherlands too. We combine the two sides of countries and cultures and the experiences from The Netherlands.

There are very skilled people in particular at the north of Mexico, with expertise in the automotive industry. At first, our Dutch office trained Mexican people in The Netherlands, because they thought the people here would not be prepared. They have now realized that we are well-prepared. Regarding our technical workers, we have about 30 operational employees. Unfortunately, rotation tends to be high among this type of employees. We try to make people feel part of the company, create loyalty, and prevent rotation. For example, we give workers a two-week holiday for Christmas, which is very uncommon in our industry. Furthermore, we try to promote education among our employees. That means helping production workers to obtain a high school diploma and helping administrative employees with a Master's degree.

6. What advice would you give Dutch companies interested in expanding to the Mexican market

Mexico is a good country, with plenty of opportunities, qualified and skilled people, international growth, cultural diversity, people wanting to grow. Turn to see: Mexico awaits you with open arms. Mexico is a great place to live.

There are a few things you need to take into account when coming to Mexico. Firstly, things, such as opening a bank account, or setting up a business, can take more time than a Dutch person is used to. You need to be prepared for that, but in the end, you will achieve your goals. Make sure to be well-informed and find the proper people to advise you.

Once you choose the place where you want to set up shop, make sure to hire people locally. Start locally, hand in hand with the people that work there. They know how things work in their country and region; they have the proper contacts. Having both Dutch and Mexican people in the organization makes for a stronger company, as we can learn the good things from both sides.

Automotive Cluster of the State of Mexico (EDOMEX)

Interview with Elisa Crespo, Executive President Automotive Cluster of EDOMEX
29 September 2020

1. Can you tell us about the history of the cluster, and the companies you represent?

The Automotive Cluster of the State of Mexico (EDOMEX) was founded approximately 7 years ago. EDOMEX is one of the most important regions for the automotive industry in the country. Our history dates back to over 85 years, when the first automotive companies established plants in the area. Therefore, the State of Mexico is one of the states with the most experience in the industry.

Nowadays, a number of OEMs such as Ford, GM, FCA, Nissan and the principal Tier 1 suppliers are present in our state in a robust ecosystem. We represent around 100 world class companies who together generate employment for 250,000 workers, of all levels of skill.

Our objectives are to create synergies in engineering, innovation, and human capital, to exchange industry insights, to establish shared benefits through collaborative projects between the companies affiliated to the cluster. We connect our members to possibilities, which ultimately generates business.

2. What are the main areas of expertise of the automotive companies in EDOMEX?

Since we are of the states with the most tradition and expertise in the automotive industry in Mexico, we can see how the companies in our state have evolved by implementing technological development. There are companies with very specialized techniques in plastic injection solutions and forging, of instance.

EDOMEX is among the first states that will be producing electrical vehicles. The Ford Match will be fabricated in Cuauhtitlán, while other suppliers in the state manufacture numerous components and autoparts for electric vehicles. There have been many investments in the US towards electrification, which will certainly create a demand for electrical autoparts and vehicles in our state. I expect these vehicles to be produced in EDOMEX within 2 years.

The value chain integration of Tier 1 parts and components manufacturers is also remarkable in our state, with powerful companies such as Bosch and Hitachi operating production centers in the state. These are some of the highest rated companies in the world.

The State of Mexico further excels in Research & Development and Human Capital. We also are home to excellent infrastructure and are conveniently located around Mexico City. This makes our state an excellent logistics hub, heaving all main suppliers nearby.

3. How does the EDOMEX cluster compare to other automotive clusters in Mexico?

First and foremost, we maintain a permanent collaboration with other regions. We are not an island, rather we need to seek collaboration to thrive.

Our cluster is not as old as clusters in some of the other regions, such as the Bajío and Coahuila, but we have used a disruptive approach to swiftly get up to speed. Our cluster is very focused on innovation and new technologies, such as the Industry 4.0 revolution. More so than the aforementioned clusters. We represent about 7.3% of Mexico's total manufacturing productions, coming in at 4th or 5th place nationwide.

Why do we focus so heavily on innovation and Industry 4.0? Apart from OEMs, Tier 1 suppliers are also in innovation stages. Adaptation to new technologies will make our state more competitive.

To give you an example, we are the only cluster in the country that participated in a contribution to the COVID-19 crisis. Ten different companies joined hands and adapted their technologies to enable the production of much-needed respiratory aid equipment. In total, they have produced 42,500 parts for the final products, an astonishing example of fast integration and adaptation. This example also shows the strength of the automotive industry in Mexico. Only as strong, well-established, and developed industry would be able to react this quickly to a crisis.

4. What is your outlook on the future, in terms of innovations (such as CASE vehicles, industry 4.0) and a changing perception of mobility? How does Mexico compare to other regions?

As a cluster, we are committed to technological development and adaptation of innovations. A new order is most surely coming. The current COVID-19 crisis has only accelerated this process. The automotive industry must use new technologies to focus on sustainability and reduction of costs for production processes hence final products. In EDOMEX particularly, we have a conglomeration of approximately 16 million people, and another 13 million neighbours living in Mexico City, urging for mobility solutions capable to handle the population.

In our region, investments are already being made towards the production of CASE vehicles and the implementation of new forms of mobility, with more to come. Continuous investments in these fields are secured, and I expect them to increase. Companies in logistics and e-commerce such as DHL and Amazon are requiring more vehicles and better performance, whilst lowering greenhouse gases. EDOMEX already has received investments for the production of such vehicles.

The government plays an important role in the digital revolution. Our cluster aims to continue the dialogue with authorities to ensure an infrastructure that is consistent with investments; increasingly more electric vehicles that are available to people, with greater safety and suitable for mass mobility. Sustainability, mobility, and human capital are core issues - we promote these types of initiatives actively. We also encourage the government to look more towards new ways of manufacturing. The integration of Chinese brands is another important point on our agenda. The quality of manufactured products and parts in Mexico is of excellent standard. The government must ensure high standards are guaranteed as new players enter the local industry.

5. The Automotive Cluster in EDOMEX has a strong focus on innovation. Can you tell us about R&D executed in the state? How does it compare to other regions and countries? What about human resources?

Apart from leading OEMs, our state is home to top Tier 1 suppliers. These companies have very high standards, which has resulted in a high level of engineering and design in our state. The state is home to major R&D and design centers, such as the facility of Ford.

Technology transfer is key. If you just import technology, nothing will happen. Knowledge needs to be transferred in order to be valuable and to be able to contribute to the digital revolution. This is the true value of technology transfer in terms of innovation.

The State of Mexico is fortunate to house the largest concentration of highly qualified people in the country. The availability of this skilled workforce translates in greater certainty of a favorable environment for manufacturing. Rotation of personnel in our state is low in comparison to other states, where availability can sometimes be perceived as problematic.

Collaboration between the private sector, government and knowledge institutions is key. Last year, we received a US\$10 million investments for the adaptation of Industry 4.0 concepts in local university programs, allowing students the opportunity to develop skills to interpret new technologies and create a change of mindset. Furthermore, we are involved in a program where we donate software to students, where they compete in platform design. This way, young people in their early years can already have access to innovative tools, learn, and become catalysts for the industry transformation.

6. How does the EDOMEX Cluster contribute to the internationalization of the automotive industry?

The State of Mexico is among the top states in terms of exportation. We export all sorts of vehicles and autoparts, including light vehicles, and specialty heavy vehicles. There are numerous foreign companies based in the state, from all over the world: Japan, Germany, Great Brittan, Corea and Spain, to mention a few. Our state is a frontrunner in terms of internationalization, with a large number of expats living in the state, allowing also for international universities and colleges. EDOMEX is an attractive destination for Foreign Direct Investment.

7. What advice would you give Dutch companies interested in expanding to the Mexican market?

First of all, congratulations on this excellent decision! Make sure to reach out to industrial clusters in the areas you consider setting up shop. You can use the clusters as instruments for in-dept information on the destination. Think about the environment you need to thrive. How is the availability of skilled human capital in your region of preference? What is the local government's position towards FDI? Companies should also consider general logistics of their operations. All in all, Mexico is a wonderful destination.

AWL Automation

Interview with Lucas Díaz, Managing Director AWL Automation Mexico.

1. Can you tell us about your current activities and how they came to be? How did you approach the market entry to Mexico?

AWL is dedicated to manufacturing and the automotive industry. We are here to ensure the productivity of our customers in a fast-changing industry. Our core activities are summarized in providing solutions in high automatization and robotizations. We do this at three locations: Firstly, directly at our customer's facilities, secondly at the AWL facilities and since the outbreak of COVID-19 also from home.

AWL started in Querétaro in 2016. We received an order for a large project from a European customer to be installed in this area. Obtaining the project from the OEM in its country of origin was certainly an advantage, as it pushed us forward and in a clear direction while it also gave us time to develop our activities in Mexico. The project took 2 years to execute, after which we focused on expanding AWL further. We continued to build the company in Mexico. It was beneficial for us to come to Mexico with this order from Europe, but our job couldn't stop after that. In order to be successful on the Mexican market, we need to explain to our customers in Mexico who we are and what we do. The local team plays a key role in this development.

2. What are some of the obstacles you had to overcome when starting up the business in Mexico, and how did you achieve this?

The biggest obstacle is building trust with your customer. If prospected customers don't know the team in Mexico, they won't trust you, so you require a capable group of Mexican people to build this trust, backed up by the Dutch company that grants high quality products and excellent service. It takes time to build trustful relationships. Your customer must feel that there is a capable local team that is able to solve his issues whenever that is required. It is easier for European companies than for small local companies to gain trust from prospected customers in Mexico, as they have a better image in terms of quality and guarantee smaller financial risks. So, the combination of a local team and Dutch backup is ideal.

Another obstacle for us is that our prospected customers were unfamiliar with our products, so we had to create awareness of our offer – something we are still working on. It's important to take calculated risks and start projects nonetheless.

Regarding the decision-making process, some decisions are made in the OEMs' country of origin, but others locally. Since AWL is a global company we can cater to both sides, making it easier for us to adapt to local and global demands. The Mexican branch for example, may have different needs in terms of time frames than the OEM in the country of origin.

3. What is your outlook for the sector in terms of innovations? In general, and for AWL specifically?

The automotive industry is a rapidly shifting sector urging players to stay on top of the latest developments. Innovation needs to be in your core, as is the case at AWL. Automation and robotics are our focus, but concepts such as cost efficiency, delivery time, etcetera remain also important. Innovation can make the difference.

I am certain that robotics will continue to grow in the business. The USMCA agreement aims to level salaries across North America, meaning that it will be more costly to employ workers in Mexico. This will likely increase local demand for other technologies to compensate.

Another innovation that will certainly be gaining territory is Internet of Things (IOT), although in Mexico perhaps not at the same speed as we see in the US or Europe. I am convinced that one day we will have all machines communicating and connecting with each other, also here in Mexico.

4. Your website states that AWL invests heavily in Research and Development. Can you tell us about your R&D projects in Mexico? How do they compare to other regions?

In The Netherlands AWL has an Experience Center to develop innovations. It is used to test products and new developments and technologies. It also invests in other technologies that are not currently part of our main business, such as collaborative robots or 3D printing. Nowadays, it's possible to print steel – a technology that may prove very valuable to the automotive industry!

In Mexico, we keep track of the innovations in The Netherlands and adapt them to the Mexican market. It is important to bear in mind that the needs here in Mexico are not necessarily the same as in other countries. An example is the E-line, a robotic welding machine specifically designed for the local market. The technology aims to empower local businesses to venture into new business opportunities by making this more affordable and easier.

We also work on some developments here in Mexico. Apps for augmented reality for instance. But our budget will take some time to come through, so we base most of R&D in Netherlands. We will grow and develop according to our budget.

AWL Mexico started as a service company, then evolved into a production center, the next step is to have an engineering department, and afterwards an R&D center. I consider ourselves to be between step 2 and 3 of these stages of growth.

5. What advice would you give Dutch companies interested in expanding to the Mexican market?

The Mexican market offers solid growth for Dutch companies, so I would advise Dutch companies in the business to analyse your options. The Mexican population is young, eager to learn, and eager to transcend. That translates into a huge push with universities and knowledge institutions and creates movement. It's important to be carefully plan the training of talent, a solid plan of approach is needed.

Furthermore, it is pivotal to understand the market you are venturing into. Not just because it works in Europe, it will work in Mexico. The customer should be at the centre of your thoughts, as he is

het one that will take decisions about your product. Identify what drives your customer; is it money, time, service, something else? For instance, Mexicans don't like to have to wait to receive support due to a national holiday in The Netherlands or the different time zones.

Lastly, you can benefit greatly if you understand the relation with the US and Canada in this industry. This will help you improve your growth plan for the region.

Bosal Mexico

Interview with José Luis Palomé, Managing Director Bosal Mexico

BOSAL is an established global manufacturer of automotive and industrial equipment, both to the original equipment market as to the aftermarket.

1. Can you tell us about your current activities in Mexico and how they came to be?

Our history starts in 1995, when Bosal took over a German company established in Mexico, that produced parts for Volkswagen (VW) and General Motors (GM). At the time, 50 percent of the company was German, the other Mexican. After the purchase, we changed to employing 90 percent Mexicans and 10 percent German. Since 2008, we have only hired people locally.

After the first few years, our market increased, and we expanded operations from downtown Querétaro to an all new facility outside of the city in 2007. We provide the best solutions for our customers. GM is our main customer, but other companies such as VW, BRP and Polaris also remain important for us. We are currently focused on supplying the OEM market in Mexico, but we are also looking to expand our market in other related segments to our business, such as aviation.

2. What is your outlook for the sector, for OEMs, the aftermarket, and in terms of innovations? In general, and for Bosal Mexico specifically? What do you expect of the current decennium?

Bosal Mexico produces mainly exhaust systems. This niche market will close soon due to the development in EVs. I expect the Mexican market to remain for another 15 to 20 years, but in Europe the electrification will not take longer than 5 to 10 years. Therefore, we are doing research on different strategies and technologies, and moving into new products, such as industrial heat recovery systems and energy hear recovery for hybrid vehicles. We already make for GM a component for hybrid cars.

In general terms, Mexico will continue being a very attractive market, due to the low labor cost and skilled workforce. The quality of skills available in the Mexican workforce is outstanding.

3. You focus on in-house Research and Development. Can you tell us about your R&D projects in Mexico? How do they compare to other regions?

Bosal is exploring options to bring our R&D center from USA, in Michigan, down to México. We used to have a large facility there, but we heavily reduced our activities there. Our R&D Centre is

still there because it's close to the 3 big US OEMs. Labor cost will be lower if we move all our operations to Mexico, and we think that the exceptional and experienced labour force in Mexico could make a big difference. Also, most of the OEMs are located in México, too. We also have R&D center in Brasil, Turkey, and at our head office in Belgium.

We have excellent human resources in Mexico. We have 10 managers that each have at least 12 years of experience with Bosal Group, and I have been with the company for 25 years. We have well-trained and, different to other companies in our industry, low rotation of floor workers. There is a lot of know-how. So much so, that we have people from Mexico give trainings to workers at our facilities in other parts of the world.

4. Your production center is based in Querétaro. Why is this the best location for Bosal Mexico?

If you look at the map, you can see that most of the OEMs in Mexico are within a 200 km radius of our facility, including the Asian brands. It's important to be close to our customers. As Tier 1 supplier, we need to follow the OEMS, always. That's how you can be their partner.

Furthermore, Querétaro has been the center of the automotive industry for the past 50 years. Therefore, people in this region are experienced and skilled. If you compare this to states such as Guanajuato, their history is very recent, no more than 20 years. They have more assembly plants nowadays than Querétaro, but less skilled people in the area to work at the facilities.

5. What are your plans for Mexico for the coming years?

We are planning to expand our operations in México by opening some other small plants to serve our customers directly. Our main hub will remain in Querétaro, but we are looking at San Luis Potosí and Puebla. We also have plans to open a facility in Ontario, Canada. One of our customers is located there and we would like to be close. It would be nice to see a Mexican company expand to Canada.

6. What advice would you give Dutch companies interested in expanding to the Mexican market?

Although we are currently undergoing change and difficult situations due to the spread of coronavirus, Mexico remains a solid investment. México understands the need to continue focusing on providing the best services and acquiring new technologies from countries such as The Netherlands.

México is a large, competitive, and diverse market with highly skilled and qualified people. Those are the most relevant aspects to consider investments in México. There is a very big potential for the coming years in the automotive industry, I foresee a lot of growth, also now that USMCA is being implemented.

I think Querétaro is an excellent place for Dutch companies. It is safe and located very strategically in the centre of the automotive industry.

Once you start operations, make sure to incorporate Mexican employees in your teams. It's important to invest in understanding the local culture and the country in order to be successful. I always say that you need to "tropicalize" things for every country. Show how things can be done, then let local people figure out how those principles can be applied for them.

Eduardo Solís. Former president of AMIA.

Interview with Eduardo Solís

1. Could you tell us what are the main areas of expertise of Mexican automotive companies? And in which areas is there room for improvement?

Since the entry into force of NAFTA in 1994, global automotive companies have identified the competitive advantages to operate from Mexico as platform for their global operations: strategic location, manufacturing costs, the growing FTA's network (including the EU, Japan, Korea and Latin America), among others.

These advantages have forced our country to continuously improve our labor force, attract new technologies and adopt the best practices in this industry. As result, Mexico is currently one of the most important players, reaching currently the 6th position as the largest manufacturer of vehicles and one of the top producers of auto parts in the world.

Some indicators: Mexico has developed world – class clusters in manufacturing processes (with 23 assembly plants operating in 12 Mexican states, including luxury brands like BMW, Mercedes Benz and Audi); state – of – the – art R&D centers supported by Tier 1 companies; universities and institutions directed to improve our engineering skills (strong labor force); and now we are moving towards the development of new technologies (EV's, hybrids).

Notwithstanding, there are always opportunities to continuously enhance the competitiveness of our automotive industry.

From my perspective, I would like mention three of the most important: (1) To strengthen our local supply basis, currently we import more than 85 percent of auto parts consumed by the industry; (2) To attract knowledge and expertise related with the manufacturing of new technologies vehicles, and in this specific point, I know that the Netherlands can be a key player in Mexico; and, (3) The entry into force of the USMCA (or NAFTA 2.0), jointly with the impact of COVID on global supply chains, will force the industry in the region to redefine processes and operations; however, this can be translated in business opportunities for Mexico.

2. What are the greatest challenges for the Mexican automotive industry? And what is your outlook on the future, in terms of innovations (such as CASE vehicles, industry 4.0) and a changing perception of mobility in Mexico?

As I mentioned previously, main challenges for the auto industry in Mexico will also rely in two important events: the entry into force of the USCMA (NAFTA 2.0) and the influence of COVID – 19

in the global operation of supply chains (bolstering “reshoring” processes from Asia towards the North American region, what I have called “de-globalization”).

These two events will generate great challenges for our industry, but also very important opportunities for the attraction of new operations and companies once the industry shows recovery, estimated by 2023.

During the next three or four years, Mexico will have to take advantage by combining a recovery process (going back to pre-COVID production levels) with a transformation process to strengthen our basis for the assembly of vehicles based in new technologies.

Please let me share a similar experience we have had in Mexico to shift from old to new technologies: until the mid- 1990's, our country was one of the top manufacturers of CRT (cathode-ray tube) and even black & white televisions, of course, we were losing ground in the global markets.

Our federal government reacted by implementing an ambitious program to transform this industry, I had the opportunity to design those policies that included: attraction of new manufacturing processes, eliminating import duties on components not available in the North American region, capacitating our workers to assemble new products.

As result: Mexico stopped producing those “old technologies” TV sets, started the production of flat screens and LCD's. Currently, our country is one of the most important manufacturers of color TV's in the world.

Something similar is occurring in the automotive industry: we have a strong suppliers and assemblers basis, high skilled labor force and the R&D basis across the country. We are convinced that the future will be in the demand of EV's, hybrids, unmanned vehicles, next step is to strengthen this base and partner with global leaders in this niche as the Netherlands.

At the same time, our country will have to invest largely in developing the required infrastructure for the operation of these new technologies, the participation of global players will be key in this process.

3. Some experts say it is time for Mexico to shift from being a traditional manufacturing to advanced manufacturing. What is your view and how do you think this can be achieved?

I think I have partially answered this question and just would add to ideas.

First, being part of one of the largest economic regions in the world and due to the inter-connection of manufacturing processes with the US and Canadian industries, currently leaders in advanced manufacturing processes, Industry 4.0 and the usage of internet, will be naturally forcing us to the adoption of those technologies.

Mexico plays a relevant role in the North American supply chain for the automotive industry. Just to give you an idea: manufacturing a piston from the raw material, incorporating it into an engine and assembling it to a final vehicle requires more than 7 border – crossings across the three countries' borders; i.e, to get an assembled vehicle, parts and components will have to cross more than 7 times across our borders taking advantage of each partner's competitive advantages.

On the other hand, the Mexican government will have to continue investing in infrastructure (roads, expansion of internet services, costs of electricity) to improve the conditions for the operation of new technologies. Also it is important to devote funds to the human capital and improve our skills related with advanced manufacturing processes. A third element, as I mentioned previously, is by partnering with countries and leader companies in order to adopt best practices in Mexico.

4. What do you think is key for success for foreign companies interested in expansion to Mexico?

Business opportunities for companies interested to do business or to invest in Mexico will be increased as result of the entry into force of the USMCA (NAFTA 2.0) and COVID – 19 (reshoring of processes towards Mexico). These two events will increase the demand of suppliers, engineers and products related with the industry once this reaches the pre-pandemic production levels.

At the same time, and as I described before, Mexico has unique competitive advantages: strategic location (easy access to North American, European, Asian and Latin American markets); preferential access to more than 12 agreements with 46 countries (EU, CPTPP – Asian nations, Latin America and, of course, North America via the USMCA); competitive manufacturing costs (we are not anymore a “cheap labor” country), among others.

Our economy relies heavily in the global markets, 89 percent of our total production is exported. Besides the resilience of the domestic market and the opportunities to serve a 130-million market, companies see Mexico as key partner to expand operations towards other markets.

5. What advice would you give Dutch companies interested in expanding to the Mexican market?

In 2020, the Netherlands became the 5th largest foreign investor for our country with presence in all sectors (manufacturing, commerce, infrastructure & services).

Main opportunities for Dutch companies can be in two areas within the automotive industry:

- On one hand, by sharing and bringing your knowledge & expertise in advanced manufacturing processes and new technologies. Mexico recognizes the global leadership of the Netherlands in this area and this has to be translated in a key partnership for our two countries.

To say “invest in Mexico” or “do business in Mexico”, usually is translated into “close your operations in your country and move to a cheaper nation”. This is not the case of Mexico.

The most important Tier 1 companies, worldwide leaders in the development of new technologies, have established R&D centers in Mexico in order to take advantage of our engineers’ skills. The right message would be: try Mexico, send us some of your basic operations, share with us your best experiences, and I promise, within the next two years you will be increasing your operations at home (larger demand in foreign countries), as well as in Mexico.

Next step: translate this knowledge in manufacturing lines by partnering with companies already operating in Mexico, contact education centers and local governments to identify their specific needs and opportunities for your companies.

Myself, I am more than glad to support you in these activities. It will be also important to see where the USMCA (NAFTA 2.0) opens new door for Dutch companies.

- At the same time, we know that Netherlands has the fastest-growing electric vehicle charging network in the world. Share with Mexico, teach the companies, bring this expertise to Mexico.

It is important to recognize that economic structure and even, geography [topology?] of our countries is different. Solutions designed for the Dutch, European or US markets definitely will not be 100 percent the same as the required in Mexico. But, again, bring your expertise, work with our engineers, contact experts in different areas, and I can assure you that “customized” solutions will rise from these synergies.

EY Mexico

Interview with Marcellus van Eck, Head of the German Business Center at EY Mexico and Raul Meyer, Partner at EY Strategic Consulting Services, Advanced Manufacturing, Automotive, Transportation, and Mobility Practice.

1. The automotive industry is truly global. Could you elaborate on the global and regional dynamics of the industry and Mexico's role in it?

It is truly global. For Mexico the automotive industry will become even more USMCA orientated. In the North American supply chain Mexico is a large supplier of auto parts. Some components cross the border a large number of times before they are finally installed into a car.

The US is still the largest manufacturer of cars in the Americas, with approximately 15 million vehicles produced each year, compared to about 4 million units in Mexico and approximately 2 million units in Canada. This will likely stay the same in the future. The US domestic market is mature and includes luxury cars, whereas in Mexico the majority market share and potential is for cars in the price range of US\$ 8,000 to US\$ 15,000. Canada's market is much smaller. Supply chains are mostly oriented towards the US and Mexico.

Mexico has a competitive advantage compared to other automotive areas. A study published by PWC shows it is cheaper to produce in Mexico than it is in China. The cost of a Mexican worker is about US\$3 an hour, versus US\$ 50 in the US, US\$40 in Canada and about €50 in Europe. This competitive advantage is expected to remain in place.

The US and Mexican economies are intertwined and very dependent on one another. Mexico exports about US\$ 90 billion worth of auto parts to the US. During the COVID-19 pandemic auto parts production in Mexico was halted. With this also US production came to a complete stop and

US President Donald Trump Mexico to restart production, otherwise the US would not have been able to produce.

OEMs guide the operations of the plants in Mexico, as well as their strategy is to serve the world market. OEMs, such as Volkswagen, are looking into the possibilities to put in place strategies to start with R&D in the US and Mexico, rather than only in Germany. Whether or not this will happen, depends on the ability of implementing the required processes and the presence of suppliers that offer fitting technology and innovation. The latter is where Dutch companies can come in.

Looking at the role of Asia, the main driver behind its automotive industry is China. The country has advanced electro mobility solutions and batteries, for example. China's car market accounts for 27 million units per year, of that figure electric vehicles account for approximately 1 million units. Asia, through mainly Japanese manufacturers such as Toyota and Honda, is driving the development of fuel cell technology for hydrogen powered cars. Europe is investing heavily into hybrid technology battery factories and technology, too.

2. What is your outlook for the automotive sector in general and in terms of innovations? What do you expect of the current decennium?

An increasing number of EVs will enter the market. Large investments are going to be made by OEMs. For example, Volkswagen is investing between US\$30 and US\$50 billion, whereas BMW is investing approximately US\$25 billion in electric vehicles. Next to EVs, hybrid, mild hybrid vehicles as well as fuel cell technology will be leading developments in this decennium. The internal combustion engine will not disappear, on the contrary, it will remain to play a role in the next 20 years alongside the new technologies. This has to do with, amongst other reasons, the lack of charging infrastructure. Even in Germany the infrastructure is not fully developed, whereas Mexico has almost no infrastructure in place.

In terms of innovation, development of battery technologies is the future. Smart mobility will also gain momentum. With COVID-19 under control, smart mobility will become important in large urban zones. This is especially the case for cities such as Mexico City, which has a young population that can easily adapt to new forms of transportation. Additionally, consumer preference towards owning a car has changed. Car sharing and new smart forms of transportation will become more important, especially in an economic downturn.

EY gets many questions from Mexican clients as to what they should do to address changes in the automotive industry, such as the arrival of electro mobility. The recommendation is to invest in R&D, which is where Dutch companies can make a difference. Opportunities include establishing battery factories, GPS systems, autonomous driving. Although Mexico is still far away from developing such technologies, it is a segment expected to receive large investments and could prove to be very profitable.

3. What strategies do OEMs and Tier suppliers in Mexico usually adopt when it comes to decision-making? Are decisions taken in Mexico or in the home countries of the

manufacturers and what is the process for R&D related decisions?

Essentially all large decisions by the OEMs, including for example strategic and audit decisions, are taken at the central entity of these manufacturers in their home countries. OEMs are trying to decentralize decision-making by establishing certain centres for R&D and excellence for certain platforms. However, progress in this matter is slow.

The Tier supplier industry follows the OEMs, which is the nature of the business. There could be some change for Tier suppliers of complicated systems, such as the transmission and engine. In the case of BMW, complicated systems like the integrated power train, which makes up approximately 25 percent of a car's value, are currently produced in Europe. This will need to change to comply with the original content requirements stemming from the USMCA. If a supplier wants to sell transmissions for the BMW 3 series, these transmissions need to be produced or manufactured with a certain amount of local content to comply with the local content threshold of 72.5 percent. Consequently, BMW needs to invest in an internal combustion engine factory in the US or Mexico.

In terms of R&D, Mexico is a follower. Without the appropriate government involvement, Mexico is not likely to become a leader. This could change if local and federal governments would oblige OEMs and suppliers to partake in R&D activities in Mexico. Currently the main R&D activities come from individual initiatives. An example of a private initiative in R&D in Mexico is that of Bosch, which is investing in a high-tech R&D cluster in the Guadalajara area. There are some other developments in R&D coming from OEMs, such as Volkswagen, but these efforts are focused more on traditional technologies, such as combustion engines. Audi's efforts are focused on the improvement of production efficiency and on manufacturing mild hybrid vehicles. The decisions of German OEMs for these R&D developments are taken in Germany, not in Mexico.


4. To what extent are OEM plants in Mexico entering into automation in comparison with other countries?

For OEMs in Mexico, the level of robotization and automation is the same as in the rest of the world. To give an example, Audi's factory in Mexico is state of the art and of a similar level as factories in Europe. The factory is full of robots, the only manual process is the Audi Q5 cockpit assembly. The same applies to the Mexican factories of BMW and Mercedes.

There is a noticeable difference in automation levels with Tier 2,3,4 suppliers in Mexico, where in some cases processes are manual or even outdated.

5. What is your view on the brain drain of talent and high rotation of personnel in Mexico?

We do not necessarily see a brain drain of talent leaving Mexico and also not to the US, since this country has created many obstacles preventing Mexicans from moving there. Instead of a brain drain it is rather a global exchange of talent. There is a high level of mobility for executives that are performing well and who rewarded with a move to another country.



High rotation does not happen at OEMs, but it does happen at suppliers, where margins are under pressure and with that also the wages. This makes it challenging for suppliers to keep their employees in the company. There are cases of employees leaving supplier A to start working for supplier B within the same industrial park for a slightly higher wage. In the automotive hubs of, for example Queretaro and San Luis Potosi, suppliers have no trouble finding sufficient personnel.

Companies, such as Volkswagen and BMW, are trying to establish strong relationships with their employees through investing in training and the opportunity to grow within company. Essential employees have specific contracts that prevent them for leaving the company within a certain period, which is essentially a means to prevent brain drain from the company.

6. What advice would you give Dutch companies interested in expanding to the Mexican market?

Do not get involved in what everybody else does, such as supplying heavy metal parts and pistons. Do get involved in high value-added segments such as electronics, automation, autonomous cars, GPS systems. However, pick your battles and take only those that you can win.

For example, Bosch is a rich company because it is driven by innovation. By doing it is the only Tier 1 supplier and can command prices because it is the only supplier of a certain technology. Creating partnerships and projects with this type of companies is where Dutch companies can make a difference. However, it does not necessarily have to be Tier 1 supplier. There are also Tier 4,5, and 6 suppliers that provide an essential part for mobility, not even necessarily the car itself.

There is an important role for organizations, such as Holland House Mexico, to help Dutch companies that are active in smart and green mobility to establish their business in Mexico.

Furthermore, there is room for Dutch companies and organizations to establish an R&D hub, similar to that of Brainport Eindhoven, in Mexico and to partner with companies with local operations, such as Bosch.

Other possibilities include setting up in Mexico a satellite of the organizations involved in Brainport Eindhoven. Consequently, a small hub, sponsored by Dutch and international companies and with involvement of local Mexican governments, could be formed in Mexico.

ITB Group

With Manolo Seeldrayers, Plant Manager ITB Group / Dooremalen Industries México

ITB Group is a full-service injection moulding company that specialises in the finest precision work.

1. Can you tell us about your current activities in Mexico and how they came to be?

ITB Group started 13 years ago in Querétaro. We were invited by one of our customers, Bosch, whom were already manufacturing in Mexico. We chose to supply them through a production line in proximity of their plant, because that would be cheaper logistically, and in terms of labor costs. It is cheaper to hire workers in Mexico than to implement technical solutions as we see in higher-income environments, such as robots to move parts from one production line to the next.

The first Plant Manager was a Dutchman. He returned to The Netherlands some years ago. We were – and still are - a good team. In the beginning, apart from the Plant Manager, around 10 to 12 percent of our staff was Dutch. We still have a mix of Dutch, Mexican, and Belgian people. This mix of cultures helps a lot because you can understand both cultures. We know how to manage the people both in the Netherlands and Europe, and in Mexico.

Nowadays, we are happy to see that Bosch is still one of our customers, but we've also expanded our portfolio to customers from the US, China, and Germany, among others. We are constantly looking for opportunities to branch out, in both the automotive industry and other manufacturing industries.

2. Why is Mexico an attractive market for you, and Querétaro in particular?

Mexico is an excellent country to do business. It's a country where you can build good solid relations with customers. NAFTA [now updated to USMCA] has opened and secured many opportunities. There is good money to be made.

We chose to have our production facility in Querétaro because we are in the middle of the country, where we have a lot of automotive industry. The region has been developing very well in recent years, not only in the automotive industry, but also in agri-tech and aerospace, for example. Our products adapt well to these other industries, too.

3. What is your outlook for the automotive sector; in general, and for ITB Group specifically? What do you expect of the current decennium?

The automotive industry in Mexico will continue to grow, that's for certain, even though we are going through a crisis. In June, our operations were down to only 45 percent, in July we were at 85 percent and in August we have returned to our pre-corona production. Some think differently, but I think this year, 2020, will remain challenging. Due to a decline in vehicle demands in the US, I foresee a decline in demands towards the end of this calendar year, as I expect Tier 1 companies and OEMs to close their operations for 2-3 weeks in December in Querétaro to rely on their stock. In January 2021 production I think production will pick up again.

In broader terms several things are changing too. Our industry is going to electric! Many OEMs are starting production of EVs. BMW is starting, Nissan Aguascalientes, Mercedes has plans. Perhaps COVID-19 is proving to be a catalyst for change. Mexico is a follower, not an innovation leader, but everything is changing now, we are going to electrify. It's happening.

As ITB Group, I think we will continue to grow in the future. The building we are currently housed in is rented, but I expect that we will buy something. We are planning to expand into the business of parts assembly, but we do not have enough space. Also, in the long run, renting is more expensive. We may build something new.

There are more competitors in Querétaro now, so doing business may not be as easy as 10 years ago. There are many plastic moulding injection companies, but a good company with good quality is key to success. QUALITY is key. Compared to Chinese products for example, our products really stand out in their superior quality, they don't compare.

4. Can you tell us about your R&D projects in Mexico? How do they compare to other regions?

Currently, our R&D takes place in The Netherlands. That's where they make all the robots and equipment, and here we do the assembly. For the future, I would like to see that technical experts come to our plant in Querétaro to train staff on the floor.

One of the issues we face here in Querétaro is a lack of technically well-prepared staff. We have workers on the floor that are cheap and low skilled, whom we give some training. It's common that there is a lot of rotation among this type of employees, so our training is limited. But the problem are the technical workers, more academy level, that are hard to find. The problem is in the schools, they are oriented on theory and lack a practical approach. You need technical training. You need to feel what you are doing. Some schools are starting to incorporate more practical training in their curriculum, but we need more of this. In Europe it is much easier to obtain skilled technical staff.

5. What advice would you give Dutch companies interested in expanding to the Mexican market?

Mexico is a good country, it is very open, the people are friendly and hardworking. Workers are flexible, they don't walk away at 5 o'clock. If I ask the crew right now to work until late tonight, all will comply without complaining.

My advice would be to make sure that you are close to your customers. How are logistics, is it easy and cost-efficient to move around people and products?

People are also key to success. Make sure you can get the right staff and be prepared to have to deal with a lot of rotation on the work floor.

Minister of Economic Development of Jalisco

Interview with Ernesto Sánchez Proal, Ministry of Economic Development of Jalisco.

1. What is your outlook for the automotive sector in general and in terms of innovations? What do you expect of the current decennium?

The State of Jalisco recognizes two significant changes in the automotive industry. First comes what the secretary of economic development called a revolution of automotive industry because of the electrification of vehicles. This market driven force will initially be driven by governments but also because of the climate change and emissions that in general have a huge influence on the market. Further it was stated that electric vehicles make only use of 10% of the parts of a traditional vehicle. This will lead to an immersion into the automotive industry. Companies that now are not important will become key players in the automotive industry as for example electronic and software developing companies. The secretary of economic development described the future car being more like a computer with wheels.

Due to the already existing talent and infrastructure, the State of Jalisco rather wants to further develop their talents in the technological hub Guadalajara, than becoming dependent only on assembling for others.

The second change mentioned was that in the traditional concept of mobility will change in the future. This means less cars will be bought by individuals but car services such as uber, car sharing etc. will increase. This will result in the automotive industry selling longer lasting cars.

Last but not least the current situation about the pandemic was mentioned as it is expected to have a short-term effect of people buying more cars in order to travel alone - safer especially in china. The secretary of economic development sees an initial slowdown in the automotive industry but expects the industry of the second half of next year to peak up again, but then probably with more electronic vehicles.

2. Could you tell us more about the programs or incentives that Jalisco is implementing or will implement to promote trade and Foreign Direct Investment (FDI)?

The incentives that had been in place before pandemic were that most of the research was focused on the internal market. However, more emphasis has been laid on scouting exactly the companies the state of Jalisco would like to attract. For the latter attention has been put in the electric vehicles industry as well as the agriculture industry especially those located in China, Texas, Europe and Japan. However, more specific regions and sectors are yet to be defined in order to set up successful strategies. Therefore, the first step is to identify the companies and sectors and then explain why they should go to Jalisco. Further it is important to have a look on both, the companies as well as their suppliers in order to check for possible local suppliers. The State of Jalisco put in place several incentives for companies to execute an FDI. Especially the cash incentives and land incentives are of high interest as the help to lure companies to Mexico and especially to Jalisco. However, these incentives are bounded to several conditions such as the companies actually creating jobs and the salaries are being paid. The money is then being given after the companies

make the expenses on their end. Therefore, the State of Jalisco has come up with many specific areas that are being supported such as construction (brick and mortar), training, equipment, infrastructure and even facility renting infrastructure. In order to make it as easy as possible every company will receive support during the whole process especially when it comes to getting permits, make payments etc.

Collaborating with the private sector which brings investments to Jalisco is a win-win situation for everyone involved. An example can be found within the energy sector where the state of Jalisco has set up an energy plant that completely goes along with the norms for protecting the environment and mitigating the climate change but being competitive at the same time. Rich in energy means not only oil but a lot of wind and sun which supports the energy industry.

3. What role does Jalisco play within the automotive industry in Mexico? How does it compare to other regions?

The Electric car industry in Jalisco for example is currently producing around 20% of a tesla car. Right now Jalisco is not such a big player in automotive industry such as Guanajuato but very soon Jalisco will turn into a key player in the electric car supply chain. Jalisco works together and forms alliances with other states that are already successful in the different sectors. That way they are able to complement each other when it comes to the automotive industry- especially electric cars. It is important to focus on national supply chains so that parts are being bought throughout the whole country. Assembling and productions of parts could be carried out by different companies throughout different states.

4. Where does Jalisco stand in terms of its readiness to become an automotive R&D hub?

There are several companies that are concentrating on automotive R&D. Currently there 3 German and one American company that are doing R&D in Jalisco. In addition to that there are also several software companies in Jalisco that will become more important in the automotive R&D. Due to data protection and privacy laws the State of Jalisco has no direct knowledge of what they are developing, but yet it seems for Jalisco turning into a prosperous future in that area.

5. What is being currently developed within Research & Development projects of the State of Jalisco? And what are they pointing towards for the next 5-10 years?

The State of Jalisco is trying to put themselves in a position as a key player regarding electrification.

6. How can the government of Jalisco participate with the private sector and the industry associations in the development of the regional and national automotive industry?

CADELEC is a very important supply chain development organization for electronic industry in the area of Jalisco. By working together, a collaboration with the private sector within the automotive cluster can be achieved. Also, for example, with the industry park association to execute the strategy planned. The State of Jalisco is a council for attracting investment and international trade-

this council gives the State of Jalisco several seats at the board of CADELEC. Synergies between the private sector and the State of Jalisco makes Jalisco becoming a facilitator and not an obstacle for companies wanting to operate their business there.

7. What advice would you give Dutch companies interested in expanding to the Mexican market.

Now is the right time to come to Jalisco. Jalisco has a particularly good position for supply chains in Asia but also in the United States. When it comes to energy storage such as batteries etc. the best place to be is in Jalisco. Especially regarding the electrification of cars due to talent position (logistics) as well as the workforce (salaries) and finally the existing infrastructure such as the airport in Guadalajara (currently enlarged) or the port in Manzanillo.

National Industry of Auto Parts (INA)

Interview with Óscar Albin, General Director of INA.

1. Why would you say the leading players continue moving to Mexico?

First, Mexico is in “the centre” of the commercial world, close to North and South America, it is “between” both, one ocean to Asia and one ocean to Europe.

Concerning the production of light vehicles in Mexico, from 2004 to 2019, Mexico has a 157% growth in vehicle production. The next three years is the period to recover from the crisis; the forecast is to manufacture around 3 million units (2020, 2021 and 2022). After these three years, I believe we are going to continue growing.

From the leading OEMs in Mexico with information from IHS Market, INA forecasts a 31% growth between 2020 and 2026.

2. What is the importance of Mexico as manufacturing hub to the US and Canada?

Every single car in the US has, on average, \$5,306 of parts imported from the low-cost country. In 2019, Mexico exported US\$ 70 billion of auto parts. This amount surpasses the heavy and passenger car exports together that accounted for US\$14 billion.

Out of the 1,000 million people employed by the auto industry, 90% is in the auto parts sector, in which there are the largest projects.

3. Could you explain to us a bit more about the auto parts and aftermarket flow in Mexico? And between the three countries of North America?

In Mexico, you could build a car with Mexican components from bumper to bumper, in most of the commodities we have more than one player. For example, headlamps, we have HELLA, Magna, Denso.

Specifically, regarding the auto part sector, Mexico was the 5th auto parts manufacturer. China, US, Japan and Germany heading the top manufacturers in that order. In 2019, Mexico reached US\$99 billion in auto parts and the forecast for 2020, is of US\$75 billion. Due to the crisis, the other countries will also reduce their production, and we are going to maintain the 5th place.

Another vital question to be answered is from which countries are the companies of auto parts located in Mexico?

For example, most of the auto parts factories are from Mexico, with 34% (mostly tier 2 and tier 3). The second and third places are the US and Japan, respectively. Japan has grown in the past five years, reaching now 17% of the market share compared to 18% from the US. Germany, Canada and France share significant presence.

From the 99 billion dollars, Mexico exports 81 billion as direct components. Around 92-93% were exported to the US and Canada. The auto part sector is practically destined to the North American market. In lower percentages, the auto parts also go to Brazil, China, Japan or Germany but the amounts are not significant.

In contrast, most of the imports in Mexico come from the US with a 49.4%. From China, the second-largest importer with a market share of 14.5% but these auto parts are mostly for the aftermarket segment.

The three prominent regions of automotive production are North America, Europe and Asia (with China taken into account as an isolated case). Korea and Japan are buying labour-intensive components from China, Philippines, Malaysia, Vietnam, Thailand and other Asian countries. They have their intensive requirements of low-cost components for the OEMs. The same situation happens in Europe where the countries in Eastern Europe as Turkey, Tunisia and Morocco manufacturing what the OEMs may need.

In the North America region, the US and Canada are only getting the components only from Mexico. Central America and the Caribbean are not an option due to political conditions, and with South America, the distance becomes longer and makes no sense for the buyers in the US and Canada.

Mexico ranks in the 7th place with 3.73 dollars per hour compared with the 1st place Czech Republic with US 6.96 and the 10th place Tunisia with US 2.26. To know how much a company is paying in dollars per hour, the factors to consider the operation cost within a standard automotive manufacturing plant are:

A standard of 700 employees split in the assembler, skilled and highly-skilled operative, automotive engineer, secretary, the quality control specialists, office services specialists, head of manufacturing, the production manager and the quality control manager.

In the chart shown, Eastern Europe is the most expensive area as they have been increasing the salaries; also China is now more expensive than Mexico.

From Latin America, Brazil and Argentina are also manufacturing auto parts. Still, they are even more expensive than Spain, and that is the reason they are not exporting as the prices are not competitive outside their own countries.

4. Where in Mexico, does the manufacturing of auto parts concentrate the most and why?

Most manufacturing plants are in the North of Mexico, the statistics of INA include the production of engines and transmissions even though that sometimes these parts are manufactured by the OEMs. Coahuila, Chihuahua and Nuevo León are the top three states for auto parts manufacturing.

This phenomenon is explained by the fact that most of these parts will end at a manufacturing plant of new cars or trucks in the US. China controls the aftermarket auto part sector. Nowadays, you can find a very reasonable quality of Chinese parts at a competitive price but also lousy quality. Their market with the produced 30 million cars per year; this volume is what also gives them vast opportunities for the aftermarket sector.

It is a big challenge for non-Chinese aftermarket companies to keep prices and competitiveness in general. Mexico is not a significant producer of aftermarket components only 5%. In the last five years, some rules have been being developed, aiming at high-quality aftermarket auto parts, but until now, it is not mandatory to comply with them.

Mexico is now focusing on components that are essential for the passengers' security. Breaks, lightbulbs, steering gears, shock absorbers.

5. Regarding Research & Development, what is the status in Mexico for auto parts and the aftermarket sector?

Regarding the Engineering Centres in Mexico, there are 26 centres that employ 15,680 engineers for different Tier 1 and OEMs. Continental and Bosh are very good examples as they are currently active in Research & Development. So as the other engineering centres, the OEMs work together with the supplier to develop components or software.

The investment in R&D activities in Mexico is not that high compared to other countries. South Korea and Japan are at the head of this investment. Japan, India, China have a rapid pace in the electric-vehicles R&D as they are countries that do not want longer to depend on the Middle East oil production. Compared to the US and Canada, that not a hurry as they are not dependent on foreign production oil. They have big pressure from the oil industry to keep the automotive industry in the combustion model business. The only different state is California, which is moving towards the electrification due to the environmental-friendly way of life.

Regarding Human Resources, the total engineers every year is about 100,000 graduates. 1 out of every 4 graduates is an engineer. I would say that the question is about the quality of the education. Is it high enough?

6. Which are the main treaties that influence directly or indirectly the most?

Mexico has 13 Free Trade Agreements with 52 countries that allow us to deliver components, cars and trucks to a wide range of export markets. Mexico exports 3.3 million vehicles, with an US\$81 billion value in auto parts. For example, if the US wants to deliver a car in Brazil, the tariff will be 35%. In comparison with the export going out from Mexico to Brazil, it would be 0% because of the Commercial Agreement between these countries.

In 2018 just after China, Mexico ranked the 2nd in deficit trade for the US; along with the entry of President Donald Trump into the White House, those were the main reasons to start the renegotiations of NAFTA. Out of the US\$ 85 billion deficit, the automotive industry was responsible for 71.6 billion, which translates into 84.2%. Hence, most of the changes for the NAFTA renegotiations regarded to the automotive sector.

INA had a seat in the “War Room” of USMCA negotiations during the last three years very closely with the Mexican government.

The conversation was centred on how the US and Canada were losing manufacturing activity since the NAFTA agreement was signed. Still, the reality is that Mexico did not take any volume from them. It only started to grow from two to four million manufactured light vehicles.

How many imports is the North America region taking and from where?

In 2019, US\$78 billion was the total grand amount of imports into the NAFTA region. The imports from Japan, Germany and South Korea were used to be essential being Japan the largest with 25% with US\$20 billion. These auto parts imported are required by the OEMs that are established in Mexico. In contrast, China that does not have any manufacturing plants imported US\$29 billion.

Here is the focus for the USMCA now, to reduce this amount, especially from China and depend less on them by starting to manufacture more within the North American region.

In the previously signed agreement -NAFTA- there was only one rule for a car to be considered “regional”. Companies only had to comply with having 62.5% of Regional Value Content (RVC). With the USMCA, there are four rules:

a) RVC= 75%

Core parts = 75%

Principal parts = 70%

Complementary parts = 65%

- b) 70% of the steel and aluminum content has to be from the North American market.
- c) 40% cost in salary region of US\$16 per hour. This is important to know as this also includes the expenses in Research & Development.
- d) The incorporation of NAFTA Core parts which are 7

If companies do not comply with the established rules previously mentioned, they must pay the corresponding tax depending on the type of vehicles. For light cars and trucks, the tax is 2.5%; for Pick Ups and Thorntons 25% and auto parts segment, it depends on which part it is, and the tax can be 0 and go up to 6%.

7. Is there Mexican regulation that fosters the sector for foreign or national companies in terms of taxes or legal matter?

From the national manufacturing industry, the automotive sector is the champion of them all representing 20.8%, surpassing the Food Industry, which reaches 20.3%. This contribution is relevant, especially when the industry associations may require support from the Mexican government. Every state, especially from the North has its incentives to attract FDI.

8. What advice would you give Dutch companies interested in expanding to the Mexican market?

For Dutch companies would be interesting to establish the entity in Mexico even if they have a contract with some company located in the US as the work can be done in Mexico and the results can be delivered from here. The cost of an engineer is US\$20 000 per year compared to the average of US\$ 120,000 when contracted in Europe.

Not only passengers' cars are important in Mexico, and I think this is important for The Netherlands as they have a heavy presence in the heavy trucks in Europe with the manufacturing of an important truck factory. In the last ten years, Mexico grew more than double. These vehicles need more components which now the companies are trying to buy Mexican pieces to depend less on the imported parts.

Diamond shape aiming at the triangle shape of Developed Countries: An option could be via Foreign Direct Investment, as the volumes are high Tier 1 supplier asks the Tier 2 supplier to reallocate their facilities into Mexico. I think The Netherlands have an opportunity in Tier 2 suppliers.

Japan is already doing it by having more Tier 2 suppliers in Mexico. Still, they only supply to Japanese OEMs, and the opportunity here would be to link the Tier 2 suppliers to the other Tier 1 or OEMs in the country, whether they are European or North American companies.

RAI Automotive Industry NL

Interview with Bram Hendrix Manager Smart Mobility & Internationalization RAI Automotive Industry NL

1. What is the general opinion of your members about Mexico and their business opportunities there?

To begin with, RAI Automotive Industry NL has a diverse member base of 200 companies. 90 percent of these companies are SMEs, although a few large companies and universities make up the member base too.

In The Netherlands, generally speaking, Mexico is viewed as a production country due to the lower income standard, the large OEMs that produce for the North and South American markets and a low level of R&D activity.

The Dutch automotive industry supplies the international automotive industry, for example in Germany, France, the US, China and Mexico. There are business opportunities with the OEMs in Mexico and in the supply chain in general. This is exemplified by the fact that large Dutch suppliers are already active in Mexico.

Many of our members are active in R&D and the innovative segment of the industry. Suppliers are searching to co-innovate with innovation hubs, such as those in Paris, Munich, or Michigan. Mexico, however, is not top of the list for now.


2. What are the specific strengths/ competitive advantages of Dutch companies in the subcategories: green mobility, smart mobility, manufacturing, and materials? What is the outlook for the next decade?

The Netherlands tops the list in innovation, disruption, and technology matters. The Netherlands is strong in terms green mobility, smart mobility, and manufacturing of materials. The competitive advantage of Dutch companies is high quality and innovative solutions.

For smart mobility chips are crucial, as cars communicate through these chips. The Netherlands has a strong record in terms of smart mobility. For example, Dutch chipmaker NXP is the number one manufacturer in terms of automotive chips, nearly every car in the world has a NXP chips in the car.

In terms of green mobility, The Netherlands is a frontrunner when it comes to smart charging infrastructure. Dutch companies do not produce electric cars, however, they do supply parts for these vehicles. There are several companies producing electric heavy duty vehicles, like busses (VDL and Ebusco) and Trucks (VDL and DAF Trucks).

The technology developed by Dutch companies varies from lightweight materials and composites, new AI technologies, and charging infrastructure, to robotics for high-end manufacturing production facilities for OEMs (including a Tesla plant), and integration of smart and sustainable manufacturing.

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3. To what extent are your members operating on international level? Any already operating in Mexico?

Currently mainly large Dutch suppliers are active in Mexico, including Alpha Roof Systems and BOSAL.

4. What opportunities and obstacles do you expect to find in the Mexican automotive industry for your members?

An opportunity for Dutch companies is to become suppliers of the big partners that already have operations in Mexico. Other opportunities exist in partnerships with innovation hubs in Mexico and in government programs related to AI production technologies and new materials. Government programs concerning building smart charging infrastructure could form an opportunity for partnerships between Mexico and The Netherlands.

An obstacle is that Mexico currently is a manufacturing hub, and most Dutch suppliers are in active in R&D and new technologies. Other obstacles include trade barriers, the language and that the Mexican market is unknown to Dutch companies in terms of regions of opportunity. Another barrier not specific for Mexico but for the global industry as a whole, is that if something goes wrong and the system collapses, there may be a possibility that companies bring their production facilities back to Europe instead of having these in China, for example.

5. The Netherlands ranks #1 in 2019 as the country most ready for autonomous vehicles, according to a comparative study from KPMG. What reasons can you give for this position?

This can be explained by the high quality and high-tech digital and physical infrastructure present in the country. The construction of this infrastructure is made possible by the high taxes paid by Dutch citizens. In general terms, the Netherlands represents an open market style in Europe and an open mind regarding innovation, with high consumer acceptance. Also consumer acceptance for new solutions is relatively high, just as government interest in this topic.

6. Any specific points you would like to emphasize in this study?

Dutch companies are developing new technologies, and the R&D centers are the place to be. It is essential to identify where innovation hubs are located and who are the key players and their suppliers.

SKT Plastics

Interview with Ben Tiebosch, Director SKT-Plastics

1. Can you tell us about your current activities in Mexico and how they came to be?

Our customers are mainly Tier 1 and 2 suppliers. We started doing business in Mexico about five or six years ago. One of our German customers started productions in Mexico, so we started supplying them there. A year and a half later, we received a request from another large German customer in Mexico for injection molding. We fabricate injection molds in Asia, then ship them to Mexico. In March 2020, we set up a new company in Mexico specialized in injection molding. Despite the challenges the corona crisis is proving to be, we have between 15 to 20 molds in Mexico now. Also we are going to set up a factory for changing the molds and refurbishment the moulds: GCE Tooling support Mexico.

2. To expand to Mexico, you chose to look for partnerships that ultimately resulted in two new companies: GCE Tooling Support Mexico and SKT-Plastics. How did you set up these partnerships and why did you choose for this approach? What were some of the barriers and how have you been able to overcome these?

Based on our experiences in Asia, we know that there are some difficulties to be expected. I am convinced that a joint venture with a Mexican company, as we did, is the easiest way to expand successfully. It can be hard to make everything clear to all the people involved, Dutch people are quite different from Mexicans, for instance.

Finding the right partner to set up our joint venture was a matter of luck, in a way. I came to Mexico without knowing anybody, but one of customers referred me to our current partner. Building trust is always very important, because how can you really know whether your potential partner will deliver?

3. You have focused your operations on the city of León. What are the main reasons for this?

That was an easy choice; most of our clients are located in the area around León, such as Querétaro and Irapuato. We also have started with as small joint venture in Saltillo. We aim to have presence in three regions: the Bajío, Puebla, and the Northern States.

4. What is your outlook for the automotive sector in Mexico? In general, and for SKT-Plastics specifically?

In line with our plans for further expansion, I think the automotive industry will continue to grow in Mexico. EV is one of the main reasons of the creation of many new models at the moment. After a few years, these (and other types of fuel injection-) models will be updated and new models will be

created, making for shorter life cycles of vehicles. Certainly, the current crisis has an impact on our operations, however. The car that we were working on has now been delayed by 10 months. Nonetheless, changing models fast is natural in the automotive industry and this will not change.

For me, it's important that in the next years we can comply to the requirement of having 20 percent of recycled materials incorporated in our products. That's why we are already working with an EU supplier of regrind material.

5. What advice would you give Dutch companies interested in expanding to the Mexican market?

Think very carefully before you go to Mexico, the Mexican automotive industry provides many opportunities, but it is not easy. The most difficult part is to find people with a good level of technical formation.

Try to find a good partner, talk to people that already do business in Mexico and examine if you can use some of this persons' experience.

Personally, I have found it easier to do business in Asia than in Mexico. It may appear before you start that it will be the other way around, but that is not my experience. A lack of technical experience from employees and a general lack of trust are the main reasons for this. It costs a lot of money and traveling, before you find the right people. Problem solving is not easy. Anything that involves the government, paperwork, banks, etcetera is not easy at all.

The Embassy of the Kingdom of the Netherlands

Interview with Alex de Kerpel, Policy and Economic Affairs Advisor

1. Which are the treaties or signed commercial agreements that most directly influence the regional dynamics of the automotive industry and what is their influence?
 - The USMCA, which is substituting the 1994 NAFTA.
 - The EU-MX modernized agreement
 - And the TPP11

The USMCA would be the one which influences the most the automotive industry. Mexico's automotive industry represents 80% of the Mexican manufacturing sector, and it is estimated to be around US\$60 billion per year. Most of the exports go to the US, and the Mexican supplies are over 35% of US imports. Mexico is the 7th producer and the 4th exporter of light vehicles.

2. What are the advantages for Dutch companies that Mexico is part of the USMCA? Compared to Canada and the United States.

Mexico is a country of the regional value chain, and this is a privileged position. Dutch companies which are generally not OEMs but rather within Tier 1 and Tier supplier companies, they would be able to integrate one of those supply chains addressed to be exported to the US.

By entering or reinforcing their position as a supplier to the US is an advantage as it is not like this when you are in Canada or self the US.

The USMCA signature comes together with the COVID-19 crisis. This crisis has opened a whole new set of questions. How is the industry going to react? How this slows down the exports and sales in the region? How are we going to reactive ourselves? The US will need to shorten their supply lines of auto parts. Of course, due to the geographical position Mexico, The COVID-19 crisis has put immense pressure on finding new suppliers that are far away, e.g. China is too risky.

3. What other international treaties and national programs (such as IMMEX) make it attractive for Dutch companies to venture into the Mexican automotive industry?

I think the treaty itself makes Mexico interesting for Dutch companies, and as previously mentioned the EU-MX modernized agreement, which happens to be signed simultaneously as USMCA.

The rules of origin rule are affecting most of the Mexican suppliers, and they must adapt to comply with these new requirements. However, many of these companies will have a period of five-year transition (seven-year in the case of heavy trucks) to reach the regional value content percentage required to be considered a product from the North America region.

In the framework of COVID-19, due to the co-dependence -especially with the US- Mexico had to accelerate the opening of the manufacturing operations starting on June 1st. Of course, this also allows the Ministry of Economy to open renegotiations regarding the RVC.

IMMEX has now almost 400 companies, but this may not be interesting for Dutch companies because of the type of goods of this scheme, that is more on the sector for “maquiladoras”.

4. What are the implications for Dutch companies under the new trade agreement between the European Union and Mexico?

Negotiations were ended in April 2018; however, the final signature is pending taking place perhaps the first quarter of 2021. Regarding the regional content, the 60% remains for both parties of most products and parts and the benefit of the 0% tariff. This applies to light equipment, trucks, special equipment, chassis, etc.

Perhaps, one interesting thing for the Dutch companies is that the certification of origin (EUR-1) will be eliminated. This certification will take place to the competent authorities in the exporting country. These are the new things in the treaty

The export country will complement the origin declaration, with elements additional to those established. Customs authorities may require cooperation from the issuing authorities.

The tariffs do not change a lot. But it gives more certainty and more control for the exporting countries regarding the origin of the products.

The mix of both treaties allows:

1. To export directly to Mexico to one assembly line
2. Position yourself with an investment project in Mexico, and from there to be part of a broader supply chain through a European or US manufacturer.

Rather than to have a subsidiary, the best way to take advantage of this is to establish as a Mexican entity and benefit from both the USMCA and the EU-MX agreement.

For the record, that is what most of the companies have done when coming to Mexico. They have come by following pre-existing clients or Dutch suppliers already in Mexico. When there are not pre-existing clients, we must scout the terrain and look for interested Mexican companies in having them as suppliers. The strategy of the US will be in nearshoring conditions, reallocating their companies from Asia to Mexico to shorten their supply lines.

5. Are there any regional regulations within Mexico that make one region more attractive for a Dutch company to establish itself than another?

In terms of government incentives, every state has their own, but I would not call that consistency. The last tax incentive was introduced in 2019, applicable to the northern states reducing from 30 to 20% the income tax and only 8% added value. It is interesting for potential investors, but this incentive is open only for two years (2019 and 2020). We do not yet if after this year it will continue.

Quéretaro, Guanajuato Aguascalientes are worth examining not only for the regional incentives but for the network of the industrial parks and their expertise on automotive and aerospace industries. NBSO is in Queretaro because of the investment climate to help, and big manufacturers are already in the Bajío area.

COVID-19 crisis slowed down the industry around 30% in terms of operations, and this changes how companies analyse prospects regarding future operations. The embassy has had several meetings with Dutch auto parts suppliers, and most of them they could adapt to the situation; where the conditions were critical, it was more complicated for them. The support received from the head offices in The Netherlands was crucial for the companies to be resilient.

6. Considering the USMCA, what is the competitive advantage of Mexico, compared to Canada and Mexico?

For the next five years, the Mexican suppliers will be readapting to the game to comply with the new percentages of RVC. I believe that traditional benefits are still applicable in the case of Mexico, versus Canada or US.

Also, the low-labour cost compared to other countries. This will be over within five years because of the rule of US\$16 dollar per hour conditions. This is not strictly for the worker himself but complementing with the R&D activities and administrative costs.

Labour, social and environmental conditions, the Mexican government is pushed to consider these matters. The US and Canada have the tools to inspect, and Mexico is more much open to allow

these inspections from the European Union, because of the new things of the agreement contemplating Intellectual property.

The geographical position is key and also, Mexico is looking more towards the Asian market, it is interesting for the companies in general as in a new future, they would be able to triangulate from those markets addressed at selling to the US. Of course, this does not apply to China but to the other countries that are part of the TPP11. We will be observing how this evolves in the next years. In this way, Mexico serves a doorway towards Asian-US operations, not only in trading but perhaps incorporating some added value. Within the framework of this treaty, more Asian companies decide to reallocate their companies to Mexico.

In the beginning, the managers are Dutch, but then the engineers and managers will be taken by Mexican employees. We need to make clear that

Other advantages to reinforce, the capacity of the Mexican, interesting aspect: Dutch managers

7. An essential part of USMCA for the automotive sector is the regional content requirement and the requirement of a certain payment level. How do you think this will shape the automotive industry in Mexico, compared to North America and the world? What are the implications for Dutch companies?

To identify the niches, we should move very consciously with the Mexican government, to bring these companies right from the Netherlands and try to succeed. By seeking projects, mobility cars, garbage disposal and other contract opportunities within the public sector; the federal government could be an entry.

Appendix II. Official websites of state governments

Every state has its own official website in which more specific information can be found. Here are some of them:

As a federal republic, every state has its own constitution and legal framework following the National Plan. Through their local Secretary of Economic Matters, every state aims at fostering their own regions and cities through specific incentives from tax percentages or exclusions, to legal conditions. Every state has its own official website in which more specific information can be found.

Here are some of them:

- Chihuahua: <http://www.chihuahua.gob.mx/>
- Coahuila: <https://coahuila.gob.mx/>
- Guanajuato: <https://guanajuato.gob.mx/>
- Jalisco: <https://www.jalisco.gob.mx/>
- Nuevo León https://www.nl.gob.mx/?P=servicio_curp
- Puebla: <https://puebla.gob.mx/>
- Querétaro: <https://www.queretaro.gob.mx/>
- San Luis Potosí: <https://slp.gob.mx/sitionuevo>

Appendix III. Overview of tradeshows in the automotive

Month	Name of the Event	Website
January		
February		
	Automotive Meetings	http://mexico.automotivemeetings.com/index.php/es/
March		
April		
	ANDELLAC 46th Expo Congress	https://www.andellac.com.mx/index.php/expo-congreso-2020
May		
June		
	ANTP National Freight Forum	https://www.antp.org.mx/foro
July		
	INA PAACE Automechanika México	https://ina-paace-automechanika-mexico-city.us.messefrankfurt.com/mexico-city/es.html
August		
	EXPO TRANSPORTATION SUPPLIERS	
	Robofest LATAM	https://www.robofestmexico.org/
September		
	Expo Foro	https://www.expoforo.org.mx/
	Expo RUJAC	https://www.rujac.com.mx/
	Automotive Supplier Forum	https://foroautomotrizgto.com/
October		
	AMDA Automotive Forum	
	Annual Industrialists' meeting by CONCAMIN	https://www.concamin.org.mx/inicio
	International Congress of the Automotive Industry in Mexico	https://ciiam.com/
	Expo Transporte ANPACT	http://www.expotransporte.com/

	Industrial Transformation Hannover Messe Mexico	https://hfmexico.mx/
	Logistic & Summit Expo	
	SiTL Americas	https://www.sitlamericas.com/en.html
	Transport & logistics Connect	https://www.sitlamericas.com/en/transport-and-logistics-connect.html
November		
	Expo Moto 2020	https://www.expomoto.com.mx/
	Logistic & Transport Expo Guadalajara	https://expotransporteylegistica.mx/
December		
	Expo Mecánico Internacional	https://expomecanico.confederaciondetalleres.org.mx/

Appendix IV. Mexico's light vehicle production and export by OEM

Light vehicle production and export by OEM

OEM	Production			Export	Export Ratio	Production		
	2018	2019	Y/Y	2019	2019	Jan.-May 2019	Jan.-May 2020	Y/Y
GM	834,414	864,143	3.6%	827,843	95.8%	361,250	226,123	-37.4%
Nissan	762,408	672,700	-11.8%	442,248	65.7%	298,698	165,544	-44.6%
FCA	639,022	560,141	-12.3%	554,255	98.9%	236,540	125,253	-47.0%
VW	608,471	600,075	-1.4%	572,048	95.3%	269,324	131,917	-51.0%
Hyundai-Kia	294,600	286,600	-2.7%	220,587	77.0%	120,100	77,304	-35.6%
Ford	280,499	249,605	-11.0%	251,454	100.0%	138,820	65,722	-52.7%
Toyota	191,978	191,831	-0.1%	191,669	99.9%	83,242	40,721	-51.1%
Mazda	149,589	91,830	-38.6%	70,889	77.2%	37,299	49,004	31.4%
Honda	147,158	204,414	38.9%	179,174	87.7%	94,806	37,022	-60.9%

Source: Mexican Auto Industry Association (AMIA), Instituto Nacional de Estadística y Geografía (INEGI)

Appendix V. Vehicle export by destination

Vehicle export by destination

	2014	2015	2016	2017	2018	2019	Market Share
U.S.	1,875,575	1,993,162	2,133,724	2,335,245	2,566,701	2,642,354	79.3%
Canada	267,371	290,340	246,324	258,753	248,557	218,763	6.6%
Latin America	249,705	225,538	202,306	239,619	287,568	203,954	6.1%
Europe	98,184	145,263	115,739	168,128	248,837	202,068	6.1%
Asia	127,171	79,902	28,214	19,946	38,520	25,737	0.8%
Africa	1,954	2,319	402	21,326	30,463	32,616	1.0%
Others	22,927	22,372	41,559	58,587	28,555	8,094	0.2%
Total	2,642,887	2,758,896	2,768,268	3,102,604	3,449,201	3,333,586	100%

Source: Mexican Auto Industry Association (AMIA), Instituto Nacional de Estadística y Geografía (INEGI)

(Note) Asia includes Oceania, and Africa includes the Middle East.

Appendix VI. Mexican light vehicle production forecast

(LMC Automotive, May 2020)

Sales Group	Global Make	2017	2018	2019	2020	2021	2022	2023
Total		3,903,846	3,916,738	3,762,838	2,899,441	3,318,996	3,674,573	3,854,740
General Motors Group	Chevrolet	615,751	584,698	632,027	541,159	549,208	621,253	635,819
	GMC	195,109	248,658	232,767	189,237	212,581	216,071	214,702
General Motors Group sub-total		810,860	833,356	864,794	730,396	761,789	837,324	850,521
Renault-Nissan-Mitsubishi	Nissan	821,259	732,646	625,230	506,353	588,551	594,696	627,168
	Infiniti	931	39,431	30,294	22,085	21,436	23,970	22,089
	Mitsubishi	0	0	0	0	0	0	1,681
	Renault	1,220	671	480	65	0	0	0
Renault-Nissan-Mitsubishi sub-total		823,410	772,748	656,004	528,503	609,987	618,939	650,938
Volkswagen Group	Volkswagen	461,248	435,373	442,924	291,019	318,507	349,089	355,217

	Audi	158,543	173,659	157,218	114,646	139,206	175,135	173,530
Volkswagen Group sub-total		619,791	609,032	600,142	405,665	457,713	524,224	528,747
Fiat Chrysler Automobiles	Ram	268,060	205,811	195,699	158,972	187,604	196,681	195,552
	Jeep	182,386	253,422	195,689	123,619	146,925	159,842	161,710
	Fiat	58,386	63,781	65,601	46,323	51,484	50,040	50,144
	Dodge	102,760	106,684	69,395	36,980	0	0	0
Fiat Chrysler Automobiles sub-total		611,592	629,698	526,384	365,894	386,013	406,563	407,406
Toyota Group	Toyota	148,642	190,019	192,952	160,216	194,187	264,805	382,022
Ford Group	Ford	272,706	246,831	219,954	104,405	225,231	301,511	351,900
	Lincoln	39,087	33,677	29,670	9,000	0	0	0
Ford Group sub-total		311,793	280,508	249,624	113,405	225,231	301,511	351,900
Hyundai Group	Kia	206,420	237,626	242,717	189,243	193,819	189,559	186,322
	Hyundai	15,080	56,974	43,883	34,012	31,869	30,049	2,076
Hyundai Group sub-total		221,500	294,600	286,600	223,255	225,688	219,608	188,398
Honda Group	Honda	213,449	147,521	204,417	136,442	145,797	171,513	173,744
Mazda Motors	Mazda	141,774	149,589	91,830	119,737	151,904	147,996	143,923
BMW Group	BMW	0	0	25,485	41,391	93,604	111,705	107,437
Daimler Group	Mercedes-Benz	0	6,713	60,087	70,806	61,993	66,332	65,796
Jianghuai Automotive	JAC	1,035	2,954	4,519	3,731	5,090	4,053	3,908

Source: LMC Automotive "Global Automotive Production Forecast (May 2020)"

Note: 1. Data indicate the number of units for only small-size vehicles, including passenger cars and light commercial vehicles with a gross vehicle weight of under 6 tons.

Appendix VII. Business enterprise R&D expenditure by industry

In million US\$ (2015 exchange rate)

Mexico

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total expenditure	3223.756	3340.975	3285.628	2333.456	2270.248	1676.709	1781.661	1976.789	1729.49
Total Manufacturing	2385.668	1786.956	1927.156	1057.831	1224.158	1014.147	1103.457	1214.766	1062.797
Manufacture of fabricated metal products, computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transport equipment	1200.864	798.272	829.377	623.038	721.895	608.452	666.824	740.318	647.703

US

Business enterprise R&D expenditure by industry in million US\$ (2015 exchange rate)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total expenditure	311 265.679	303 958.532	313 870.546	316 508.14	331 916.701	344 276.142	355 821	370 845.716	388 680.031
Total Manufacturing	15 096.089	214 325.865	214 903.116	218 245.908	227 923.105	235 239.399	236 132	247 985.659	249 884.4
Manufacture of fabricated metal products, computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transport equipment	131 479.942	128 312.673	132 061.877	132 517.253	136 022.578	140 710.172	141 406	146 735.876	147 233.687

Germany

Business enterprise R&D expenditure by industry in million US\$ (2015 exchange rate)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total expenditure	63 496.55	65 393.679	70 420.171	73 067.776	71 358.665	74 540.535	78 353.212	79 822.702	86 490.904
Total Manufacturing	54 291.339	56 073.801	60 295.269	62 938.555	61 344.164	64 713.528	66 733.664	67 794.664	73 547.816
Manufacture of fabricated metal products, computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transport equipment	39 599.969	41 768.96	45 094.267	47 683.732	46 370.437	49 468.398	50 838.575	51 260.034	57 714.292

Appendix VIII. Legal Framework

Supplying a Growing Industry: A simple Guide for the Automotive and Auto Parts Industry in Mexico

The 2008 and 2009 economic crisis that severely affected the global economy also took a hard hit on the automotive industry worldwide. In the aftermath of the crisis, and in an effort to reach better competitiveness conditions, the automotive industry has placed its eyes on Mexico as a viable option to improve the efficiency of its operations.

Because of the well known advantage that Mexico offers for its vicinity with the United States of America and the well structured chain of Free Trade Agreements that Mexico has with a number of countries in the Americas and Europe, leaders of the automotive industry seem to agree that Mexico is a great location to increase their manufacturing production or to begin new ones.

Therefore, it is vital for automotive manufacturing companies (Original Equipment Manufacturers "OEMs"), and their parts and component suppliers to understand the legal framework that Mexico has adopted to host this industry.

In the early 2000s Mexico dramatically changed its policy towards the operation of the OEMs and the auto parts industry. The new policy deregulated the industry and has focused on manufacturing and investment levels.

The change in policy derives from Mexico's implementation of several obligations from the Free Trade Agreements under the World Trade Organization's Agreement on Trade Related Aspects of Investment Measures.

On December 31, 2003 (in force January 1, 2004 and amended on November 30, 2009¹), the Mexican government published in the Official Federal Gazette, the Decree for the Support of the Competitiveness of the Automotive Industry and the Promotion for the Development of the Domestic Automotive Market (the "New Auto Decree").

The New Auto Decree, which repeals the Decree for the Development and Modernization of the Automotive Industry² effective as of December 11, 1989 (the "Former Auto Decree"³), is a recognition by Mexico that the automotive sector is prepared to open and deregulate an industry

¹ The New Auto Decree was implemented through the Rules for the Implementation of the New Auto Decree, published in the Official Federal Gazette on April 15, 2009.

² The Former Auto Decree was implemented through the *Resolution Establishing the Rules for the Implementation of the Auto Decree*, published in the Official Federal Gazette, which has been also repealed.

³ As amended on June 8, 1990; May 31, 1995 and February 12, 1998 respectively.

that does not solely depend on domestic consumption, considering that 2.93 million vehicles were produced in Mexico during 2013, and 2.42 million vehicles were exported in 2013.

This guide contains the main issues that must be considered by the participants in the automotive and auto parts industry when doing business in Mexico, but keeping an eye on the North, Central and South American markets.

The Automotive Industry has become a strategic sector for the Mexican Government with the announcement of new plants and many others to come to Mexico. The new plant projects will bring micro-cities full of tiers and after-markets with other related services and contribute to the growth of this sector in Mexico.

The Auto Decree

What are the main differences between the New Auto Decree and the Former Auto Decree?

In essence, the changes evolve around policy and legal framework. The provisions of the Former Auto Decree focused more on developing the domestic automotive and auto parts industry to ensure its competitiveness and efficiency, by imposing on OEMs export, national content and favorable foreign exchange balance requirements. In contrast, the New Auto Decree focuses more on manufacturing and investment levels.

The New Auto Decree does not set forth any export, national content or favorable foreign exchange balance requirement, and does not establish any auto parts supplier or national supplier registry requirement. The only additional registry that the New Auto Decree provides is the "new automotive production company registry" (the "Company Registry"). For an OEM to be registered before the Company Registry, six requirements must be met:

- The OEM must manufacture new vehicles⁴.
- The OEM must have manufactured at least, 50,000 units in Mexico in the preceding year⁵.

⁴ Under the New Auto Decree, vehicle is defined by paragraph I of Article 3 as:

Those classified under headings 8702, 8703 (except subheading 8703.10), and 8704 of the General Import and Export Duties Law;

Those with a gross vehicle weight equal or lesser to 8,864 kilograms, and;

Those that have the characteristics that allows them to be identified as vehicles that are destined for the transportation of persons or goods mainly on paved urban roads or highways.

Excluded are those vehicles that: may be driven in paved delimitating roads, such as race-tracks, airports, go-karts race-tracks and alike; for agricultural purposes; mountain or desert terrain; in beaches; in train tracks; or other similar transportation.

⁵ On 2012 there was a proposal to amend the number of units that should be assembled in Mexico to access the New Auto Decree benefits, raising the requirement from 50,000 to 100,000 units. However, on

- At least 100 million U.S. dollars must be invested in fixed assets to produce vehicles.
- The OEM must have their own trademarks or evidence that the company has the authorization to use a trademark by its owner.
- The OEM must declare, under oath, that the company has domestic or international agreements to supply parts contained in the vehicle that was manufactured in Mexico.
- The OEM must comply with the Mexican Official Standards on air emissions.

The New Auto Decree provides that the Ministry of Economy may condition the registration of a company if requirements 2 and 3 above are not met.

Among the benefits that the New Auto Decree grants to OEM's are:

- Importation of goods without the payment of import duties when the goods enter into Mexican territory through the recognition of them as "manufacturing companies" for the purposes of an "automotive bonded warehouse", pursuant to the Customs Law and for all other purposes of the Customs Law;
- Reduction and/or elimination of duties for parts and components through the automatic recognition of OEMs as manufacturing companies for the purposes of the Sectorial Promotion Programs of the Automotive and Auto Parts Industry (PROSEC);
- The right to offer their vehicles in governmental bids as domestic vehicles, regardless of their country of origin; and
- The right to import duty free, based on the company's import-quota. The import-quota is equivalent to 10% of the vehicles that the company has manufactured in Mexico, considering the company's data from October 1 through September 30 of each year. The Ministry of Economy may authorize an increase of such import-quota conditioned to the investment and technological development commitments of the OEM.

The registry must be renewed on a yearly basis between November 1 and December 1.

Foreign Investment, Automotive Industry and Maquiladoras

Can foreign investors participate as OEMs in the Mexican market?

Yes. The Mexican Foreign Investment Law does not have any restriction as to the participation of foreign capital in this industrial sector.

Can foreign investors participate as suppliers of an OEM?

January 10, 2013, after reviewing the possible adverse macroeconomic and financial effects of the new requirement, the proposal was repealed.

Yes. The most common vehicle for their participation is through a Mexican subsidiary. There are no registrations required to become a supplier of an OEM.

Can an OEM operate as a maquiladora?

Yes. It should be noted, however, that all requirements of eligibility and operation under the Decree for the Promotion of the Manufacturing, Maquiladora and Services Export Industry (the "Maquiladora Decree") must be met. This requirement includes some exportation thresholds⁶. The New Auto Decree does not establish any provision imposing an OEM the obligation to operate under the terms of such decree. Therefore, any interested OEM may evaluate the differences that either alternative offer for the business model the OEM elects for its Mexican operations.

It is important to keep in mind that companies operating under the Maquiladora Decree enjoy (and have enjoyed for a number of years) a series of administrative, duty and tax benefits that are not currently offered by Mexico to other type of companies, including companies operating under the New Auto Decree⁷.

Any OEM investor interested in manufacturing in Mexico should consider the benefits (and the possible limitations) that the Maquiladora Decree offers to its project.

Moreover, it should be noted that in order for maquiladora companies to have access to the special tax benefits under Mexican tax legislation, the maquiladoras shall comply with the following, among other important requirements:

- Export (physically or virtually to another maquiladora or OEM) the entirety of their production;
- To limit their income to productive activities (which implies that they should have separate entities for domestic commercialization and for production)
- To utilize materials, machinery and equipment owned by their foreign principal
- The foreign principal of the maquiladora company shall be a tax resident of a country with which Mexico entered a tax treaty

The main benefits of a manufacturing operation that meets the applicable conditions to be deemed to have a *maquila operation* for income tax purposes (including the above), may enjoy the following benefits:

⁶ To export more than US\$ 500,000.00 or export more than 10% of the total invoicing of the company.

⁷ Please note that maquiladora companies are entitled to the following customs benefits also granted to companies of the New Auto Decree: i) temporary importation of materials without the payment, or with the deferral of the obligation to pay import duties; and, ii) reduction or elimination of duties for parts and components under the terms of the Sectorial Promotion Program of the Automotive and Auto Parts Industry (PROSEC). These are two of the same benefits of the New Auto Decree.

- Statutory exemption of the foreign principal from a permanent establishment exposure in Mexico for manufacturing activities
- Additional tax deduction equivalent to 47% of the fringe benefits paid to employees
- Assessment of taxable profit under special transfer pricing rules issued for maquiladora companies

Can a supplier of an OEM operate as a maquiladora?

Yes. By operating as a maquiladora, the supplier of the OEM is entitled to conduct the temporary importation of materials, machinery and equipment that would enable a company to set up an efficient manufacturing operation in Mexico. Maquiladoras have a preferential treatment that offers important duty and tax benefits.

Can an OEM operate as a maquiladora without Company Registry under the New Auto Decree?

Yes, if a company cannot meet the Company Registry requirements of the New Auto Decree, it may continue to operate as a maquiladora.

If an OEM operates without a Company Registry, the importation of vehicles will be subject to the payment of the applicable import duties in Mexico for foreign vehicles (at the general import duty rates). However, if the foreign vehicles qualify as originating from any of Mexico's free trade agreements, the import duties for new vehicles would be assessed or exempt, as the case may be, under the terms of the corresponding free trade agreement, and provided that the corresponding certificate of origin is issued for such vehicles.

Customs Transfers of Goods

How can a maquiladora company deliver goods to OEMs?

The delivery of goods to the OEMs can be made through the "transfer" called virtual import-export declarations "*pedimentos*" or "Transfer of Goods Certificates" ("Transfer Certificates"). The use of virtual import-export *pedimentos* and Transfer Certificates are regulated under the Foreign General Trade Rules.⁸

In principle, Transfer Certificates are available for transfers by maquiladoras to OEMs when the transfer is based on a sale of the transferred goods by the maquiladora to the OEM. Historically, maquiladoras did not sell the goods to the OEMs (the sale was made by the parent company of the maquiladora) and the transfer may be documented with virtual import-export *pedimentos*.

It is very important for an auto parts supplier to properly analyze and structure its transactions with the OEMs from customs and tax perspectives, considering that the transfer regulations benefit the OEMs.

⁸ Published on a yearly basis by the Ministry of Tax and Public Finance.

What are the differences between virtual import-export pedimentos and Transfer Certificates?

The main difference resides in the party responsible for paying the duties and value added tax on the transferred goods.

Transfer Certificates are used to formalize the transfer of goods from the maquiladora to the OEMs. The maquiladora company assumes the liability of changing the customs regime (i.e. paying the applicable import duties, value added tax and complying with tariff and non-tariff requirements) of the transferred goods that the OEM includes in vehicles that are destined for the domestic market. In contrast, when virtual import-export declarations are used, the OEM assumes the liability of paying any applicable duties and taxes.

Environmental Concerns

What environmental permits are required to begin operating an automotive or auto parts manufacturing plant?

An environmental impact authorization must be secured prior to initiating operations. As a general rule, the automotive and auto parts industry is not subject to federal jurisdiction in the area of environmental impact. This means that State environmental authorities are entrusted with issuing such authorization. Nevertheless, if a facility uses certain hazardous chemicals in its process, in quantities exceeding maximum threshold limits, that facility may be deemed high-risk and will be subject to federal jurisdiction in the area of environmental impact. Also, high-risk facilities must submit a risk study and an accident-prevention plan.

What are the general licensing and compliance requirements in the area of wastewater and water-quality?

Facilities that discharge process wastewater must secure a wastewater discharge permit. If wastewater is discharged into a federal water system (such as a river, lake, lagoon or waterway) the permit must be secured from the National Water Commission (CONAGUA). If wastewater is discharged into a municipal or urban sewer system, the permit must be obtained from the Municipal water authority. Wastewater must not exceed the maximum allowable pollutant limits specified under applicable water-quality standards.

What are the general licensing and compliance requirements in the area of air emissions?

The automotive and auto parts industry is considered to be a federally regulated stationary source of air emissions.

Automotive and auto parts manufacturing facilities must secure a Consolidated License from the Ministry of Environment and Natural Resources (SEMARNAT). In addition, their air emissions must not surpass the maximum allowable limits established by applicable air-quality standards. Air pollution control equipment must be installed to prevent air emissions from exceeding the established limits. Also, new car and truck coating operations must comply with Mexican Official Standard NOM-121-SEMARNAT-1997 that establishes maximum allowable limits for volatile organic compound (VOC) emissions.

What are the general permit and compliance requirements in the area of hazardous waste handling and disposal?

Hazardous waste is any waste that is discarded by its owner, producer or generator and that is corrosive, reactive, explosive, toxic, flammable or bio-infectious. Hazardous waste generators must record their waste stream before SEMARNAT or before the local authorities, depending on the yearly quantity of waste they generate. Hazardous waste must be handled, contained and stored in accordance with the Federal Environmental Law.

Hazardous waste generators must dispose of their hazardous waste through licensed transportation and disposal carriers. Transportation and disposal records must be filed-out each time hazardous waste is shipped to a final disposal site. Generators must keep signed records for at least 5 years. In addition, hazardous waste generated from raw materials imported into Mexico on a temporary basis must be exported to their country of origin, unless such waste may be recycled in Mexico.

What other issues do automotive and auto parts industry companies need to be aware of in the area of environmental compliance?

Mexican Law requires any owner or occupier of land that is contaminated with a hazardous waste, to remediate the situation regardless of fault. Owners or occupiers are jointly liable for remediation even if none of them caused soil or groundwater pollution. Therefore, it is advisable for any company wishing to acquire or lease land, to do an environmental assessment and find out what type of environmental liability there may be.

Labor Matters

What types of unions are common in the automotive and auto parts industry in Mexico?

Although under the Mexican Federal Labor Law there are several types of unions, two of them are more common in the automotive and auto parts industry: the national industrial unions and the company unions. In general terms, both models have proved to be efficient and active and although similar, advantages and disadvantages must be considered.

A national industrial union allows a better control of the labor relationships, due to the fact that it includes a better-organized structure, whereas the company union is composed exclusively by employees of the same company. Notwithstanding the foregoing, this fact can also be viewed as an advantage, as company unions create a closer action from the union, vis-à-vis the company's needs, since it is its central obligation.

The decision for a company to orient its employees towards an affiliation with a national industrial union or a company union depends on its particular characteristics and an accurate analysis should be conducted before making such decision. Additionally, from a practical standpoint, it is relevant to mention that there are also several labor organizations that operate as such, in search of creating a hostile labor environment, while allegedly defending the employees' rights. The Mexican authorities do not recognize such types of organizations, as their composition does not fulfill the legal requirements.

Is it compulsory in Mexico to enter into a collective bargaining agreement (“CBA”)?

No it is not; however, it is an employees' right. If the employees decide to adhere to a union, the company cannot refuse such a request; otherwise, employees are entitled to file a strike notice. Therefore, it has become a common practice for certain hostile unions in some regions of the country to put pressure on employees in search of their support to have CBA's entered into. For this reason, in many cases companies decide to anticipate the hostile unions' search by approaching a so-called friendly or “white” union, in order to establish an amicable union relationship. This has been carried out through so-called administrative CBA's, where in many cases unions exercise a negotiated degree of pressure on companies, which allows companies to operate.

Is there a Contrato-Ley (a binding collective bargaining agreement) applicable to the automobile and auto parts industry in Mexico?

No, there is not a Contrato-Ley currently in force specifically for the automotive and auto parts industry. However, there is one regarding the rubber industry, which is related to the automotive and auto parts industry for certain components of vehicles. In addition, it is relevant to mention that the automotive and auto parts industry is included within the sectors of industry considered by the Mexican Constitution as being under federal jurisdiction. This means that all claims, registrations and other related matters in the automotive and auto parts industry are subject exclusively to the federal authorities. A proper degree of practice before such authorities is relevant to identify the criteria used in different cases. This is particularly true for litigation before Federal Conciliation and Arbitration Labor Boards, where a specific criterion has been approved by the Boards' assembly for many aspects of procedure. The same circumstance applies regarding the Labor Inspection and other areas of the Ministry of Labor. As the automotive sector has its own particularities, it has become very important to the Automobile Practice Group to establish a constant lobbying with those authorities.

How can the labor culture in Mexico benefit the new automotive and auto parts investment?

There is currently a process that focuses on better labor relationships between unions and employers, in order to assure the permanence and development of foreign and Mexican workplaces. This process has been called “the New Labor Culture in Mexico”, and has as its major goals the following:

- The constant training of workers and entrepreneurs as a permanent and systematic process.
- The management of a better forecasting capacity and adaptation to the change in the companies.
- To generate a national culture of productivity and quality that helps the preservation and promotion of the sources of employees.
- To promote qualification programs on the values of quality, productivity, respect, justice, equity and the recognition of the work as a route for the personal and collective progress.

This new labor culture will certainly allow companies to develop the investments in a proper labor environment in Mexico.

How risky does the Social Security Legislation consider the production activities related to the automotive and auto parts industry?

They are considered to be regular-risk. The Activity Catalog of the Social Security Law referring to the Regulation for the Company Classification in the Work Risks Insurance includes 6 sections for activities linked to the production of automobiles or their parts. The activities in each section are initially classified in five classes, where 5 is for the highest risk, and 1 the lowest. Three sections are classified in class 4, two sections in class 3 and one section in class 2. Although at the beginning the Regulation treats any automotive workplace equally, those who are certified and keep a low-risk record year by year have the chance to considerably reduce their work risk insurance expenses.

As an example, a company that is classified in class 4 can be paying the least work risk contributions possible, saving around 20% of the total social security contribution expense, after four years of strictly following safety procedures and avoiding serious injury accidents.

Is there any chance for the automotive and auto parts industry companies in Mexico to join together and provide high-quality medical services of their own to their employees?

Yes. The Mexican Social Security Institute ("IMSS") is empowered by the Law to execute agreements with private entities that have the sufficient and certified means to provide medical and even nursing services to their employees. By this process, the company is able to get more involved in seeking the employees' quality of life improvement. Companies under the described scheme have to pay the contributions as usual, but at the end of the fiscal year they will get a high percentage of contributions back from the IMSS. Please note that the agreement with the IMSS implies a series of requirements; therefore, it is advisable that companies gather in chambers or associations that can strengthen their interests and that of their employees', in order to appear with an important and viable proposal.

Value Added Tax Considerations

Is Value Added Tax paid upon temporary importation of auto parts or assembled vehicles into Mexico?

Yes. As of January of 2015, the importation of parts or vehicles into Mexico by OEMs operating through an automotive bonded warehouse or through a maquiladora authorization will be subject to the payment of value added tax. However, such companies may apply for a certification to obtain an advanced credit of value added tax to be applied against their payment obligation, mitigating the possible financial cost of paying value added tax upon importation.

What are the Value Added Tax consequences and differences when using virtual import-export pedimentos and Transfer Certificates?

Value added tax is triggered for the following events: i) importation; ii) rendering of services; iii) sale of goods; and, iv) lease of goods. Value added tax rate is 16% nationwide, although exportation of goods or services will be subject to a 0% rate.

Now, as mentioned previously in this guide, the difference between using virtual import-export *pedimentos* or Transfer Certificates resides in the party responsible to pay the value added tax on the transfer of goods.

When using the Transfer Certificates, the value added tax will be triggered at the 16% rate basically because the Mexican entity of the auto parts company will be required to sell the goods to the OEM (shifting value added tax at the regular rate).

Moreover, the goods that remain in Mexico will be subject to value added tax upon the change of their customs regime to a permanent importation. Value added tax would be paid at the regular 16% rate for such importation. Please note that in order to apply the 0% value added tax rate, when using virtual import-export *pedimentos*, the maquiladoras must comply with procedural requirements established by the administrative rules.

A 0% value added tax rate will be applicable if the goods are exported, physically or virtually. Therefore, when import-export *pedimentos* are used, administrative rules provide a 0% value added tax rate on such sales (due to a virtual exportation of goods). The Customs Law considers such transfers as exports. However, please note that in the event the goods remain in Mexico, the OEM will be subject to value added tax at the 16% rate upon the change of the customs regime of the goods (parts of vehicles) to a permanent importation.

Real Estate Matters

Can foreign entities directly investing in the automotive and auto parts industry own real property in Mexico for the establishment of their operations?

Yes, with certain exceptions:

- The Mexican Foreign Investment Law imposes special restrictions on foreign direct ownership on a strip of land located within 50 kilometers of the coastline and within 100 kilometers of borders (the so-called “Restricted Zone”). In this area, foreign investors can only own nonresidential real estate through wholly owned Mexican corporations. Also, indirect ownership in the Restricted Zone is permitted for residential purposes through real estate trusts, incorporated with Mexican banking institutions acting as trustees, where the foreign investors act as beneficiaries of the trusts; and
- Mexican law permits the acquisition by foreign investors of title over land located outside of the Restricted Zone by entering into an agreement with the Ministry of Foreign Affairs containing the so called “Calvo Clause”.⁹

Are industrial facilities and/or industrial space readily available for automotive and auto parts industry companies in Mexico?

⁹ A foreigner must agree to consider itself as Mexican, for property ownership purposes, and not to seek the protection of its government, and under such circumstances it must agree to forfeit its property rights for the benefit of the Mexican State.

Yes, but certain considerations have to be taken into account: there is considerably more “ready to occupy” space available for the OEMs than for larger car assembly operations, since the latter require considerably larger expanses of land and manufacturing space. Nevertheless, there is plenty of greenfield/greenbelt zoned for industrial purposes and a large number of industrial parks strategically located all over the major cities in Mexico available to the automotive and auto parts industry companies. However, different considerations have to be made when moving into a greenfield (i.e. legal title to the property, availability of utilities, road access, etc.). Typically, developers that own these parks and vacant land would also own a construction company or have a strategic alliance with one, therefore offering a wide variety of products and services, from greenfield projects to spec buildings, built-to-suit facilities for sale and/or lease in different modalities, and utility installation, among others.

Are infrastructure services readily available for automotive and auto parts industry companies in Mexico?


Typically, industrial parks will have installed their own infrastructure (i.e. power, gas, water, sewerage, telephone, etc.) readily available for connection with the end user having only to execute a service contract with the corresponding service provider and pay connection and/or capacity fees. Nevertheless, considering the special needs of gas and electricity that the companies of the industry require, special arrangements have to be made in certain cases in order to procure the services in the desired capacity. For instance, a special infrastructure and/or capacity fee has to be paid to the Federal Electricity Commission. Some States offer to pay for this fee as an incentive for the industry. Also, a permit may be obtained from the Energy Regulatory Commission in order to install a natural gas pipeline for self-supply, thus allowing the companies (shareholders and partners of the self-supply permit holder) to have gas supplied at better prices from PEMEX or other entities and therefore implementing hedging mechanisms.

Also, a permit may be obtained from the Energy Regulatory Commission in order to incorporate an entity that generates electric energy for self-supply, thus allowing the companies (shareholders and partners of the self-supply permit holder) to have a more cost-efficient power supply than if contracted from the Federal Electricity Commission. In addition, under Mexican law it is permitted to build an emergency plant within the company’s industrial complex in order to avoid interruptions in the production line. This emergency plant would have to comply with certain regulations.

Please note however that Mexico is under an ongoing energy reform which will open the power generation sector to full private participation and investment. The amendments to the Mexican Constitution remove the classification of power generation as a public service activity that is reserved exclusively to the Mexican State, thus, permitting private investment and competition in power generation.

This change represents a fundamental separation from the previous model under which private parties could only participate in limited power generation activities (such as through self-supply permits or cogeneration permits). Nonetheless, power transmission and distribution, as well as the planning and control of the national electric grid, will remain reserved exclusively to the Mexican state.

Power generation would be restructured with the initiative of a new Power Industry Law (Ley de la Industria Eléctrica) that will implement the full liberalization of the power generation industry.

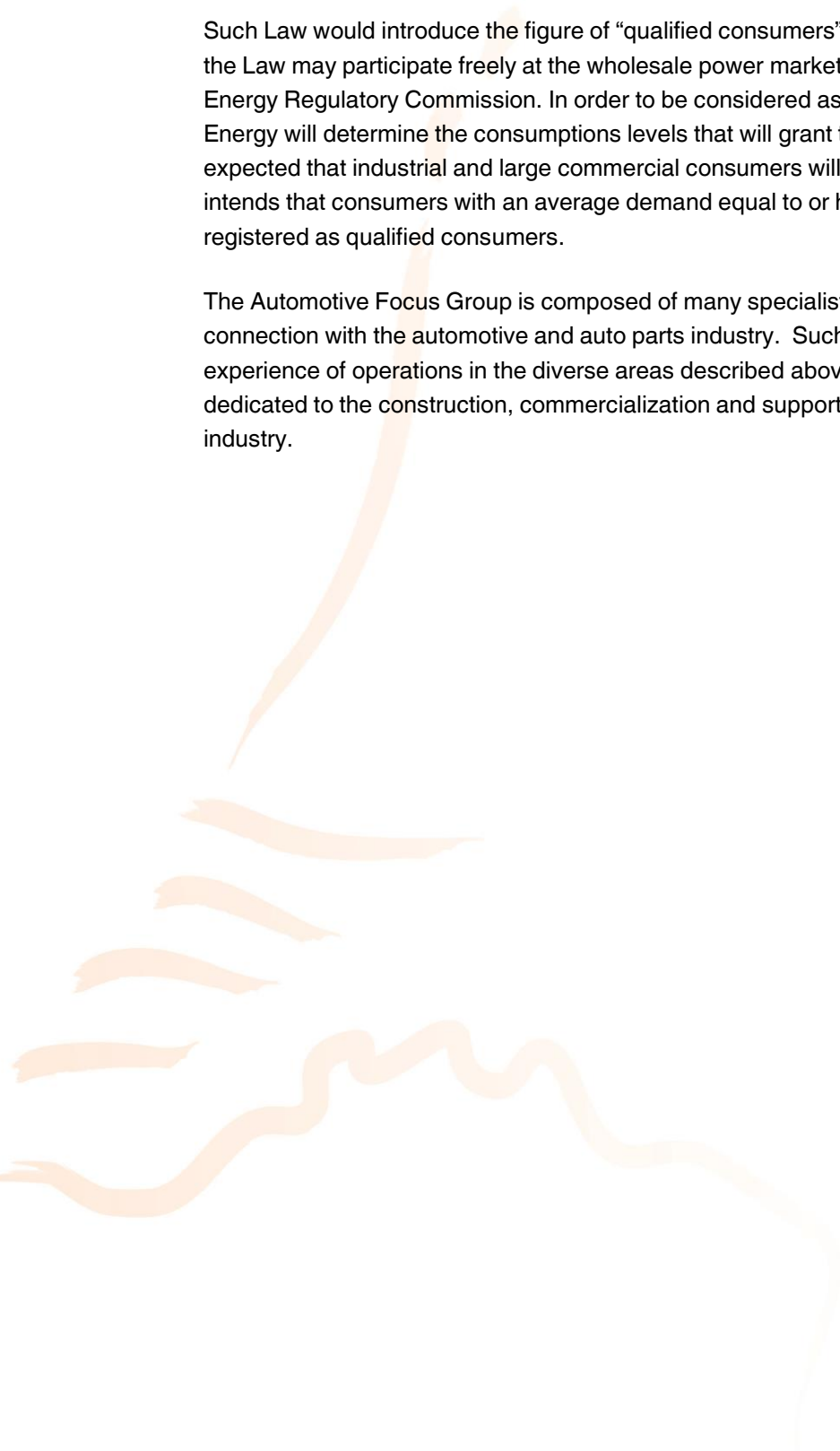


Currently, the generation of power is dominated by the Federal Electricity Commission (“CFE”), with roughly 80% of Mexico’s generating capacity consisting of plants built with state funds, and the CFE maintains exclusive control over the transmission and distribution of power. With these reforms, private parties will be allowed to build, operate, finance and extend transmission and distribution infrastructure as well as power generating plants. The CFE will no longer operate as a monopoly in the power industry as a result of this restructuring.

If such law is approved in the proposed terms, a wholesale power market will be created, much like other markets currently existing in other countries. In essence, competing generators will offer their output through this wholesale market to different categories of retailers, which will then sell it directly to the public (basic consumer), or to qualified consumers.

Such Law would introduce the figure of “qualified consumers”, which pursuant to the initiative of the Law may participate freely at the wholesale power market and shall be registered before the Energy Regulatory Commission. In order to be considered as qualified consumers, the Ministry of Energy will determine the consumptions levels that will grant this characteristic; therefore, it is expected that industrial and large commercial consumers will receive this qualification. This Law intends that consumers with an average demand equal to or higher than 5 MW per year, might be registered as qualified consumers.

The Automotive Focus Group is composed of many specialists with significantly high profiles in connection with the automotive and auto parts industry. Such specialists have extensive experience of operations in the diverse areas described above, representing companies dedicated to the construction, commercialization and support to the automotive and auto parts industry.



Appendix IX. 2020 Vehicle Autonomous Vehicles Readiness

KPMG

Assessing the preparedness of 30 countries and jurisdictions in the race for autonomous vehicles.

To read the full report: <https://home.kpmg/xx/en/home/insights/2020/06/autonomous-vehicles-readiness-index.html>

Appendix X. Cultural Differences When Conducting Business with Mexico

Cultural differences when doing business in Mexico

You will meet with different cultures when you start doing business abroad. You'll be more likely to succeed if you're aware of these differences.

Being familiar with local customs will help you deal successfully with foreign business partners. Holland House Mexico can give you tips and advice. We know the local business culture and can work with language and cultural barriers. According to Geert Hofstede's cultural dimensions, Mexican culture can be understood in the following manner.

POWER DISTANCE

This dimension deals with the fact that all individuals in societies are not equal – it expresses the attitude of the culture towards these inequalities amongst us. Power Distance is defined as *the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally*.

At a score of 81, Mexico is a hierarchical society. This means that people accept a hierarchical order in which everybody has a place and which needs no further justification. Hierarchy in an organization is seen as reflecting inherent inequalities, centralization is popular, subordinates expect to be told what to do and the ideal boss is a benevolent autocrat

INDIVIDUALISM

The fundamental issue addressed by this dimension is *the degree of interdependence a society maintains among its members*. It has to do with whether people's self-image is defined in terms of "I" or "We". In Individualist societies people are supposed to look after themselves and their direct family only. In Collectivist societies people belong to 'in groups' that take care of them in exchange for loyalty.

Mexico, with a score of 30 is considered a collectivistic society. This is manifest in a close long-term commitment to the member 'group', be that a family, extended family, or extended

relationships. Loyalty in a collectivist culture is paramount, and over-rides most other societal rules and regulations. The society fosters strong relationships where everyone takes responsibility for fellow members of their group. In collectivist societies offence leads to shame and loss of face, employer/employee relationships are perceived in moral terms (like a family link), hiring and promotion decisions take account of the employee's in-group, management is the management of groups.

MASCULINITY

A high score (Masculine) on this dimension indicates that the society will be driven by competition, achievement and success, with success being defined by the winner/best in field – a value system that starts in school and continues throughout organizational life.

A low score (Feminine) on the dimension means that the dominant values in society are caring for others and quality of life. A Feminine society is one where quality of life is the sign of success and standing out from the crowd is not admirable. *The fundamental issue here is what motivates people, wanting to be the best (Masculine) or liking what you do (Feminine).*

Mexico scores 69 on this dimension and is thus a Masculine society. In Masculine countries people "live in order to work", managers are expected to be decisive and assertive, the emphasis is on equity, competition and performance and conflicts are resolved by fighting them out.

UNCERTAINTY AVOIDANCE

The dimension Uncertainty Avoidance has to do with the way that a society deals with the fact that the future can never be known: should we try to control the future or just let it happen? This ambiguity brings with it anxiety and different cultures have learnt to deal with this anxiety in different ways. *The extent to which the members of a culture feel threatened by ambiguous or unknown situations and have created beliefs and institutions that try to avoid these* is reflected in the score on Uncertainty Avoidance.

Mexico scores 82 on this dimension and thus has a very high preference for avoiding uncertainty. Countries exhibiting high Uncertainty Avoidance maintain rigid codes of belief and behavior and are intolerant of unorthodox behavior and ideas. In these cultures there is an emotional need for rules (even if the rules never seem to work) time is money, people have an inner urge to be busy and work hard, precision and punctuality are the norm, innovation may be resisted, security is an important element in individual motivation.

LONG TERM ORIENTATION

This dimension describes *how every society has to maintain some links with its own past while dealing with the challenges of the present and future*, and societies prioritize these two existential goals differently. Normative societies, which score low on this dimension, for example, prefer to maintain time-honored traditions and norms while viewing societal change with suspicion. Those with a culture which scores high, on the other hand, take a more pragmatic approach: they encourage thrift and efforts in modern education as a way to prepare for the future.

The relatively low score of 24 means that the Mexican culture is normative. People in such societies have a strong concern with establishing the absolute Truth; they are normative in their thinking. They exhibit great respect for traditions, a relatively small propensity to save for the future, and a focus on achieving quick results.

INDULGENCE

One challenge that confronts humanity, now and in the past, is the degree to which small children are socialized. Without socialization we do not become “human”. This dimension is defined as *the extent to which people try to control their desires and impulses*, based on the way they were raised. Relatively weak control is called “Indulgence” and relatively strong control is called “Restraint”. Cultures can, therefore, be described as Indulgent or Restrained.

With a very high score of 97, Mexican culture has a definite tendency toward Indulgence. People in societies classified by a high score in Indulgence generally exhibit a willingness to realize their impulses and desires with regard to enjoying life and having fun. They possess a positive attitude and have a tendency towards optimism. In addition, they place a higher degree of importance on leisure time, act as they please and spend money as they wish.

Do's-and-don'ts in Mexico


You'll notice that doing business in Mexico takes more time than in The Netherlands. Mexican culture will focus on first establishing a solid personal relationship, before venturing into business. Furthermore, processes will take longer to finish, especially when dealing with governmental entities. Patience is the way to go.

Language

The official language in Mexico is Spanish, which is spoken in different dialects across the country. A great number of indigenous languages prevail. It is not uncommon for businessmen not to speak English. Most government officials also do not speak English. In the north of the country there are more English-speaking Mexicans. Their subculture is also more direct than other parts of the country.

Business meetings

The communication style in business is diplomatic and indirect. Although infamous for always being late, it is very important to be on time for a business meeting. Failing to do so will be interpreted as a lack of interest in the counterpart. Generally, a Mexican will not answer you with a clear “no”. This in no way means that your counterpart is saying “yes” to your ideas. The Mexican businessman tends to take their time to take decisions. It is also common that certain opinions get expressed multiple times, as if they were being highlighted. This should give you a better understanding of what your counterpart is really thinking. It could happen that you assume a deal is coming through, but no action is taken by your Mexican partner, hence silently indicating they were not (entirely) on board with the project. It can be difficult for the Dutch to interpret the opinion of the Mexican counterpart. Try asking additional questions to ensure that your proposal is fully



understood and try to establish the reasons why your proposal may be rejected. Agreements with large international corporations are generally strictly honoured.

Communication

Mexico is a culture with high power distance, hence status is important to acknowledge in everyday encounters. Status is based on family background and professional achievements. As in many Spanish speaking countries, it is custom that people have two last names; from the father and the mother. Make sure to address people stating their professional position (Licenciado, Doctor, Maestro etc.) followed by their two last names. In case a professional position is not clear, address people with Señor, Señora, Señorita, etc.

Due to the hierarchical structure of Mexican culture, employees are unlikely to give critical feedback, particularly to those in higher positions. It is common to ask for permission before starting new tasks and projects. During business communications, make sure you are directing your efforts towards people that have the power to take decisions.

Closing the deal

Coming to Mexico, your goal is probably to establish successful business relationships. However, the average Mexican will take business decisions based on the personal relationship you have built. If you have transmitted to be trustworthy and have treated your Mexican counterpart with care and attention, you are likely to have established a solid basis for successful business.

