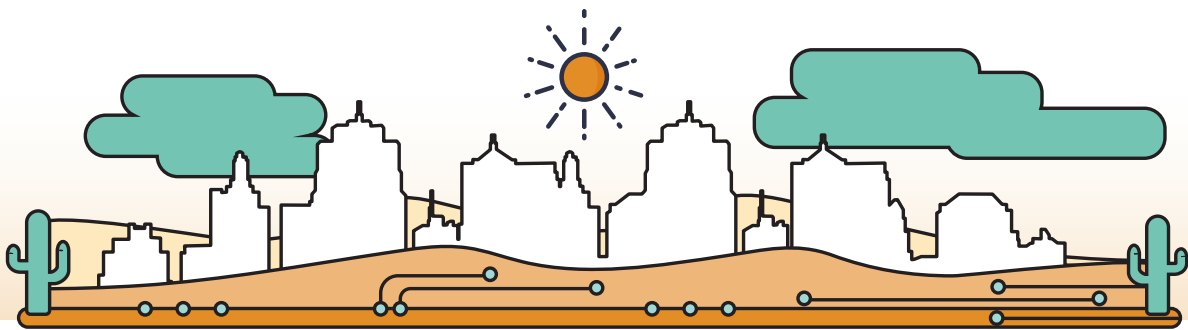


Mexico: A New Hub for Electronics Manufacturing

Mexico has developed a well-earned reputation as being an ideal production hub for electronics manufacturers, including contract electronics manufacturers, serving the lucrative North American market. Thanks to competitive production costs, good logistical access, a skilled and deep talent pool and state-of-the-art technology, Mexico now produces everything from flat-screen televisions to smartphones and other consumer devices employing surface-mount technologies. How did Mexico's strengths in electronics manufacturing services evolve?



Bright sunshine and stunning weather much of the year. A fast-paced way of life where young, well-educated, ultra-connected hipsters form an important part of a growing economy that drives innovation. A palpable buzz in the air, where it seems that youthful enthusiasm and a can-do mentality fueled by technology and entrepreneurialism come together, making anything possible. A who's-who list of important Fortune 500 companies and startups coexisting: IBM, Intel, Oracle, Flextronics, Wizeline, TTech, HP and Tata, to name just a few.

You might get the impression you're in Silicon Valley but, In this case, you're actually some 3,000 kilometers away, in the heart of Mexico's Silicon Valley in Guadalajara, Jalisco state. You'll find many of the trappings here that you would find in Mountainview, San Jose or San Francisco in this greater metropolitan region of over 5 million people, which is Mexico's second-most-populous area

behind Mexico City. While Guadalajara's reputation is increasingly well known as a diverse, thriving tech city, what's less commonly understood is that the area is just one of many in Mexico where a young educated workforce, technology and an optimistic spirit are merging to drive economic growth and opportunity, particularly in the Electronics Manufacturing Services (EMS) sector.

Such hubs are found across Mexico in areas as diverse as Monterrey, Aguascalientes, Tijuana, Querétaro and San Luis Potosi. How did this happen? How did regions of the country known for manufacturing or agriculture transform into thriving urban centers of learning, innovation and possibility? To answer that question, we must first explore the recent past, because you cannot understand Mexico's current strength in EMS, including contract electronics manufacturing, without first understanding its competitive relationship with China.

Mexico's Transition to Technology and Electronics

Starting in the late 1980s and early 1990s, Mexico underwent a significant economic restructuring. With once major state-owned companies now privatized, Mexico went from being a closed economy to an export-oriented industrial one. The result of this transformation was a steady increase in trade between Mexico and the United States. By 2000, the U.S. accounted for nearly 80% of all Mexican trade – up from 69% in 1990, according to Forbes.

It also was around the turn of the 21st century that China began positioning itself as a cost-competitive alternative to Mexico. In response to this move, Mexico began to transform yet again, this time by shifting focus away from assembly and toward manufacturing more value-oriented products, such as those found in the electronics sector.

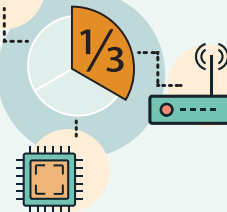
While our customers demand cost efficiency and you simply can't find better cost savings than what Mexico offers, we also moved for talent.

Steve Fraser
V.P. Operations, Firstronic
(Grand Rapids, Michigan)

Today, electronics manufacturing overall is one of Mexico's fastest-growing industrial areas. According to Forbes, between 2002 and 2012, Mexico's electronics exports increased by 73%, from \$43.3 billion to \$74.9 billion. As of 2015, the manufacturing value-added sector, which electronics is part of, accounted for 18% of Mexico's GDP. That same year, electronics exports surpassed \$80 billion. The main destination for these exports was the U.S., with an 86% share, followed by Canada, China, France, the Netherlands and Germany. Computers account for the largest share in exports, followed by flat screen TVs and mobile phones.

Most recently, a significant hub of electronics and contract manufacturers has sprung up in Mexico, with experts pegging the number of manufacturing plants dedicated to the electronics sector at more than 700. Electronics manufacturing is thriving in Mexico's north-central region (known as "The Bajío," and is comprised of parts of the states of Aguascalientes, Jalisco, Guanajuato, Querétaro and San Luis Potosí), which is lined with state-of-the-art facilities bearing the logos of such leading international electronics OEMs as Samsung, LG, Toshiba, Foxconn, Flextronics and Intel – among others. With the global electronics OEMs now firmly established in Mexico, the rest of the supply chain has quickly followed, attracting new investors, generating jobs and solidifying the region's reputation as Mexico's answer to Silicon Valley.

ELECTRONICS MANUFACTURING IN MEXICO – AT A GLANCE



A third of electronics manufactured in Mexico are for the Information Technology industry (computers, computer CPU and memory chips, network switches, routers, etc.).

30% of the electronics that Mexico produces are consumer electronics, including televisions and other audio/visual goods.



Mexico also produces circuit boards, LCD panels, mobile phones, communication equipment and electronics appliances.

Mexico is the world's **top exporter** of flat-screen TVs and the fifth-largest exporter of computers.



Only China surpasses Mexico in the number of electronics products **exported to the U.S.**

The World's Lowest Business Costs

In a competitive global market, finding ways to manage ever-rising costs is essential to corporate success. Here, Mexico brings many advantages. According to KPMG's *Competitive Alternatives 2016* report, Mexico has the world's lowest business costs. Compared to the U.S., Mexico offers an 11.9% savings on the costs of manufacturing electronics equipment and components. KPMG also reports that Mexico enjoys the lowest component production costs within the industry – as much as 18.2% lower than other leading electronics manufacturing countries like Canada, the Netherlands, UK, France, Germany and Japan. It also boasts the lowest operating costs in the Americas for the manufacturing of electronics components and equipment.

As a result of these cost advantages, as of 2016, Mexico ranked as the world's sixth-largest producer of electronics and the third-largest producer of computers. Exporting more than \$70 billion in technology products to the U.S. every year, Mexico is the second-largest supplier of electronics products to the U.S. market (behind only China).

Cost-Competitive Talent

With cost advantages like these, it is little wonder that we are now witnessing a global shift of manufacturing to Mexico. Yet Mexico's attractiveness extends beyond cost-competitive production, as it comes backed by an available pool of talent, particularly young talent. "While our customers demand cost efficiency and you simply can't find better cost savings than what Mexico offers, we also moved for talent," says Firstronic Vice President of Operations, Steve Fraser. Firstronic, a Michigan-based electronics contract manufacturer, has global production in eight locations, including Juarez, Mexico. "Mexico has good technical staff and more and more people are getting tech degrees every year," Fraser added.

According to Forbes, as Chinese wages continue to rise, Mexico's cost advantage further strengthens. Mexico's labor costs are now almost 20% lower than China (whereas in 2000 they were 58% higher). At the same time, electronics

ELECTRONICS IN MEXICO'S AUTO SECTOR: IN TOP GEAR

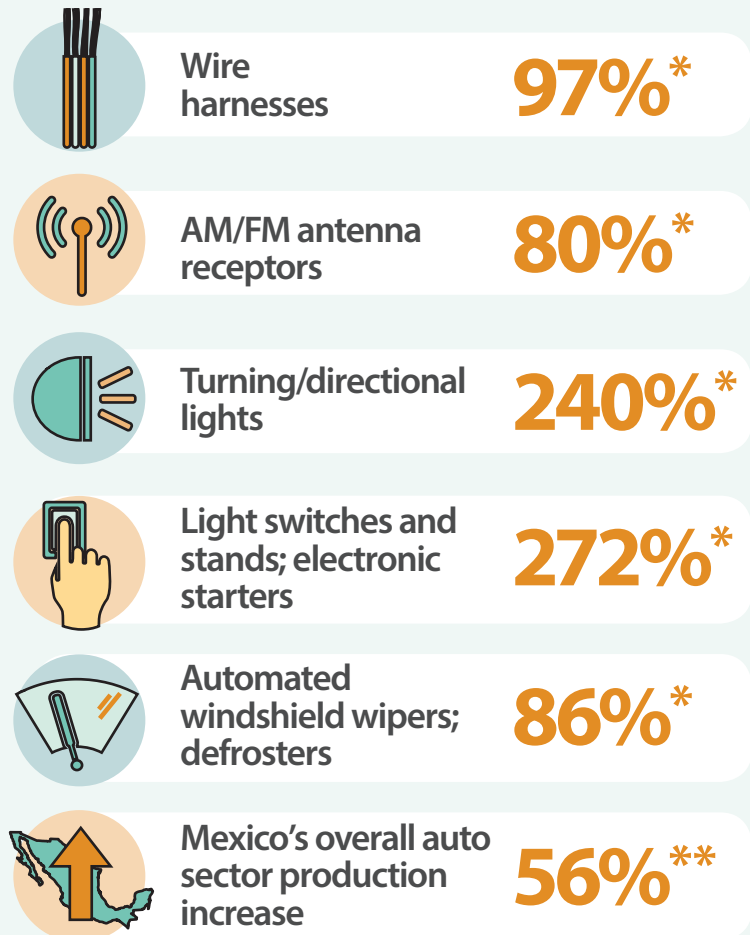
Mexico's gains in electronics may be surpassed only by the explosive growth Mexico is experiencing in the automotive (cars and light trucks) sector. At the same time electronics components are becoming increasingly important to today's global auto sector, Mexico is amplifying its strengths as a global supplier, thanks to all the reasons portrayed above in this paper: engineering talent, production capacity, enhanced value-add processes, etc.

In fact, an overview of the key electronics processes and advances in today's automotive world (such as: backup cameras, connected vehicles, keyless ignition, enhanced safety systems, navigation systems, autonomous vehicles... to list just a few), reveals that there are no major categories in automotive electronics in which Mexico is not a key player. As illustrated by the data below, Entrada's clients that manufacture for the auto sector have experienced substantial growth within several key product categories.



AUTO PRODUCT EXPORT GROWTH BY ENTRADA CLIENTS

PERCENTAGE GROWTH INCREASE BY CATEGORY, 2010-2016



Sources: * Data based on tariff code export reports for Entrada Group clients producing for the automotive sector (cars and light trucks), 2010-2016.

** AMIA (Mexico's automotive manufacturing association)

Continue to Page 5...

ENTRADA INSIGHT: HOW EMS FIRMS CAN BECOME EMPLOYERS OF CHOICE

As the EMS industry continues to grow in Mexico, a side effect is increasing competition for talent, across Mexico. Mexico's talent base is growing quickly, but the supply still isn't sufficient to keep up with explosive demand. Solving the shortage of skilled labor means knowing how to look in the right places.

"To find skilled knowledge workers, companies must search outside their area," says Benjamin Orozco, Entrada's Director of Human Resources. "You have to know where to look, of course. And that is where the expertise of an experienced Mexico partner like Entrada comes into play. You're looking for technical electronics staff? Turn to Guadalajara, which excels in talent with hardware experience: PCs, small electronics, cell phones. Monterrey, for example, offers an abundance of contract electronics manufacturers, with Nokia and its related ecosystem found there. This can also be a reliable talent pool.

"It's more important now than ever before, as demand continues to grow," Orozco added.

"Electronics represents the fastest-growing industry at our manufacturing campus in Zacatecas, accounting for a full one-fifth of the workforce of our clients; further, 15% of that workforce are engineers, program managers or designers. So we know firsthand that the need is there."

Of course, recruitment is only part of the story. "We help our clients not only reach out to talented technical people from these areas and coach them on how to recruit, we also educate our clients about effective retention programs for Mexico's labor market. Perhaps more so than in the U.S., in Mexico, offering an overall competitive employer-value proposition is essential. We help our clients understand it is not just pay that keeps skilled workers around. They need to fully consider leadership,

work environment, benefits, advancement potential...the full package," Orozco says.

Finally, as Entrada advises its own clients, offering competitive compensation to employees requires knowledge of prevailing local turnover trends. "We educate our clients about data standards and benchmarks for what retention levels should be," Orozco says. "About a year ago, we had a client that was experiencing turnover rates that were much higher than other companies operating at our manufacturing campus in Zacatecas. To help reverse this trend, Entrada developed an employee retention strategy that included a full salary benchmark, steps for improving working conditions and a new staff training process. After implementing these recommendations, their retention improved by 33%. But they couldn't make that improvement without a baseline to start from," Orozco says.

MEXICO'S ELECTRONICS ADVANTAGES



The United Nations ranked Mexico the **6th best place** in the world for foreign direct investment



Proximity to **U.S. border**



Free trade agreements with **46 countries** worldwide



Competitive prices

12% savings in manufacturing costs compared to the U.S.

18% lower production costs than other leading electronics manufacturing countries



Experience and expertise

114,000

engineering and technology students graduate from Mexican universities every year, a higher number per capita than in the U.S.



Protection of **intellectual property**



State-of-the-art technology

Home to a high-level of manufacturing technology capable of producing **quality finished goods**

Tablets and smartphones are the **top export products**

companies aren't coming to Mexico for cheap labor, they're coming for cost-competitive talent.

Over the past decade, Mexico's population has become increasingly educated, with a growing number completing advanced academic degrees. According to the National Association of Universities and Institutions of Higher Education, in 2012, Mexican universities graduated 101,700 engineering and technology students. Today, KPMG places that number closer to 114,000 annually. In other words, Mexico graduates 18% more students in the manufacturing, engineering and construction fields per capita than the U.S. does.

As a result, what was once an undereducated and inexperienced workforce is now seeing a marked increase in the availability of engineering and design specialists. This is good news for the electronics industry as this talent pool is fundamental to supporting the growth of electronics manufacturing in Mexico. For example, because of this commitment to producing engineering and tech-focused talent, technology research and development has become a major export of the Mexican electronics sector. In fact, Mexican engineering firms now design a substantial portion of the electronics being manufactured not only in Mexico, but around the world.

But it isn't just formal "classroom" training that has enabled Mexico to close the gap on China as a producer of consumer electronics devices, according to Rafael Gonzalez, HR Director at Aguascalientes-

Mexico's workforce has become more skilled through their experience assembling other items related to the aerospace, automotive and medical device industries.

Rafael Gonzalez
HR Director, Sensate Technologies
(Aguascalientes)

based Sensate Technologies, an electronics producer for the automotive and other sectors. "Mexico's workforce has become more skilled through their experience assembling other items related to the aerospace, automotive and medical device industries," he says. "Consumer electronics companies know Mexico is a strong alternative to having their goods made in China."

Gonzalez notes that because of this deep pool of local talent, companies no longer have to import their skilled workers. As companies see the quality of work that local talent can produce, leading OEMs and Tier One companies gain more trust in Mexican production. These days, Gonzalez says, most plants are run by

Welcome to the Bajío: The Epicenter of Mexico's Electronics Manufacturing

As Mexico began turning toward more value-added and high tech production, the Bajío region became better known as the country's manufacturing hub. By building infrastructure and training facilities, supporting the skill development of the local workforce and providing a range of other benefits, foreign investment began flowing in, increasing from \$7.2 billion in 1993-2002 to \$16.3 billion in 2003-2012.

A significant portion of U.S. export-oriented middle- and high-end manufacturing, including electronics manufacturing, now takes place in this north-central region.

Cities like Guadalajara and Aguascalientes form part of Mexico's epicenter of Electronics manufacturing. Over the past decade, the state of Jalisco, for example, has received more than \$14 billion in investment within the electronics industry. Today, the state is home to 12 electronics manufacturing OEMs, 14 EMS companies and over 380 specialized electronics suppliers. Together, the State of Jalisco and the City of Guadalajara employ over 50,000 Mexican workers.

Jalisco has received more than **\$14 billion** in investment within the **electronics industry**

Home to **12** electronics manufacturing OEMs

14 EMS companies

Over 380 specialized electronics suppliers

Mexicans, with fewer and fewer expats involved. And they're not limited to doing only production – much of the engineering, R&D, design, customer service and supply chain are all overseen by local talent.

"Twenty years ago, there was always an expat client representative on the floor overseeing quality assurance; not anymore," says Gonzalez. "Out of the 300 people [Sensata] recently hired, three-quarters were from Aguascalientes and 100 came with experience in contract manufacturing."

Even with these gains in talent and skill, Mexican workers are still extremely cost-competitive in comparison to workers in other countries – especially when you take into consideration overall productivity. Fifteen years ago, Mexican labor cost 58% more than Chinese labor. Now, not only is the cost of Mexican labor almost one-fifth less than Chinese labor, it is also significantly more skilled.

Prime Positioning

In addition to competitive production costs and highly skilled labor, Mexico's Bajío region offers global electronics manufacturers an excellent transportation infrastructure (see "Welcome to the Bajío: The Epicenter of Mexico's Electronics Manufacturing" for more on the strengths of this manufacturing powerhouse region). This is essential to an industry where the lifecycles of products grow shorter and consumers demand new products ever faster.

With shipping time from China taking up to six weeks, manufacturers that urgently require devices are often faced with paying high rates for air cargo. Electronics manufacturers with Mexico operations, however, are within a two-day drive (or less) from the U.S. border – via an advanced road network. "If you do a true cost comparison between Mexico and China, including freight volume you must commit to and total cost of acquisition, Mexico is very competitive," says Gary Baltimore, Director of Business Development for MC Assembly, a U.S.-based contract electronics manufacturer that has Mexico production in the state of Zacatecas, at Entrada Group's manufacturing campus.

At the same time, the reality is that many component manufacturers are still located in China, meaning electronics manufacturers in Mexico still need to source some components from China, as



DID YOU KNOW?

Manufacturing in Mexico leans heavily on American input? That's because exports from Mexico contain up to three times as many American-made components than the number of American parts included in exports coming from China.

domestic production in Mexico continues to mature. But logistically too Mexico proves capable, with its state-of-the-art ports on the Pacific Ocean, Gulf of Mexico and the Caribbean. In fact, to better handle this incoming cargo, Mexico has expanded its Pacific ports, using rail to connect them to both the industrial base and to consumer markets. As a result, Pacific ports such as Lazaro Cardenas, the fastest growing port in North America, are booming.

An Expanding Cycle of Technology and Opportunity

When foreign companies set up operations in Mexico, they bring with them the high-tech machinery, equipment and know-how needed to produce their goods. Similarly, when these companies create a joint venture with a Mexican company, the local company gains access to this technology and expertise. In addition, contract manufacturers with modern manufacturing equipment draw even more business with them – including SMEs – into the country. The result? Mexico now has a high-level of manufacturing technology capable of producing high quality finished goods.

This is an ongoing cycle that feeds on itself and generates yet more investment and knowledge-worker growth in Mexico. More and more foreign companies are expanding their manufacturing and R&D in Mexico, which in turn attracts more companies, and so on. "It's not just production anymore," says Sensata's Gonzalez.

"As foreign investment increases, Mexican capabilities in engineering, processes, R&D, design, customer service and supply chain also improve," he added.

With consumption of domestic appliances in the U.S., Canada and Latin America exceeding production capacity, this cycle shows no signs of stopping, making now the right time for EMS producers or contract manufacturers lacking a Mexico presence to join the fray.

Entrada Group and Electronics Manufacturing

Several EMS producers and electronics contract manufacturers are part of our client roster in Central Mexico, so Entrada is well positioned to help companies of all size transition to Mexico production. Our unique manufacturing support platform means we are fully responsible for all non-production-related services at the campus, including risk management and all aspects of Mexico compliance. At the same time, our clients retain full control and responsibility of production and quality, handing over the G&A support tasks to our team of Mexico experts, including legal, regulatory, infrastructure and administrative functions.

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