MASTER PLAN FOR THE DEVELOPMENT OF THE SEMICONDUCTORS' INDUSTRY IN MEXICO

2024-2030

September 2024

INDEX

BACKGROUNDS

Through diverse meetings and joint bilateral efforts between Mexico and the United States, CANIETI with representatives of the United States Embassy in Mexico, put together synergies for collaborating in opportunities to improve the dynamics of the supply chain of semiconductors in a global level. With this objective, it was sought to create a flexible platform orientated to the results of persuading regional prosperity, amplify the employment creation, and reduce the technological gap through relocation.

In this sense, the working committee for the semiconductors industry analysis was created, headed by CANIETI and the United States Embassy, conformed in November 2023, in order to transform the semiconductors industry in Mexico, arguing better public policies practices, promoting semiconductor special skills, with the aim of unifying efforts and sharing knowledge in order to impulse the development and the Collaboration forum for Mexico-USA Semiconductors coordination, where important actors for the supply chain are reunited to present initiatives to reinforce the high technology industry development.

The United States Embassy has become the main sponsor of these forums, in which 2 out of the 4 planned meetings have been already done in strategic states around the country, like Jalisco and Baja California. These Forums have also been held in collaboration with the Ministry of Economy, Ministry of Public Education, the American Chamber of Commerce, INDEX, CCE, the Government of Guadalajara, Baja California, Chihuahua, Sonora, CDMX and more than 40 public and private institutions which have been fundamental to strengthen, the bilateral talks are about innovation, security in the resources global chain and the creation of political frameworks.

Representatives from the United States government, Universidad Autónoma de Baja California, Tecnológico Nacional de México, INAOE, AMCHAM, Intel, Qualcomm, Arizona State University, California University, CETYS University, Skyworks, Infineon, INDEX, CINVESTAV, American Tower México, Purdue University, among other organizations have participated.

During the first forum at Jalisco, the benefits that Mexico has in each stage of supply were highlighted, as well as the employment generation, the axes of key actions (talent, infrastructure, incentives and competitiveness), which were a catalyst to take the opportunities and challenges which should be implemented in the country. Finally, 26 actions were proposed, setting the bases for the National Semiconductor Master Plan.

Subsequently, in the second edition of the semiconductor forum, the National Master Plan draft was presented, which objective is to unify all perspectives of the industry and serve as direction to advance the development of the Semiconductor supply chain in Mexico with a comprehensive vision, with specific objectives and in established time horizons that can take Mexico to the next level in the global supply chain.

This National Master Plan has as its main axis its development areas, goals and horizons for the 2024 - 2030 period. That is why for its elaboration many national plans and strategies have been taken as an investigation, in this way this master plan counts with elements in common: a general vision, long, medium and short term objectives, important areas in the value and supply chain, key topics; such as education, infrastructure, trade, public and private key actors and sets of programs and actions. Besides the industrial/public policy, or productive development in specific actions of the semiconductor production chain.

I. MOTIVATION

The Collaboration Forum for Semiconductors Mexico - USA is an initiative created to join in collective action the different authorities, industry and academia to advance the common goal of strengthening and resiliency of the semiconductor industry in North America. This forum is sponsored by the United States Embassy, coordinated by CANIETI.

The first encounter of the Collaboration Forum took place in Guadalajara on February 22nd, 2024. Congregating more than 130 experts from nearly 40 public and private institutions. In the first edition the forum participants identified 26 cooperation actions[1] and decided to work on the elaboration of *"A master plan or roadmap for the Semiconductors in Mexico that takes into account CM, PCB, among others and focuses on 1. Design, 2. Validation, 3. ATP[2], 4. OSAT[3], 5. PCB[4] e 6. Integration"*.

In the second forum encounter, held in Tijuana, Baja California on June 10, 2024, the first draft of the *Master Plan for the Development of the Semiconductor Industry in Mexico 2024-2030*[5] was presented. During this meeting, the unanimous support of the participants was expressed[6] to prepare a final document Master plan and deliver it to the elected federal government and the key states within the supply chain in Mexico, so that it serves as a work plan for policy decisions and industry and academic initiatives over the next 6 years. To this end, the draft document was shared for comments until July 15, 2024 and contributions were received from more than 10 stakeholders[7]. This document corresponds to the final version of the plan, which will be delivered during the third meeting of the Collaboration Forum to be held between October 16 and 17, 2024 in Ciudad Juárez, Chihuahua, Mexico.

[1] (2024). *FORO DE COLABORACIÓN PARA SEMICONDUCTORES MÉXICO-EUA.* Revista Digital CANIETI, edición 22, marzo 2024, pp. 18-21. Descarga aquí: https://www.flipsnack.com/6AD7AEFF8D6/revista-digital-canieti-edici-n-no-22/full-view.html?p=8

[2] Sigla en inglés para: Assembly, Test and Packaging.

[3] Sigla en inglés para: Outsourced Semiconductor Assembly and Test.

[4] Sigla en inglés para: Printed Circuit Boards.

[5] Este documento no representa la posición particular de CANIETI o de los miembros del Comité del Foro de Colaboración de Semiconductores México – EUA. El documento corresponde al trabajo compilatorio de los diferentes análisis sobre la industria de semiconductores en México y sintetiza dichos hallazgos en un primer borrador de Plan Maestro para su posterior desarrollo e implementación.

[6] More than 170 experts from nearly 50 public and private institutions.

[7] Among them, contributions from the Ministry of Economy, TecNM, UABC, SIA, FOMEC, FUMEC, DGETI, among others.

II. WHY A MASTER PLAN FOR MEXICO?

From the discussions held at the Collaboration Forum meetings, it was concluded that there is sufficient work on the identification of the different stages of the supply chain where Mexico presents competitive advantages, as well as the challenges and key areas of action for its development (Incentives and Competitiveness, Talent, Infrastructure, and Ecosystem)

Therefore, it is considered that the discussion in Mexico related to the development potential of the semiconductor industry is already mature[8] and it is necessary to advance a specific strategy, with goals, actions, and assignment of responsibilities.

To this end, this document is structured in 6 sections: 1 and 2 - background and motivation. Section 3 presents a review of the international context. Section 4 provides a review of the local context and progress to date. Finally, section 5 presents The Master Plan for 2024 – 2030.

[8] Por ejemplo, con el auspicio de USAID, FUMEC publicó en junio 2024 el estudio: *"Mapa de Ruta: Oportunidades para el Nearshoring de Semiconductores en México"*. De manera previa, en abril de 2022, el BID lanzó el trabajo: *"México y la Cadena de Valor de los semiconductores"* Descargable aquí: https://publications.iadb.org/es/mexico-y-la-cadena-de-valor-de-los-semiconductores-oportunidades-de-cara-al-nuevo-escenario-global. En ambos trabajos se identifican las actividades de oportunidad de la cadena de valor en México y los desafíos.

III. GLOBAL CONTEXT

Since the promotion of the *Chips & Science Act*[9]. In the United States, a massification of legislation, plans, agreements and strategies have been generated to promote activities related to the manufacturing and supply chain of semiconductors globally. Semiconductors are considered the essential component of the digital world and hence their strategic importance for any county[10] but, above all, for those with a vocation to develop the activity, among which is Mexico.

For the purposes of this report, a country is considered to have a vocation for the development of the industry if it has relevant economic activity in any of the segments of the value chain. The vocation is also strengthened to the extent that the country has notable downstream activity, that is, when the country has the capacity to integrate semiconductors into final goods of great demand such as those related to electronics, automotive and communications equipment[11].

Table 1 summarizes this short list of countries with a vocation, where Mexico occupies a particular position, since it is part of the group of countries with the presence of back-end activities and at the same time, it holds global leadership positions in industries with high demand for semiconductors such as automotive, telecommunications equipment, and electronics equipment.

If Mexico could grow and mature the presence of the semiconductor industry, this would allow to increase the value that the country can add to the export of the downstream sectors that contribute to more than 24%[12] of exports, which would generate employment, prosperity, sovereignty and at the same time would help the resilience objective that resonates for the United States, the largest trading partner.

[9] https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/

[10] Un riguroso análisis de su importancia se encuentra resumido en: https://www.weforum.org/podcasts/radio-davos/episodes/silicon-chips-semiconductors-chris-miller/

[11] De acuerdo con Mckinsey (https://www.mckinsey.com/industries/semiconductors/our-insights) la electrónica contribuirá al 35% de la demanda, el equipo de telecomunicaciones con el 30% y el automotriz con el 20% de la demanda de semiconductores a 2030.

[12] Cálculo basado en información de https://oec.world/en

TABLE 1. COUNTRIES WITH A VOCATION FOR THE DEVELOPMENT OF SEMICONDUCTOR ACTIVITIES (2024)

GLOBAL LEADERS (+90% FROM THE MARKET)	FRONT-END (WAFER MANUFACTURING AND MANUFACTURING EQUIPMENT)	BACK-END (ASSEMBLY, PACKAGING AND VALIDATION - ATP)	EXPORT OF ELECTRONIC GOODS (TOP 20)	EXPORT OF TELECOMMUNICATIONS EQUIPMENT (TOP 20)	AUTOMOTIVE INDUSTRY EXPORT (TOP 20)
UNITED STATES	YES	YES	2	2	3
KOREA	YES	YES	4	6	5
JAPAN	YES	YES	6	7	2
GERMANY	YES	YES	5	3	1
TAIWAN	YES	YES	8	9	-
CHINA	YES	YES	1	1	-
OTHER COUNTRIES WITH A VOCATION					
IRELAND	YES	YES	-	-	-
ISRAEL	YES	YES	-	-	-
HOLLAND	YES	-	9	11	-
FRANCE	-	YES	14	13	11
POLAND	-	YES	-	-	20
INDIA	YES	YES	17	18	16
MALAYSIA	-	YES	10	10	-
SINGAPORE	-	YES	7	8	-
VIETNAM	-	YES	11	5	-
BRAZIL	-	YES	-	-	15
COSTA RICA	-	YES	-	-	-
MÉXICO	-	YES	12	4	4

Source: Own elaboration based on information from Mckinsey (2024), SIA (2024), WTO (2024) y WTW (2024).

However, realizing these benefits come with great challenges, in a report published by SIA[13], it was identified that since 2021 there has been a substantial increase in government efforts to support the semiconductor industry, with incentive plans in China, South Korea, the United States, India, Japan, Taiwan, and the European Union involving +$316 billion dollars, not counting other efforts by countries that compete with Mexico for investment such as Malaysia, Poland, Singapore, Thailand and Vietnam. These incentive plans have supported strong investment growth not only in wafer manufacturing, but also in ATP in those geographies.

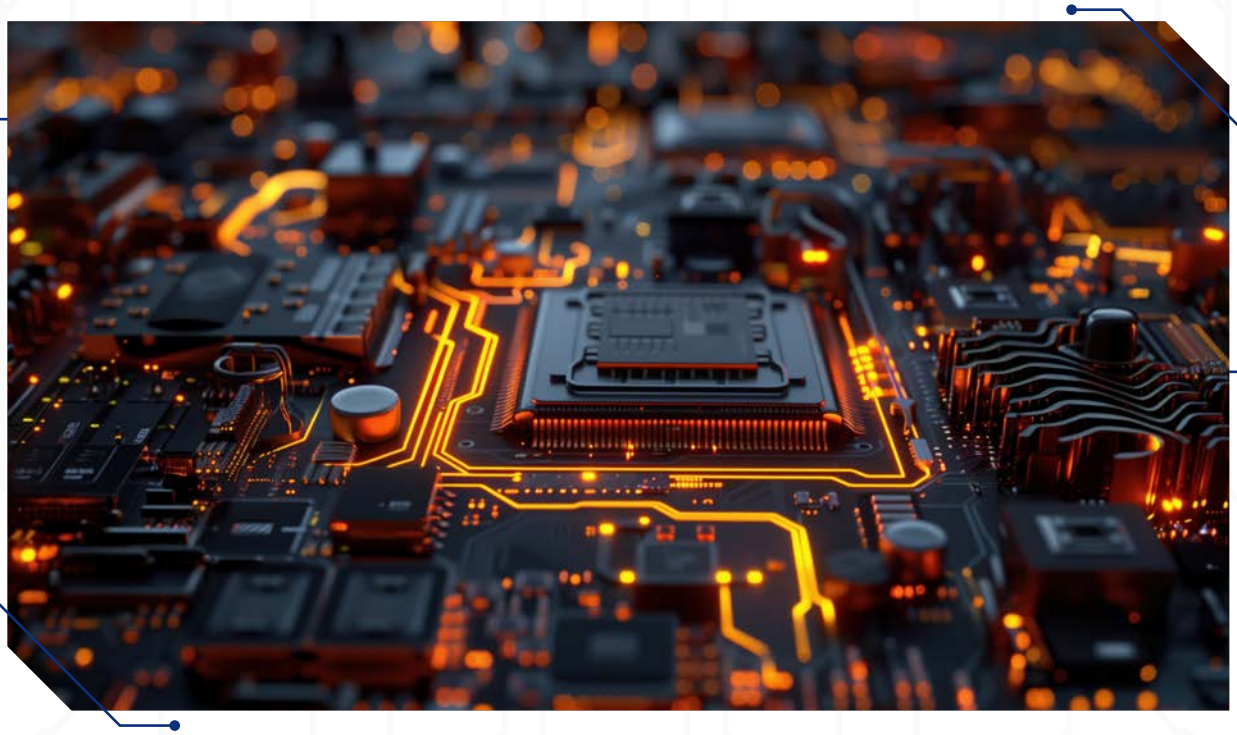
Along the same lines, in the latest SIA[14] report it is estimated that investment or expansions of semiconductor operations have grown 280% over the last 5 years. In contrast, according to the analysis carried out by the Business Relocation Commission in Mexico, it is estimated that the automotive and electronics segments have been the most relevant in FDI, but investments directly related to semiconductors have not shown the same dynamics.

So, there is evidence that the opportunity to grow the semiconductor industry in Mexico has been only partially taken advantage of. In this regard, SIA in its latest report recommends that administrations work on improving 5 areas to achieve growth in semiconductor investment: 1. Investment and operating costs, 2. Workforce and talent, 3. Infrastructure, 4. Regulatory environment and 5. Integrated Ecosystems. These areas coincide with those that the Collaboration Forum has been working on and are also common in national strategies or plans.

[13] SIA & BCG. (2024). *Emerging Resilience in the Semiconductor Supply Chain. Semiconductor Industry Association.* May 2024. Descarga aquí: https://www.semiconductors.org/emerging-resilience-in-the-semiconductor-supply-chain/
[14] *SIA & BCG. (2024). Attracting Chips Investment: Industry Recommendations for Policy Makers. Aug 2024.* Descarga aquí:https://www.semiconductors.org/wp-content/uploads/2024/08/Attracting-Chips-Investment_Industry-Recommendations-for-Policymakers_full-report.pdf

Particularly, on our continent, national plans have emerged in countries such as Canada[15], Brazil[16], and recently, the government of Costa Rica became the first to publish a *Roadmap for Strengthening the Semiconductor Ecosystem*[17]. These works reinforce the urgency of having a Master Plan in Mexico.

Although there is no Master Plan for Mexico, that does not mean that the topic of semiconductors has been absent in the local environment. On the contrary, since 2022 with the start of the High Level Economic Dialogues (DEAN for its acronym in Spanish) between Mexico and the United States, joint work has been unleashed between both governments, including the state governments, and between actors of the industry, which is summarized in the following section.



[15] https://irp.cdn-website.com/e5abb5aa/files/uploaded/Canadas-Semiconductor-Action-Plan.pdf
[16] https://brazilian.report/tech/2024/02/09/semiconductor-production-chain/
[17] https://www.comex.go.cr/media/10187/hrs_vfinal_21-3-24.pdf

IV. DOMESTIC CONTEXT AND PROGRESS IN MEXICO

As noted in this document, Mexico has not been isolated from public-private discussions and action aimed at strengthening the semiconductor industry. At the government level, the Ministry of Economy (SE) has been leading different efforts, such as Mexico's participation in the DEAN[18] and formation of the Working Group between Taiwan and Mexico for the development of Printed Circuit Boards PCB[19]. Also, SE has been actively participating in the Semiconductor Collaboration Forum, has led the *OECD*[20] Informal Working Group and has joined forces with other agencies such as the Ministry of Public Education (SEP) to bring semiconductor workforce development into the country through the Tecnológicos Nacionales system[21]. In terms of facilitation, SE created the Single Window for Investors[22].

Additionally, SE issued the *"Collaboration Agreement to Promote the Development of the Semiconductor Industry"*[23] in June 2024. This Decree must become the framework for a good part of the decisions that are required from the government to attack the 5 key areas for improving the investment proposed by SIA[24] and in turn, must be an integral part of the Master Plan.

Additionally, the "Shared Prosperity" government plan promulgated by the elected president, Claudia Sheinbaum, includes the semiconductor, electronics and automotive industries within the 5 strategic sectors of the National Relocation Plan, proposes the consolidation of 10 industrial corridors, construction of 100 industrial parks, tax and customs simplification, water, energy, transportation, and telecommunications infrastructure plans.

[18] https://www.gob.mx/se/prensa/declaracion-conjunta-tras-el-dialogo-economico-de-alto-nivel-entre-Mexico-y-ee-uu-de-2023
[19] https://www.gob.mx/se/prensa/empresas-Taiwánesas-de-microchips-visitan-México-para-conocer-ventajas-competitivas-en-el-marco-de-la-relocalizacion
[20] https://www.gob.mx/se/prensa/economia-y-la-ocde-llevan-a-cabo-la-cuarta-reunion-de-la-red-informal-de-intercambio-de-semiconductores?idiom=es
[21] https://www.gob.mx/se/prensa/presentan-sep-y-economia-talento-mexicano-en-los-colegios-comunitarios-de-estados-unidos-353977?idiom=en
[22] https://ventanillaunica.economia.gob.mx/
[23] https://www.diariooficial.gob.mx/nota_detalle.php?codigo=5729560&fecha=05/06/2024#gsc.tab=0
[24] *El Convenio tiene por objeto establecer la participación de "LAS PARTES" y la coordinación entre ellas, para impulsar el desarrollo de la industria de semiconductores, en el ámbito de sus respectivas competencias, como uno de los sectores de mayor potencial de crecimiento económico para las inversiones.*

At the bilateral level, cooperation between the United States and Mexico has intensified. Beyond the commitments of the DEAN, the *Semiconductor Collaboration Forum* has served to unify bilateral academic cooperation programs, finalize private agreements, and align federal and state actions. Likewise, initiatives such as the *Semiconductor Alliance Mexico*[25] have emerged to advance programs and enlist the talent required by the industry.

Recently, with the cooperation agreement under the *International Technology and Security Innovation* (ITSI) *Fund*[26], the first calls[27] for financing by the US for projects in the field of workforce, regulation, and supply chain aimed at strengthening ATP activities in Mexico to complement the growth of wafer manufacturing in the USA.

These efforts and others already mentioned, such as the IDB studies in 2022 and FUMEC-USAID in 2024, have brought progress for Mexico towards a better diagnosis of the industry and have given guidelines on how the country should progress towards a resilient supply chain. Added to this are the findings of the *United States Technical Delegation in Semiconductors and Human Capital Development* in August 2023[28], and the results of the work carried out by the OECD that are still awaited, which will provide specific recommendations for the advancement of ATP in México[29].

At the state level, progress has also been important in those regions where the semiconductor industry or the electronics industry (Original Equipment Manufacturers - OEM and Original Design Manufacturers - ODM) have presence, such as Baja California, Chihuahua, Jalisco and Nuevo León. It is no coincidence that new investments have arrived in these states or expansion projects have been generated by semiconductor companies such as Infineon, Intel, Micron, Qualcomm and Skyworks, among others.

[25] https://iberotech.org/semiconductor_alliance.php
[26] https://www.state.gov/new-partnership-with-México-to-explore-semiconductor-supply-chain-opportunities/
[27] https://www.grants.gov/search-results-detail/355376
[28] *Recomendaciones de la Delegación Técnica de Estados Unidos en Semiconductores y Desarrollo de Capital Humano.* Agosto, 2023.
[29] https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2024/april/2024-us-mexico-high-level-economic-dialogue-mid-year-review-fact-sheet

In the particular case of the state of Jalisco, this region has issued a policy as a consequence of the *Chips & Science Act* denominated the *Jalisco Tech Hub Act*[30], which includes a component of incentives and actions to promote the semiconductor industry. The states of Baja California and Chihuahua also have workforce and ecosystem public policies.

Other places, in particular, Mexico City, have also created their own investment attraction working groups and activities. Finally, local companies like QSM Semiconductores, located in Querétaro, have begun to emerge.

In addition to these efforts, there are also those from the private sector, among which the following stand out, the creation of the Vice Presidency of Semiconductors of CANIETI, the semiconductor working group from the American Chamber of Commerce, the support of the CCE towards the PCB working group, INDEX's works for the support of the maquila industry associated to semiconductors, and the automotive industry's vinculation through AMIA[31] and INA[32]. All of the above is evidence that, based on this work, there is already a knowledge base and will to move forward with a *Master Plan*.

Therefore, it is urgent to facilitate a more competitive environment for the semiconductor industry in Mexico. According to the IDB study (2022), efforts should continue to increase careers and programs related to the industry's needs, public investment in R&D, investment subsidy programs, financing of anchor companies and simplification of procedures. For its part, the FUMEC study (2024) proposes action plans in the areas of infrastructure, supply chain, workforce, innovation, entrepreneurship and sustainability for 6 key regions and 5 with potential.

[30] https://coordinacioneconomia.jalisco.gob.mx/jalisco-tech-hub-act
[31] https://www.milenio.com/negocios/amia-celebra-invitacion-mexico-plan-chips-norteamerica
[32] https://www.eleconomista.com.mx/empresas/INA-iniciara-la-busqueda-de-proveedores-de-chips-20240415-0002.html

All of these actions agree that current policies are not sufficient for Mexico to be able to grow a larger global-scale industry, and are ineffective in addressing the influence on ATP direct investment currently exerted by Costa Rica, India, Poland, Malaysia, Singapore, Thailand, and Vietnam through better tax conditions, subsidies and trade facilitation of semiconductor-related goods. It is also a matter of concern that these countries surpass Mexico on Artificial Intelligence implementation rates[33], one of the main motors of the semiconductor industry in the future.

Currently, Mexico has the most mature ecosystem of the electronics and semiconductor industry in Latin America (see Figure 1)[34], but the aforementioned studies warn that this privileged condition does not in itself guarantee a greater participation in the global supply chain. For example, the recent growth of the industry is associated with the consolidation of what already exists (Design, validation and integration), rather than with a deepening of the ATP and the supply chain, as explained below.

Over the past 3 years, Mexico has continued to benefit from its strong domestic market, the established electronics and automotive ecosystem, its proximity to the United States and its free trade agreements (particularly USMCA / T-MEC), which is reflected on some nearshoring and FDI metrics.

[33] https://www.tortoisemedia.com/intelligence/global-ai/#rankings
[34] Un mapeo a mayor nivel de detalle y específico se encuentra en FUMEC (2024)

FIGURE 1. MAIN ELECTRONICS AND SEMICONDUCTOR COMPANIES ESTABLISHED IN MEXICO

Source: CANIETI.

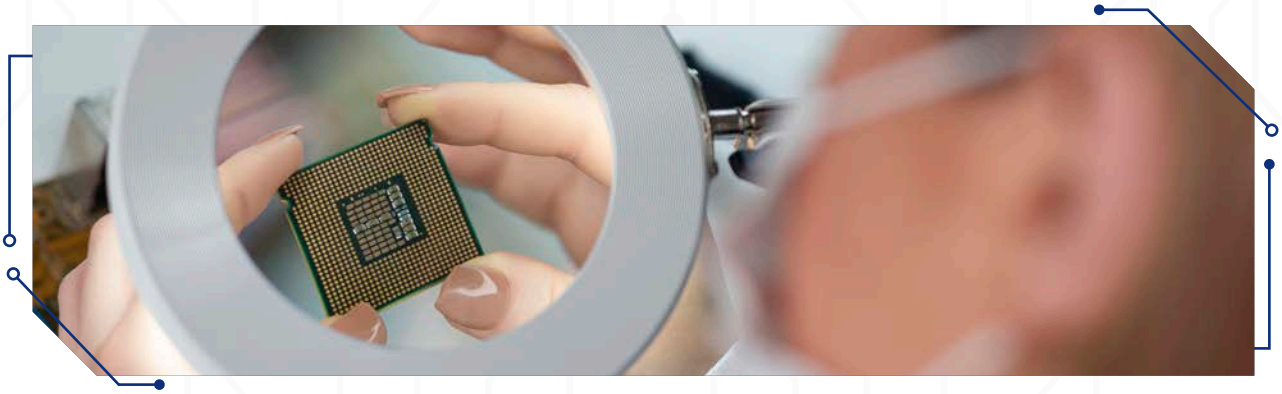
A recent study presented by Deloitte[35] found that the semiconductor and components industry has the highest propensity to nearshoring (100% propensity). Likewise, the industry that generates the greatest demand for semiconductors, the computer industry, is the fastest growing in Mexico among the nearshoring sectors (5% - 7%) and such growth is greatest in the states of Baja California, Jalisco, and Nuevo León. These investments are focused on computer and electronics manufacturing operations, chip design and validation and, to a lesser proportion, chip and discrete component assembly. In other words, they focus on the expansion of existing operations, with the exceptions of some of the investment announcements outlined above.

[35] (2024). Deloitte. *Nearshoring in México.* May 2024.

However, Mexico has not yet received the expected benefits from the development of *Assembly, Test and Packaging* (ATP) activities. According to the SIA study (2024), the main global investment destinations for ATP investments are the United States, China, Denmark, France, Poland, Korea, Japan, India, Malaysia and Taiwan. Apparently, the construction of wafer manufacturing centers in the United States has generated a movement of ATP out of that country in Europe and Asia, but this has not had an impact on the rest of the continent outside of Costa Rica.

These findings regarding the untapped potential of ATP development in Mexico are consistent with the observed by Miller & Talbot (2023)[36] and with the recommendations of the *U.S. Technical Delegation on Semiconductor and Human Capital Development*. All evidence suggests that, if a systematic improvement of the competitiveness that Mexico can offer to the semiconductor industry begins to take place, it will generate at least twice as much economic activity[37] as the one being generated by current organic growth.

For all the above, the current semiconductor *Master Plan* must contribute to the action and coordination among the different actors that will take Mexico to the next level in the global semiconductor supply chain.



[36] Miller. C. & Talbot D. (2023). *México's Microchip Advantage.* Foreign Affairs. August 28, 2023.
[37] Mckinsey estima que la industria de semiconductores crecerá hasta 1 trillón de dólares para 2024 desde $600 millones de dólares en 2021. https://www.mckinsey.com/industries/semiconductors/our-insights/exploring-new-regions-the-greenfield-opportunity-in-semiconductors

V. MASTER PLAN 2024 - 2030

From the review of the master plans or national strategies discussed in section III of this document, a common structure of general vision, short-, medium-, and long-term goals, focus areas in the value and supply chain, key themes, actors, and sets of actions and programs can be identified. The industrial or productive development policy for the specific activities in the semiconductor production chain is a mandatory element in the revised plans, without it, it is not possible to modify the conditions that enable the arrival of investment or the creation of local suppliers.

Therefore, this plan includes these minimum elements and is based on the work and contributions made in different discussion forums held with the federal government, the scope of the Semiconductor Decree/Agreement, the agreements of the HLED, and the technical mission lead by the U.S. government, the work done by the organized industry through CANIETI, Amchan, CCE and INDEX, the discussed in the meetings of the *Semiconductor Collaboration Forum* and the academic work on the subject, among them, those carried out by the IDB (2022) and FUMEC-USAID (2024), and dialogues with the OECD.

MASTER PLAN BASIS AND VISION

Urgency. *The Master Plan* starts from the basis that opportunity for Mexico in semiconductors arises primarily from the disruptions on the global supply chain[38]. This implies that the opportunity is limited and actions require a sense of urgency. It also indicates that most actions that integrate a plan must be executable in a 3 to 5 year horizon, while the relocation phenomenon derived from such disruptions is completed. Part of that movement has already occurred in the leading countries (see Table 1) with the significant increase in investment in wafer manufacturing and the recent increase in ATP investment outside the leading countries in countries with vocation listed in Table 1.

[38] Deloitte. (2024). y Miller. C. & Talbot D. (2023).

Considering that the investment required by ATP can range from $300 and $1 billion dollars[39] such investments will not be repeated in the next 10 to 15 years, once they have been defined for a geography. For that same reason, it is preferable to agree on a *Master Plan* for a 5-year horizon, as opposed to a longer horizon plan that might result ineffective. Although increasing the level of complexity of the supply chain in Mexico is a process that may take more than 10 years, the fundamental actions to achieve it should be detonated in the first few years. Additionally, the industry is changing rapidly, influenced by geopolitics, the advancement of artificial intelligence, and electro mobility, so very long-term actions may quickly become obsolete.

Export vocation. It is recognized in the various studies cited above that the natural market for the relocation of semiconductor-related operations is based on complementarities with the United States[40]. In other words, the business case for those who establish operations in Mexico goes beyond local markets and also focuses on regional exports. The FUMEC study (2024) shows that, in terms of semiconductors, Mexico is still a small exporter to the U.S. and other destinations, as well as a large importer from Asia. This differs from the significant downstream export contributions of the automotive, computer and telecommunications equipment sectors, in which Mexico has already become the #1 exporter to the U.S. Therefore, the Master Plan must focus on increasing exports.

Competitive improvement vis-à-vis Asia. The development of the semiconductor chain in Mexico requires a decisive facilitation of trade with North America and the infrastructure required to grow exports related to the semiconductor supply chain from Mexico to those countries competitive with imports from Asian countries.

[39] Con base en los anuncios que han realizado diferentes empresas en países como Estados Unidos, Tailandia, Corea, Polonia, Costa Rica y e información compartida en el Grupo de Trabajo Mexico – Taiwán para PCB.
[40] (2023). *Recomendaciones de la Delegación Técnica de Estados Unidos en Semiconductores y Desarrollo de Capital Humano.*

There is also an additional challenge since, in recent years, Asian-oriented countries (Korea, Japan, India, Malaysia, Singapore, Thailand, Vietnam) have strongly increased their commitment to attract the semiconductor industry through investment incentive packages (direct subsidies, tax credits and reduced income tax rates). Such countries also present better conditions in terms of access to energy and infrastructure (according to the IDB study, 2022) and better progress on AI implementation[41].

In various cases, Asian incentive packages have already translated into concrete investments in ATP, which puts pressure on the opportunity for Mexico, unless a policy to support the industry is deployed soon (1 to 2 years). For this, not only the proposals that emerge from this plan will be key, but also those that are defined taking into account the diagnosis currently carried out by the OECD for Mexico. This necessarily implies including in the *Master Plan* the areas of Investment, Infrastructure and Regulation recommended by the SIA investment attraction study.

Empowering talent. On the other hand, it has been recurrent from different studies and forums, that the main advantages of Mexico are found (in addition to its proximity to the US), in the competitiveness of its specialized workforce and in the accumulated knowledge of the electronics and automotive industry established that potentially facilitate a faster learning curve towards back-end activities such as ATP[42] and the supply / availability of materials and components (in these, PCB and substrates stand out)[43]. This means that the *Master Plan* must also work on the workforce and ecosystem areas identified by the SIA (2024), knowing that - in the case of Mexico -, it is not necessary to start from scratch. On the contrary, actions that allow generating the workforce required for back-end and its supply chain are needed. It has also been emphasized that such training, reskilling and upskilling initiatives must encourage the participation of women in these areas of the supply chain.

[41] https://www.tortoisemedia.com/intelligence/global-ai/
[42] Incluyendo los proveedores que hacen ATP para terceros: *Outsourced Semiconductor Assembly and Test* (OSAT, por su sigla en inglés)
[43] Este hallazgo es también aportado por Miller. C. & Talbot D. (2023).

Growth in ATP and Back-End. All the evidence gathered points to the fact that the potential development of back-end activities in Mexico enjoys a unique double complementarity condition in terms of supply chain. On one hand, the domestic market has the downstream electronics and communications and automotive industries. On the other hand, North America has the upstream chain specialized in design, IP, tooling and equipment, and wafer manufacturing[44]. Consequently, it is imperative that the *Master Plan* considers all the necessary measures to unlock investments to develop ATP, OSAT, PCB, substrates and supply of materials required for ATP (heat sinks, thermal trays, chemicals, among others). Table 2 shows the segments of the value chain with the greatest strength in Mexico and the greatest complementarity with the U.S. and reinforces this idea.

Substitute raw materials. In addition to this double complementarity, another specific opportunity relies on the fact that some countries have to grow the development of their semiconductor industry and this condition is related to the possibility of substituting raw materials such as some minerals and chemicals, which come mainly from China to North America. There are some studies that suggest that Mexico could develop the production of materials such as graphite, zinc, barite, manganese, tungsten, among others[45]. This is an area that must definitely has be incorporated in the *Master Plan*.

Strengthen design. Mexico must not neglect its installed capabilities in matters of design. This is an activity that complements ATP activities and is increasingly distributed globally. Likewise, it does not compete with / or duplicate the developed capabilities in North America (see Table 2).

Leading regional development. Having demonstrated that Mexico is the country with the most developed semiconductor industry in what refers to Latin America, the proper execution of this plan could also begin to trigger opportunities with other countries in the region.

[44] SIA & BCG. (2024)
[45] Con base en mapeos encomendados por el Consejo Coordinador Empresarial.

Mexico could lead the development of talent in the region and at the same time could begin to find complementarities in the supply chain with nearby countries such as Costa Rica, Colombia, Central America, among others.

TABLE 2. OPPORTUNITY FOR MEXICO BY SEGMENTS ACCORDING TO PRESENCE AND COMPLEMENTARITY WITH THE U.S.

SEGMENT	PRESENCE MX	U.S.	ASIA	OTHERS	OPPORTUNITY MX
ATP(1)	Moderate	3%	74%	23%	1
Materials	Moderate	9%	75%	16%	2
Design	Relevant	51%	35%	14%	3
Equipment and tools.	Low	47%	32%	21%	-
EDA & IP	Very low	68%	7%	25%	-
Wafer manufacturing	Very low	10%	75%	15%	-

Source: Own elaboration based on SIA & BCG (2024)
Relevant presence: several operations, several states. Moderate presence: presence in industries related or legacies. Low and very low presence: small and legacy operations. The best relocation opportunity arises from the combination between: Greater presence in MX + Lower participation of U.S. + Greater participation in Asia.
(1) There are validation centers in high-end and assembly presence of legacy and OEM-ODM technologies.

These 8 stylized facts are constituted in the foundations of the *Master Plan* and invite the adoption of a realistic but ambitious vision that considers the specialties in which Mexico has an advantage, but that does not ignore the fact that the country is not alone in this technological race and that other emerging countries, mostly Asian, are already obtaining relocation results. Therefore, this document formulates the following unified vision for the development of semiconductors in Mexico:

VISION OF THE MASTER PLAN FOR SEMICONDUCTOR DEVELOPMENT

> ***"Mexico should DOUBLE the SEMICONDUCTORS industry established in the country in the next 5 YEARS, COMPLEMENTING the growth in wafer manufacturing in North America, and INCREASE ITS RESILIENCE in the areas of Design, Assembly, Packaging, Validation (ATP) and Supply of materials and raw materials (minerals and chemicals), LEVERAGED in the ELECTRONICS, COMMUNICATIONS EQUIPMENT and AUTOMOTIVE industries."***

Based on this vision, a set of goals and actions are proposed below to bring the vision to reality. The actions are established for the key areas postulated by the SIA: **1. Competitiveness and Investment, 2. Workforce & Talent, 3. Infrastructure, 4. Regulatory Environment, and 5. Coordination & Ecosystem.**

These factors coincide with the thematic areas of work of the Collaboration Forum. They also share elements with the action plans of the roadmap proposed by FUMEC-USAID and incorporate the IDB's policy recommendations.

MASTER PLAN GOALS 2024-2030

1. Double the exports and employment in the semiconductor industry in Mexico.

2. Double and diversify the design activity of semiconductors in Mexico.

3. Relocate more than $10 billion USD worth of ATP operations in Mexico.

4. Relocate PCB operations, substrates, and other key back-end and supply chain inputs for the electronics, telecommunications equipment, and automotive industries in Mexico, reducing import dependence by 10%.

5. Double local sourcing of goods and services for semiconductor OEM, ODM, and CM.

6. Initiate the supply of raw materials from Mexico to improve the resilience of the semiconductor supply chain in North America and the region.

TABLE 3. MASTER PLAN ACTIONS 2024 – 2030

GOAL	ACTIONS 2024 - 2025	ACTIONS 2025 - 2027	ACTIONS 2027 – 2030
1. DOUBLE SEMICONDUCTOR EXPORTS.	1.1 Deliver the *Master Plan* to the Mexican Government and maintain the *Collaboration Forum*. 1.2 Implement the *Collaboration Agreement* for the semiconductor industry. 1.3 Elaborate Master Plans in 5 high-vocation states. 1.4 Build a base line that allows quantifying the semiconductor investment, exports and employment in Mexico. 1.5 Design the necessary tax investments for the development of the semiconductor industry. 1.6 Reform the *IMMEX Program* to make it competitive with programs in Asian countries. 1.7 End the controversies of returns that impact the investment of semiconductor companies. 1.8 Integrate the *OECD Recommendations* for the development of the semiconductor industry. 1.9 Create a national program for the scaling and sustainability of federal and state workforce and talent development projects, including those funded by ITSI, dual education and internships. 1.10 Design and implement a work and study visa program with key countries for relocation. 1.11 Include in the *National Infrastructure and Industrial Parks Plan* the transportation of water, electricity and telecommunications infrastructure to semiconductor vocation sites. 1.12 Define a *harmonization of standards plan* for semiconductor-related products in North America. 1.13 Design an investment attraction program and mission for back-end and its supply chain.	1.13 Implement 7x24 customs operations in key semiconductor trading states. 1.14 Implement a *fast track* and/or *trusted supplier* model for temporary imports of semiconductor-related goods.	1.15 Implement specific trade facilitation and technology transfer measures between vocation states and countries with greater semiconductor trade.
2. DOUBLE AND SOPHISTICATE SEMICONDUCTOR DESIGN.	2.1 Create mechanisms to promote design projects that meet the needs of the electronics and automotive industries established in North America.	2.2 Encourage cooperation between companies and industry (shuttle model) for the manufacture of designs of the Mexican R&D ecosystem.	2.3 Improve agility and costs in obtaining patents compared to leading countries in semiconductor design.
3. RELOCATE ATP AND OSAT.	3.1 Create talent acceleration programs that address the needs of ATP and OSAT with relocation potential.	3.2 Design and implement sustainable water and renewable energy use standards in semiconductor operations.	3.3 Create policy, talent and private project facilitation programs for scaling up and sophistication of ATP and OSAT operations for back-end from legacy and discrete to high-end semiconductor and packaging.
4. RELOCATE SUPPLY CHAIN (BACK-END AND DOWNSTREAM)	4.1 Create talent acceleration programs that address the needs of back-end and downstream (OEM-ODM-CM) supply chain operations with relocation potential.	4.2 Design and implement sustainable water and renewable energy use standards in semiconductor supply operations.	4.3 Create policy, talent and facilitation programs for private projects in order to expand and sophisticate back-end supply operations to move from basic components to more advanced ones (substrates).
5. DOUBLE LOCAL SOURCING (BACK-END AND ELECTRONICS)	5.1 Map local supply needs for back-end and electronics for goods and services with potential for import substitution.	5.2 Agree with the back-end and electronics industry on a local sourcing roadmap and a sourcing facilitation program.	5.3 Close local supply agreements with semiconductor and electronics companies.
6. INITIATE RAW MATERIAL SUPPLY FOR SEMICONDUCTORS.	6.1 Map local production capacity and competitiveness of key raw materials for semiconductors in North America.	6.2 Design a policy for the concession, sustainable exploitation and export of usable raw materials for the semiconductor industry.	6.3 Close agreements for the supply of processed raw materials from Mexico to North America.

The following is a brief description of the proposed actions and their justification:

1. Competitiveness and investment.

The Master Plan must be submitted to the elected government and the vocation states (Action 1.1) in order to trigger the activities to be carried out by the Mexican government. At the federal level, the Master Plan serves as an input to implement the *Collaboration Agreement* through actions (Action 1.2). The vocation states must elaborate their own Master Plans (Action 1.3) aligned with this National *Master Plan*. All of the above requires the consolidation of the baselines in terms of investment, exports, employment in order to follow up and measure the different plans and actions (Action 1.4).

It is over diagnosed that Mexico requires incentives to capture the attention and investments in ATP (Action 1.5). This aspect is included in the Collaboration Agreement. The existent problems with the current export promotion mechanisms, such as IMMEX program, must be solved (Action 1.6 and 1.7). This has been a recurrent matter in the dialogues with the United States, associations and Working Groups such as the PCB, since VAT refunds, which are directly applied by competing countries, can be out of date, delayed or even rejected through *ex post* audits by SAT in Mexico.

Additionally, the recommendations of the OECD analysis expected by the end of 2024 for the development of the semiconductor industry must be integrated (Action 1.8).

Finally, in an environment of competition for investment, a deliberate and permanent investment attraction effort is required; therefore, a program and investment attraction mission / campaign for back-end and its supply chain must be designed (Action 1.13).

2. Workforce and talent.

Currently, there already exist multiple initiatives related to the creation of careers, programs and curricula related to semiconductors at the federal and state levels, from English for semiconductors, to complete curricula for design.

Initiatives have also been created to detect talent needs and the required training such as the one led by the *Semiconductor Alliance Mexico*[46]. Likewise, different training initiatives will soon emerge once ITSI funds are allocated to different projects selected by the U.S. government.

Therefore, the main immediate need in terms of talent development lies in the scaling of such public and private initiatives. To this end, it is proposed as an action to create a national program for the scaling and sustainability of federal and state workforce and talent development projects, including those financed by ITSI, dual education and internships (Action 1.9).

However, there is also a need for programs in the areas of talent development where Mexico has yet to develop and that will take more time, such as ATP and OSAT (Action 3.1), as well as a need to address in a complimentary manner the downstream talent needs of OEMs, ODMs and CMs (Action 4.1).

In the area of design, the leading countries have programs that facilitate design and cooperation with downstream industries such as electronics and automotive. The idea of these programs is to finance academic initiatives or those of national and regional research centers in cooperation with companies in order to develop designs that meet local needs (Action 2.1).

In the same sense, cooperation between Academy and industry companies and industry (shuttle model) could be encouraged for the manufacturing of designs from the Mexican R&D ecosystem. In other words, projects in which financial support is given to the country's R&D centers to link up with semiconductor companies to manufacture their designs (Action 2.2).

[46] https://iberotech.org/semiconductor_alliance.php

In parallel, Mexico must improve the flexibility to receive workforce from relocation countries, which requires designing and implementing a work and study visa program with key countries for relocation (Action 1.10).

Finally, these efforts must evolve over time and become more sophisticated. As ATP, OSAT and key input supply operations such as PCB develop, so must the educational initiatives have to evolve towards more complex tasks. This implies the maturing of talent development oriented programs for packaging activities or the development of substrates (Actions 3.3 and 3.4). These actions must surely be developed as part of the expansion projects towards these activities.

3. Infrastructure

First of all, the National Infrastructure Plan proposed by the elected federal government in terms of water, energy and telecommunications infrastructure transportation must include initiatives to improve supply to semiconductor vocation sites (Action 1.11). Although it is unpredictable to know exactly where new investments and projects will be developed, they will undoubtedly be oriented to vocation states and areas where the industry is already present. In addition, the fact that these initiatives are included in the Plan itself will generate a positive signal for potential investors.

The sustainability component must be an integral part of the Plan and therefore, with the growth and maturing of the semiconductor industry in Mexico, standards of sustainable water and renewable energy use must be designed and implemented in semiconductor goods supply operations based on best industry practices (Action 4.2).

In terms of logistics, there are many opportunities to improve the traffic and logistics of goods in Mexico with North America and thus reinforce the competitive advantage vis-à-vis Asia. To this end, and as an example, 7x24 customs operations in key semiconductor trading states must be implemented (Action 1.14).

4. Regulatory environment

The regulatory environment presents a window of opportunity in areas such as trade, intellectual property and standardization.

In trade, leading countries have managed to implement fast track and trusted supplier models for temporary imports of semiconductor-related goods (Action 1.15). In the same line, temporary imports are the essence of activities such as design, ATP and back-end in general, since it works mainly on unfinished goods or goods that enter the country for an intermediate and temporal use, and not for the final consumer.

In the long-term, specific trade facilitation and technology transfer measures between vocation states and countries with increased semiconductor trade should be further studied and explored (Action 1.16).

In the area of intellectual property, with a growing design activity, it is necessary to improve the agility and costs of obtaining patents compared to those of leading countries in semiconductor design (Action 2.3), which would generate additional advantages for locating in the country, trust and alternatives to the foreign patent activity that predominates in the existing design centers.

In the area of standards, there is also much potential to achieve a more robust supply chain. Currently, semiconductor design services are provided in Mexico, but such services are mostly provided to parent companies and this does not translate to finished designs in Mexico and for the Mexican market.

To the extent that standards for electronic devices, communications and the automotive industry in North America are harmonized, this will positively impact the integration of the semiconductor supply chain in North America. A plan to harmonize standards for semiconductor-related products should be looked in this area (Action 1.12).

5. Coordination and ecosystem.

Finally, the coordination and ecosystem area is essential due to the fact that this is where the heart of the supply chain is located.

First and foremost, there is an urgent need to map local back-end and supply chain needs for goods and services with import substitution potential (Action 5.1). Subsequently, a local sourcing roadmap and a sourcing facilitation program need to be agreed on with the back-end and electronics industry (Action 5.2), to finally start obtaining wins and close sourcing agreements (Action 5.3).

A similar process must be followed for the supply of raw materials, mainly related to some minerals and chemicals. Afterwards, the corresponding mappings must be made (Action 6.1), followed by the design of a policy for the concession, sustainable exploitation, and export of usable raw materials for the semiconductor industry (Action 6.2) and finally the closing of the supply agreements (Action 6.3).

[47] Iniciativas similares existen en la India.

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