MINISTRY OF FOREIGN TRADE

GOVERNMENT OF COSTA RICA

ROADMAP FOR STRENGTHENING THE SEMICONDUCTOR ECOSYSTEM IN COSTA RICA

PREPARED BY THE MINISTRY OF FOREIGN TRADE

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CONTENT

ABBREVIATIONS

Term	Abbreviation
Investment Facilitation for Development Agreement	AFID
Trade Facilitation Agreement	AFC
Semiconductor Industry Association of the United States	SIA
Central Bank of Costa Rica	BBCR
Global Value Chain	GVC
Costa Rican Social Security System	CCSS
Science & Technology	S&T
National High Technology Council	CENAT
National Council of Private Higher Education	CONESUP
National Council of Rectors	CONARE
General Directorate of Customs	DGA
Directorate-General for Migration and Aliens	DGME
Multinational companies	MNC
Social Development and Family Allowances Fund	FODESAF
International Fund for Innovation and Technology Security	ITSI Fund
Greater Metropolitan Area	GAM
Global Minimum Tax	IMG
Costa Rican Institute of Pacific Ports	INCOP
Costa Rican Tourism Institute	ICT
Joint Institute of Social Assistance	IMAS
National Learning Institute	INA
National Insurance Institute	INS
Technological Institute of Costa Rica	TEC
Foreign Direct Investment	FDI
Research & Development	R&D
Research, Development, and Innovation	R&D+i

CHIPS Act and Science	CHIPS Act
Costa Rica's National Qualifications Framework for Technical Vocational Education and Training	MNC-EFTP-CR
Ministry of Science, Innovation, Technology and Telecommunications	MICITT
Ministry of Foreign Trade	COMEX
Ministry of Economy, Industry and Trade	MEIC
Ministry of Public Education	MEP
Ministry of National Planning and Economic Policy	MIDEPLAN
Ministry of Foreign Affairs and Worship	MREC
Ministry of Labor and Social Security	MTSS
World Intellectual Property Organization	WIPO
World Trade Organization	WTO
Organization for Economic Co-operation and Development	OECD
State of the Nation Program	PEN
Costa Rican Promoter of Innovation and Research	PCII
Costa Rican Foreign Trade Promoter	PROCOMER
Free Trade Zone Regime	RZF
Technical Secretariat of the Budgetary Authority	STAP
STEM	Science, Technology, Engineering and Mathematics
Information and Communication Technologies	Tics
University of Costa Rica	UCR
National Technical University	UTN

Presentation

The semiconductor industry has become the backbone of the global economy and a powerful driver of investment. The growing importance of the sector has led to a discussion about the architecture of its supply chain, which is highly concentrated geographically and has limited possibility of quickly adapting to disruptions. As a result, the industry has demonstrated not only the interest but also the need to create a more resilient and diversified chain that enables sustainable growth in the face of the increase in demand caused by new technologies and guarantees the availability of qualified human talent. This resilience could be achieved by strengthening segments of the supply chain in other latitudes, such as Latin America.

Costa Rica is uniquely positioned to help the industry overcome vulnerabilities of the semiconductor supply chain and contribute to value-added processes. Our country is recognized worldwide as a safe and reliable investment destination, characterized by an open market economy, legal security, political stability, democratic values, and sustainable vision. Costa Rica has distinguished itself for being adaptable and innovative, with a highly skilled talent pool and experience in high-value-added sectors. This has allowed the country to host an advanced national semiconductor ecosystem with more than 25 years of experience in manufacturing and in the development of the human talent that is required by the industry.

This experience, along with a solid reputation as a recipient of foreign direct investment, has made Costa Rica a key partner for the semiconductor industry and explains the crucial role it will play in the sector's diversification and geographic expansion. Proof of this is that it was the first country in the world to be designated a strategic ally of the United States under the Chips and Science Act (CHIPS Act).

The current situation represents a historic opportunity for Costa Rica in the international arena as the semiconductor industry seeks flexibility and diversification in its supply chain. In this context, the country is in a unique position to consolidate itself as an ideal destination for investments related to this sector, thus contributing to mitigating the existing vulnerabilities in this chain at a global level.

In this context, the Ministry of Foreign Trade (COMEX) presents the Roadmap for Strengthening the Semiconductor Ecosystem in Costa Rica, an inter-institutional initiative involving more than 20 public entities, the private sector, and academia.

The Roadmap has two fundamental objectives: (i) to generate a vision of the country's position and competitiveness with respect to the semiconductor industry, and (ii) to formulate clear actions that benefit the industry and, at the same time, strengthen the country's investment attraction proposal, based on specific investment drivers in this sector and on Costa Rica's strengths compared to other competitors at the regional and global levels. The achievement of these objectives will be based on four pillars, each with short-, medium- and long-term action plans. These pillars are described in detail below:

1) Human Talent and Workforce: Focuses on the education and training of specialized professionals for the semiconductor industry. The plan details initiatives to increase and strengthen installed capacity, promote bilingualism, attract specialized talent, and encourage applied research

2) Incentives 2.0: Seeks to modernize existing incentives and design new ones to encourage research and development (R&D) and foreign direct investment (FDI), especially in the context of new international tax rules.

3) FDI Attraction: This strategy focuses on positioning Costa Rica as an attractive destination for investments related to the semiconductor industry. It uses prospecting and collaboration strategies to attract projects that contribute to the sector's growth and consolidation.

4) Regulatory Improvement and Investment Facilitation: This pillar is centered on the transparency, efficiency, and competitiveness of the regulatory environment. Strategic areas such as health, immigration, intellectual property protection, and trade facilitation are addressed.

The document reflects Costa Rica's ambition to position itself as a leading destination for the semiconductor industry. This effort aims to capitalize on the unique opportunity to attract investment, consolidate a more transparent, secure, and sustainable value chain, and contribute significantly to the country's socio-economic development.

Manuel Tovar Rivera Minister of Foreign Trade	**Indiana Trejos Gallo** Vice-Minister of Foreign Trade

A Country Vision: Costa Rica as a Strategic Partner of the Semiconductor Industry Worldwide

Assessing the Present Context

The semiconductor industry, also known as microchips, has grown exponentially over the past three decades, reaching a value of US$550 billion in 2022. (Gartner, 2024) Currently, semiconductors are the fourth most traded product globally. It should be noted that three of the five largest investment projects announced globally in 2022 belonged to the semiconductor industry. During that same year, there was a 5% increase in investment projects in industries highly dependent on global value chains, such as this sector. (UNCTAD, 2023) This growth, intrinsically linked to technological advancements that impact multiple aspects of everyday life, has resulted in this industry being regarded as the "backbone" of the global economy. (Baisakova & Kleinhans, 2020)

Despite its success and transcendence, the semiconductor industry faces significant challenges regarding its supply chain. The dependence on a small number of companies for the production of state-of-the-art microchips, the scarcity of raw materials, and a high geographical concentration, considering that manufacturing processes are mostly carried out in Asia, are just a few examples of obstacles that must be addressed. The current structure of this highly concentrated, specialized, and interdependent chain does not offer the necessary flexibility for the industry to respond adequately to demand or adapt to events that may paralyze or limit semiconductor production.

These vulnerabilities have been exacerbated in recent years, especially by disruptive events such as the COVID-19 pandemic. For example, during this period, the industry was forced to prioritize semiconductor manufacturing to meet increased demand in sectors such as cloud computing and electronic devices, resulting in a shortage of microchips. In addition, events such as earthquakes, fires, and droughts in major Asian manufacturing hubs increased this shortage, affecting approximately 169 industries. (Bhandari, 2023)

The increase in demand due to technological advances such as electric vehicles, the Internet of Things (IoT), artificial intelligence, and automation adds additional pressure on the industry's supply chain. The possibility of disruptions for geopolitical reasons, as well as an eventual wave of shortages, opens up new opportunities for its expansion, where diversification of supply sources seems to be an imperative necessity.

Therefore, the rebalancing, flexibility, and resilience of the semiconductor industry's supply chain presents a huge opportunity to attract investment to Latin America, particularly Costa Rica.

Currently, the country has a national semiconductor ecosystem made up of more than a dozen companies with more than a quarter of a century of experience in the manufacture of these components and the generation of the human talent required by the industry. The companies installed in the country participate in the segments of research and development (R&D), design, verification, assembly and testing, and the ecosystem also has companies that supply testing machinery and manufacturing components. (COMEX, 2024) The structure of the sector shows several short and medium-term opportunities for the development of the local industry and for investment attraction, such as the strengthening

and attraction of existing segments in the country, as well as the possibility of attracting new segments, such as advanced packaging and key suppliers for the industry.

Faced with this opportunity, in 2022, Costa Rica submitted a country value proposition to the U.S. Government to be considered as an ally within the framework of the Chips and Science Act (CHIPS Act) and thus access funds from the International Fund for Innovation and Technology Security (ITSI Fund); aimed at the development and strengthening of the semiconductor industry's supply chain. In July 2023, the U.S. Department of State announced the country as the first strategic ally in the world to (i) explore opportunities for diversification and expansion of the national semiconductor ecosystem, (ii) establish a more transparent, secure, and sustainable global supply chain, and (iii) strengthen the country's capabilities in the generation of talent for the assembly, testing and packaging segment (ATP).

In addition, COMEX is leading actions to expand and strengthen all the segments represented in our national ecosystem. In this sense, it has embodied initiatives in this Roadmap with the aim of benefiting companies installed in the country and contributing to the efforts to attract investment in this sector. Other additional initiatives, such as the Center of Excellence led by the Ministry of Science, Innovation, Technology and Telecommunications (MICITT) and by the National Learning Institute (INA), where COMEX participates in the semiconductor axis, will also contribute to the training of talent for the industry at the national and regional level.

In this context, the country is facing a historic opportunity to consolidate itself as an ideal destination for this type of investment and contribute to solving existing vulnerabilities in the supply chain. This Roadmap is the result of an interdisciplinary and intersectoral construction, which aims to cement the foundations of the vision and direction towards which Costa Rica must work in the coming years to strengthen and attract this industry, identifying short, medium, and long-term actions that benefit the existing national ecosystem and positively impact the attraction of investment in this strategic sector.

Looking to the Future to Power the Present

Intense competition to secure a place in the new definition of the semiconductor industry's value chain is already underway regionally and internationally. This situation has led some countries to take exceptional public policy measures to ensure the success of attracting investment from the industry to other latitudes. This section analyzes the global situation and underlines the importance of the country taking immediate action to provide an optimal investment climate for this industry.

In the last two years, different countries in North America, Europe, and Asia have made public their long-term vision to attract a part of the investment that is projected for the industry in the coming years through various strategies to strengthen their national ecosystems.

For example, the enactment of the CHIPS Act in August 2022, which came in response to vulnerabilities exposed during the semiconductor shortage crisis in 2021, marked a significant milestone in U.S. industrial development. This policy, the strongest yet in terms of resources and ambition, reflects the urgency of addressing industry vulnerabilities that have already been identified.

The CHIPS Act established the ITSI Fund, allocating US$500 million to the Department of State (US$100 million annually for five years, beginning in FY 2023). This fund, of which Costa Rica is a beneficiary, has as its main objective to support the creation of a secure supply chain for the industry through collaboration with allies and business partners.

Canada has announced a US$240 million investment to boost the semiconductor sector in the country and become a leader in the sector in the Americas. This investment will be used for research, development, and talent training programs, as well as incentives to attract foreign investment and promote innovation in the sector.

In Europe, the United Kingdom has published its National Semiconductor Strategy, focused on the development of the national industry in research, development and innovation (R&D+i). With this approach, the country seeks to strengthen its capacity to design and produce cutting-edge semiconductors, consolidating itself as a leader in technology and promoting job creation and economic growth.

In Asia, India has launched a new program aimed at attracting semiconductor factories as part of its plan to become a global design and manufacturing hub. This program seeks to leverage India's talent, skilled workforce, and growing domestic market to establish a strong presence in the industry and foster technological innovation.

In addition, Vietnam recently announced that it will be implementing a National Semiconductor Strategy by 2024, offering policies and programs to attract foreign investment, foster talent generation, and strengthen its technology infrastructure, with the aim of becoming a major semiconductor manufacturing and export hub in Southeast Asia. Meanwhile, the Philippines is working on improving its technology infrastructure and promoting policies that encourage foreign investment in the sector in order to become a major player in the global semiconductor supply chain.

On the other hand, Latin America, Panama, and Mexico have established strategic alliances with universities and are strengthening their relationships with key countries in the sector,

such as the United States and Taiwan, to improve their competitiveness and become a manufacturing and technology development center in the region.

This evaluation of public policies designed at the global level to strengthen the semiconductor industry supports Costa Rica's need to take strategic measures to continue strengthening its position in this sector and become a hub in the Latin American region.

The Semiconductor Industry Association of the United States (SIA) has identified some priority policies for the sector, which have been considered as part of the actions defined by COMEX. Among the policies identified by SIA (2024) are:

- **Investment In Research**: State incentives in scientific research have enabled some of the most revolutionary inventions of recent years.
- **Foreign Trade Platform**: The semiconductor industry continues to expand globally. Trade openness is a fundamental driver of global growth and development, which is why public policy aimed at promoting a broad foreign trade platform is a priority for the sector.
- **Incentives for the Semiconductor Industry**: The existence of incentives for this sector is an important driver for this industry.
- **Environmental Policies**: The semiconductor industry is recognized for promoting sustainable design and manufacturing, considering that it is a water—and energy-intensive sector. Therefore, the existence of policies and regulatory frameworks that promote clear environmental procedures and sustainable investment represents an added value for the industry.
- **Sanitary Regulations**: These regulations are indispensable in semiconductor manufacturing. These policies are also linked to the high dependence on chemicals in some manufacturing processes.
- **Workforce**: One of the key factors driving growth and innovation in the semiconductor industry is the availability of highly skilled professionals to create jobs and develop new technologies. This includes the consideration of immigration regulations to access specialized talent in the area.

For this reason, COMEX, looking to the future, designed a Roadmap for the Strengthening of the Semiconductor Ecosystem in Costa Rica and the country's value proposition with two priority objectives: (i) to generate a vision of the country's position and competitiveness with respect to the semiconductor industry, and (ii) to formulate clear initiatives that will benefit the industry and, at the same time, strengthen the country's investment attraction proposal based on the specific investment drivers of this sector and Costa Rica's strengths compared to other competitors at the regional and global levels.

Public Policy Pillars

The Roadmap for the Strengthening of the Semiconductor Ecosystem in Costa Rica is based on four pillars designed to guide the actions of public institutions that contribute to promoting the sustainable and continuous growth of the industry and the benefits that this would entail around the country's development objectives. These pillars are as follows:

1. **Human Talent and Workforce**: This pillar recognizes the importance of human capital in innovation and technological development. It focuses on the education and training of specialized professionals in the semiconductor industry.
2. **Incentives 2.0:** This pillar focuses on creating an attractive environment for investment and innovation by proposing public policy actions to modernize existing incentives and designing incentives that promote R&D. The aim is to attract FDI and promote the expansion and diversification of the sector in Costa Rica.
3. **Attracting FDI:** Based on the potential of foreign investment as an engine of socio-economic development, this pillar is oriented towards the active promotion of Costa Rica as an attractive and conducive destination for investment in semiconductors. Through prospecting and collaboration strategies, it seeks to attract investors and projects that contribute to the growth and consolidation of the sector.
4. **Regulatory Improvement and Investment Facilitation:** Considering the importance of a transparent, efficient, and competitive regulatory environment, this pillar focuses on identifying opportunities for policy and regulatory improvement that directly impact the sector in strategic areas.

Each pillar of the Roadmap includes an action plan with short-, medium--, and long-term measures to strengthen the semiconductor industry.

Pillar 1: Human Talent and Workforce

Global Context and Trends

The semiconductor industry, a fundamental pillar of digital transformation and economic development, faces a crucial global challenge: the shortage of specialized human talent. To take advantage of opportunities for growth and diversification in the industry, it is imperative to promote the training and development of technical and professional talent.

The specialized skills gap is a critical factor that must be addressed to ensure the availability of a skilled workforce capable of meeting the growing demand of the industry. According to (Brugmans et al., 2024), the main barriers to talent development include the shortage of graduates in STEM areas, the aging of the workforce, difficulties in attracting and retaining talent, as well as the lack of popularity of the industry, which limits the attraction of talented young people.

To address the challenges related to the shortage of specialized talent, countries such as the United States have reviewed their immigration and training policies in STEM areas, seeking to increase the level of skills available. This drive towards specialized training is reflected in global employment projections. For example, in the United States, an additional 115,000 jobs are expected to be created by 2030, and more than 27,300 vacancies have been projected for engineers. (SIA, 2023)

This trend is replicated in Europe and Asia, where countries have intensified their efforts to fund and orient educational institutions towards disciplines such as electronics and microelectronics, recognized for their high employability and demand in industry. The United Kingdom, for example, has announced a £5 million investment aimed at financing projects that address the talent and skills gap related to the semiconductor industry through initiatives such as internships, technical and vocational courses, and STEM ambassadors, among others. (UK Research and Innovation, 2023)

Solutions to address the need for talent focus on training and attracting specialized human talent. Competition for talent attraction has become a high-priority global phenomenon for countries looking to expand their semiconductor ecosystem. In the short term, specialized foreign talent represents an opportunity for countries to close gaps and meet the most immediate demands, complementing the national force and promoting the transfer of technical knowledge. The Organization for Economic Co-operation and Development (OECD) explains that the migration of professionals can be a useful tool to correct skills mismatches and address specific skills shortages. In response, countries have adapted their migration policies and regulatory frameworks to improve their business climate and the conditions for attracting and retaining human talent. (OECD, 2019)

The OECD has created a mechanism to measure the conditions of countries that make them more attractive to foreign talent. The combination of regulatory procedures and conditions and opportunities for foreigners are the differentiating advantages between one country and another. For example, the availability of employment, access to the internet, the ability to communicate in English and investment in R&D are part of the elements that create a competitive environment to attract talent. (OECD, 2023)

These global trends represent an opportunity for the region and reflect the importance of identifying each country's enabling conditions and the specific areas where added value can

be generated in the semiconductor industry chain. Given its scale, complexity, and innovation, it is necessary to understand where there is potential for talent training that meets the specific needs of this industry, with the aim of positioning Costa Rica as a competitive destination.

Prospecting and analyzing emerging technologies and development opportunities for the country has yielded results in areas of high-value-added talent that meet the needs of digital transformation. Therefore, Costa Rica is ready to provide solutions to the global challenge of generating specialized talent for the semiconductor industry.

Current Situation in Costa Rica

Costa Rica stands out internationally for multiple social and economic achievements, and education has been one of the main differentiating pillars for attracting FDI. The country's long-term vision and public investment in providing free education and universal coverage have resulted in its positioning as one of the best investment destinations in Latin America in terms of human capital, job skills, and quality education.

The country has demonstrated its ability to anticipate and respond appropriately to emerging challenges, turning them into tangible opportunities. Aware of the importance of addressing the global talent shortage, the country has prioritized strengthening and expanding its national ecosystem. Currently, continuous, open, and transparent dialogue is maintained with different actors in industry and academia through different means (such as accompanying companies to promote tailor-made education programs and dual education, among others) to outline joint actions that promote the development of competitive human talent through different working groups. This is with the aim of linking the needs of the private sector with the public policies promoted by the competent institutions in the field of training and employability.

Costa Rica is one of the few countries in the region with experience in semiconductor manufacturing, in addition to Mexico and Brazil, that have participation in the value chain. Currently, the semiconductor industry generates around 5,000 direct jobs in Costa Rica (COMEX, 2024). Given the imminent opportunity for the country to diversify and expand the sector, this number could grow significantly in the coming years.

The discussion on the demand for skills in the labor market and supply began several years ago in the country. The knowledge economy shows a reality where skills and crossovers between profiles from different disciplines are rapidly changing, reflecting accelerated innovation and technological advances. Ten years ago, artificial intelligence was a developing and unknown topic, but currently, the Ministry of Public Education (MEP) has the first technical specialty in this area, launched in 2023.

Considering that Costa Rica is one of the few countries in the region that is a member of the OECD, the country also has great opportunities for improvement both in the implementation of attractive and flexible migration policies, as well as in other elements that reflect a good quality of life for foreigners. This is critical, as attracting educated and specialized talent can complement local talent to generate a multiplier effect of the technological development that countries are seeking. (OECD, 2023)

Therefore, a tripartite collaboration involving academia, government, and companies is essential to ensure talent training that considers the skills and knowledge required by the industry. In addition, it is essential to consider financing options that support the actions, as

well as to foster a culture of entrepreneurship to enhance knowledge spillovers and innovation between local industry and FDI, as well as linkage opportunities.

As a result of the mapping carried out to companies linked to the semiconductor industry, it was identified that it is essential to promote existing public policies in the development of talent at three different levels: technical, professional, and highly specialized. The country does not have specific doctoral training programs for semiconductors, so it is imperative to attract or train more people at the doctoral level in these areas. The proposal to boost these three levels of talent is to establish a route based on the mapping of supply and demand. This route will guide short-, medium-- and long-term efforts and actions, focusing on labor supply and the generation of critical skills for the sector. Below are 1.1) a summary of the current consolidated supply of technicians and professionals in Costa Rica, 1.2) the results of a talent supply and demand analysis conducted by COMEX, and 1.3) the priorities for semiconductor talent development.

1.1) Academic Offering for Semiconductors

In Costa Rica there are multiple training programs aimed at advanced manufacturing processes, including the semiconductor sector, ranging from technicians to master's degrees. It is important to note that the talent platform already exists in the country, and with it, the educational infrastructure of laboratories, specialized academics and a diverse offer distributed between public and private centers.

Multiple institutions, such as public and private universities, INA, and MEP, offer these programs. Approximately 3,035 professionals graduated in 2022 in priority areas for the semiconductor industry and 7,903 technicians in the same year, which reflects the solid human talent platform that already exists in the country at the technical and professional level (qualified personnel), but not so in terms of highly specialized personnel. Costa Rica's trained talent is highly qualified, and the country faces the challenge of expanding the number of technicians and professionals available in line with the increase in demand. However, the niche of highly specialized talent must be filled initially through policies to attract foreign professionals and the Costa Rican diaspora.

Below are the main academic programs offered nationally related to the semiconductor industry:

Academic Institutions	Programs & Trainings
UNIVERSITIES	
Technological Institute of Costa Rica (TEC)	**University Bachelor's Degree:** • Electronic Engineering • Computer Engineering • Mechatronics Engineering • Materials Engineering • Industrial Design Engineering **Masters' Degree:** • Electromechanical Engineering • Electronics

	• Computing with an Emphasis in Computer Science • Electronics with an emphasis in Microelectronics **PhD in Engineering**
University of Costa Rica (UCR)	**University Bachelor's Degree:** • Industrial Electromechanical Engineering • Electrical Engineering with Specialization in Computer Networks and Electronics and Telecommunications • Computer Engineering – emphasis in Computer Science or Software Engineering **Masters' Degree:** • Electrical Engineering • PhD in Engineering
National Technical University (UTN)	**University Bachelor's Degree:** • Electronic Engineering • Electromechanical Engineering • Electrical engineering • Software Engineering
State Distance University (UNED)	• Telecommunications Engineering • Computer Engineering
Private Universities: Texas Tech, Universidad Hispanoamericana, Universidad Latina, Fidélitas, ULACIT, Universidad Central, CENFOTEC	**University Bachelor's Degree:** • Electrical Engineering (At least 2 programs) • Electronic Engineering (At least 4 programs) • Electromechanical Engineering (At least 3 programs) • Computer Engineering (At least 3 programs) • Software Development Engineering (At least 5 programs)
TECHNICAL PROGRAMS	
National Learning Institute (INA)	• Industrial Electronics • Mechatronics • Electromechanics (Dual Modality)
Ministry of Public Education – Technical modality	A. Electronic Engineering B. Electromechanics C. Electronics in Telecommunications D. Installation and Maintenance of Electrical Systems
Academic Institutions	**Programs & Trainings**
TECHNICAL PROGRAMS	
TEC	• Electromechanical
National University (UNA)	• Electrical Technician • Electrical Metrology Technician in Production Systems
UTN	• Diploma in Mechatronics
CUC (Colegio Universitario de Cartago)	• Electronics

COVAO (Vocational College of Arts and Crafts)	• Industrial Electronics
International Polytechnic University	• Basic Electronics
University of Costa Rica (UCR)	• School of Electronics Continuing Education
Fidélitas University	• Basic Semiconductor Manufacturing
Invenio University	• Diploma in Design and Manufacture of Mechatronic Systems
RESEARCH CENTERS	
• Center for Research in Information and Communication Technologies (CITIC, UCR) • Center for Research in Mathematics and Meta-Mathematics (CIMM, UCR) • Center for Research in Electrochemistry and Chemical Energy (CELEQ, UCR) • Center for Space Research (CINESPA UCR) • Center for Research in Pure and Applied Mathematics (CIMPA, UCR) • Center for Research in Materials Science and Engineering (CICIMA, UCR) • Center for Research in Atomic, Nuclear and Molecular Sciences (CICANUM, UCR) • Center for Research in Computing (TEC) • Center for Research and Extension in Materials Engineering (CIEMTEC, TEC) • Laboratory of Research and Technological Innovation, R&D Building of the State Distance University (UNED) • National Nanotechnology Laboratory (LANOTEC, CeNAT) • National Collaboratory of Advanced Computing (CNCA, CeNAT)	

This academic offer has allowed the country to develop a base of human talent backed by more than a quarter of a century of experience in this sector.

1.2) Studies Carried Out by the State of the Nation Programme of the National Council of Rectors

In the last quarter of 2023, COMEX established a strategic alliance with the State of the Nation Program (PEN) of the National Council of Rectors (CONARE) to measure the supply and demand of human talent in the industry. Databases from the PEN-CONARE online portal were used, and a survey was designed for 13 of the main companies in the sector to estimate the demand for talent. This joint effort identified the necessary professional profiles and the "zones" of professional talent inside and outside the Greater Metropolitan Area (GAM) to strengthen the human talent ecosystem in the country and guide investment decisions (Durán Monge et al., 2023). The following is a summary of the main findings of the study carried out by PEN and the survey carried out by COMEX.

1.2.1) Professional Talent Pipeline for the Semiconductor Industry

To quantify the supply of professional talent, critical profiles were identified in conjunction with the industry, which indicated special interest in the following: Electrical and Electronic Engineering, Electromechanical Engineering, Mechanical Engineering, and Mechatronics, as well as two groupings of disciplines related to Information and Communication Technologies (ICTs), which are Computer Science and Informatics and Information and Communication Engineering. Based on this, the trends in the graduation of new professionals during the period 2000-2022 in the previously identified disciplines were analyzed.

The results obtained show the following:

- **There is an opportunity to improve the graduation level in areas related to semiconductors:** Costa Rica has the opportunity to increase the graduation level in STEM careers since in 2022, 26% of the diplomas awarded correspond to the four areas of Exact and Natural Sciences[1]. This percentage drops even further if you consider only the semiconductor-related disciplines, which account for 6% of graduates in that year.
- **Growth in the rate of graduates:** Between 2000 and 2022, the number of graduates in the six disciplines associated with semiconductors mentioned above grew at an average annual rate of 8.3%. This is a positive result and a trend that could continue and should be strengthened.
- **High concentration of ICT professionals:** 75% of the personnel trained in the semiconductor areas correspond to areas associated with ICTs. This talent profile is required in multiple sectors and, therefore, is in high demand by different industries.
- **Graduates in disciplines associated with semiconductors are mostly a young population with a low presence of women:** 40% of professional talent is young (under 35 years old), and women represent only 21% of the supply in these disciplines. This gender gap remains the same in all the professions considered, but it is accentuated in disciplines related to ICTs.
- **Baccalaureate stands out as the highest academic degree.** At the academic degree level, the university baccalaureate prevails as the highest academic degree (66% of professionals in these areas are baccalaureates), and the low presence of personnel with postgraduate studies stands out. This data is important, as it could limit the growth in links with a high level of specialization, such as R&D, segments in which greater added value could be generated in knowledge transfer.
- **High concentration of supply in the GAM:** 77% of the talent is located in the GAM. For example, the focus in the central region was identified as having the highest concentration of professionals (more than 22,000 professionals within a 15 km range). However, other zones of professionals outside the GAM with relevant capabilities to the semiconductor industry are also identified, such as Occidente del Valle Central, Esparza, San Carlos, Puriscal, and Pérez Zeledón.

1.2.2) Technical Talent Offering For the Semiconductor Industry

Graduation trends were analyzed for specialties that the industry recognized as critical areas, including the fields of "Software and Web Application Development and Analysis," Network and Database Design and Administration, and Electronics and Automation for the period 2014 – 2022. The main findings are summarized below:

- **Technical talent is increasing at a faster rate than professionals:** 14% of technical education graduates between 2014 and 2022 correspond to the profiles required by this industry (versus 6% in professional profiles for the same period). Expenditures in these areas show an average annual growth of 19% between 2014

[1] Natural Sciences, Engineering and Technology, Medical and Health Sciences, Agriculture and Veterinary.

and 2022, driven mainly by Network and Database Design and Administration profiles.

- **The gender gap persists in technical profiles**: Of the total number of graduates between 2014 and 2022, only 14% of the talent trained at the technical level are women.
- **High-level profiles predominate:** 51% of the technical offer consists of intermediate MEP technicians who correspond to level IV and intermediate MEP technicians, which is growing at an average annual rate of 13%.

1.2.3) Survey Conducted by COMEX: Characterization of the Demand For Semiconductor Talent

COMEX launched a survey between November and December 2023 to measure and evaluate the demand for technical and professional talent required by this industry from companies linked to the sector in the country.

The survey also offers an assessment of the occupational profiles needed along with the sector's perspective on the indispensable skills and the need for the required vacancies for the next three years. The main findings are summarized below:

- **Demand for talent varies according to the link in the chain**: By 2023, it is estimated that semiconductor companies will generate more than 4,993 jobs in Costa Rica. Most of the talent demanded by the semiconductor industry is professional (66.3%), followed by technicians (12.6%). It should be noted that this distribution varies significantly depending on the link in the chain in which the company participates. For example, in design and verification companies, professional talent is 90%, while assembly and testing companies are 39%.
- **There are opportunities to increase female employment participation**: Women make up only 33% of the industry's current workforce. Companies were interested in increasing this participation. However, the shortage of labor supply was seen as one of the main obstacles to achieving this.
- **Interest in increasing hiring**: 92% of companies report their intentions to increase the demand for professional and technical talent for the next three years. The estimated demand is around 380 new jobs per year (under a conservative scenario), and 73% of the profiles that will be required are professionals. The most in-demand careers are Electronic Engineering, Computer Science and Informatics, and Industrial Production. It should be noted that companies are willing to hire more staff in operational (with a basic level of education) and technical areas, which expands employment opportunities at different levels. This poses new challenges to preparing the required talent since both the training of professionals and the programs and curriculum of these careers must be scaled up, which must incorporate the content required by companies.
- **There is no demand for hiring outside the GAM:** The high concentration of companies and demand in the GAM constitutes a barrier to the inclusive development of the industry at the territorial level.
- **Bilingualism is one of the main challenges in hiring:** English language proficiency is identified as the main barrier to hiring new talent, even compared to

the lack of skills specific to industry activities. 83% of companies indicated that they require an intermediate level of English (B2). Therefore, English proficiency is considered as important as the rest of the industry-specific technical knowledge. Even if there are enough professionals in the required areas, if they do not have English language proficiency, it will not be possible to employ them in this industry.

- **Companies perceive gaps in critical skills**: The high level of industry specialization and the great speed of technological change mean that most companies highlight the existence of knowledge gaps in certain essential industry topics, such as very large-scale integration (VLSI), mechanical and thermal analysis, data analysis, and programming languages.
- **There are gaps in soft skills**: Companies consider that the following soft skills should be reinforced from an early age: Working in a multidisciplinary team, communication skills, and problem-solving.

The findings highlight the opportunity to strengthen the supply of talent in specific areas and address challenges such as the gender gap and soft skills, boosting the growth and competitiveness of the semiconductor industry in Costa Rica.

1.3) Priorities for Semiconductor Talent Development

In response to the main results of the studies on supply and demand, the following issues have been identified as priorities to scale the supply of human talent available for the semiconductor industry:

- Strengthen and accelerate technical training, as it is critical to the growth of the assembly and testing segment.
- Promote a joint review of the government, universities, and industry's offers of technical and professional careers to align them with the labor market's needs while promoting careers in technological areas.
- Train talent in other skills and areas demanded by companies in the semiconductor ecosystem and related industries.
- To reach a critical mass of people with a knowledge of at least English B2 level, which meets the required demand[2].
- Reduce gaps in soft skills, such as logical reasoning and critical thinking, the ability to work in a team, and the ability to communicate effectively.
- Address the limitations in the profile of teachers. Teacher effectiveness is the most important factor in effectively influencing learning and skills development and reducing inequality. Therefore, it is necessary to attract, develop, and retain highly qualified personnel to teach in areas of high demand.
- Promote vocational guidance from childhood in order to attract more inclusive talent to this industry.

[2] A good command of English is considered essential for young people to be able to take up better-paid jobs and contribute, in turn, to the growth of the Costa Rican economy (Mayorga López, 2018)

- Strengthen communication with the productive sector. Institutions must strengthen communication with the industry through articulated governance with clear objectives and indicators.
- Prioritize closing the gender gap to scale and diversify this industry. Vocational guidance and work from childhood are fundamental for this.
- Generate legal tools and incentives to enhance the attraction of specialized talent and provide continuity through a long-term policy.
- Generate research capacities, foster greater collaboration between academia and the private sector, and strengthen the infrastructure of laboratories and other facilities necessary to promote an R&D+i ecosystem in Costa Rica. The country has enormous potential to increase its contribution to science and technology, with stable foundations of public education, which have allowed the development of a network of research centers and specialists dedicated to creating knowledge.

The following work plan is established to address these challenges and boost the semiconductor industry. It identifies short-, medium-, and long-term actions that seek to strengthen and address the priorities above through inter-institutional articulation with the private sector and academia.

This plan is consistent with the National Plan for State Higher University Education 2021-2025, the National Employability Strategy (Brete Strategy), coordinated by the Ministry of Labor and Social Security (MTSS), and where COMEX participates with the MEP, the MICITT, the INA, and PROCOMER. The Strategy has pillars such as labor market intelligence, population prioritization, and labor intermediation to identify the areas of greatest demand by companies and generate public policies aimed at employability and training for employment. Therefore, each initiative of this Roadmap is integrated with the strategic axes established in the Brete Strategy and in the National State University Higher Education 2021-2025

Action Plan

Costa Rica is projected as a talent hub in Latin America. To meet a greater demand for talent in the future, the number of technicians, engineers, and Ph. Ds must increase to meet the needs of the advanced manufacturing and semiconductor sectors, which share the same profiles sought by other industrial sectors.

Based on the results presented, this action plan is divided into four main axes: (i) initiatives aimed at strengthening and expanding the installed capacity and number of graduates aimed at the semiconductor industry; (ii) actions aimed at strengthening bilingualism; (iii) actions needed to attract highly specialized talent and (iv) efforts to create research capacities applied to this industry. Below are the vision, objectives, and actions proposed for each axis.

Axis 1: Development of Talent Specialized in Semiconductors

Vision: To turn Costa Rica into the first talent center for the semiconductor sector in Latin America, generating technical and professional talent in STEM areas, taking into account the pace at which the demand for talent increases, both in the sector and in related industries.

General Objective: To expand the existing offer and offer new technical and university education programs that respond to the talent needs of the semiconductor industry in the areas of design, R&D, assembly, and testing, positively affecting the availability of talent.

Specific Objective 1: To align the technical curriculum to the needs of the sector in the most demanded areas of the semiconductor industry.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Update the curriculum of technical programs in Electronics, Electromechanics, Industrial Maintenance, Installation and Maintenance of Industrial Electrical Systems, and other related programs, which include the contents identified in the gap analysis defined by the companies. Brete Strategy Action Plan, Talent Training Component – A1.1.	• To have up-to-date programs according to the needs of the industry. **Example:** The MEP's Networks specialization was updated in 2023 and incorporated the configuration and support of communication networks and operating systems as indicated by the employer sector.	MEP INA College Schools Technical Training Centers	COMEX PROCOMER MTSS MICITT CONARE	Collaboration between academia and industry to include the required content in training programs. Collaboration between industry and government to monitor and offer feedback on updated programs and the percentage of employability.	Short (6 months – 1 year)
Expand Dual Vocational Technical Education and Training (TVET-Dual) programs in topics relevant to the semiconductor sector. Brete Strategy Action Plan, Training for Employment Component – AE3.	• Increase the number of dual-modality programs. • Implement improvements in the company-training center agreements. • Increase the number of agreements with companies that adopt the dual education program. **Example:** In 2022, the Industrial Electronics specialty was one of the first MEP programs to be adjusted to the dual-modality. With the lessons learned and improvements implemented, the specialty of Electromechanics was adopted in 2023. Multinational companies, such as Intel, have managed to develop these programs in conjunction with the MEP.	MEP INA	COMEX PROCOMER MTSS Universities	Collaboration between academia and industry to sign dual education agreements and commit to the execution of programs. Collaboration between industry and government (business chambers, for example) so the sector can provide feedback on its needs.	Short (6 months – 1 year)

Specific Objective 2: To increase the academic offer in the areas most demanded by the semiconductor industry, including programs with emphasis on different processes of the value chain of this industry.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Create new technical programs on topics related to the semiconductor industry based on new qualification standards (including technicians and professional updating).	• Implement new programs created from new qualification standards. **Example:** The MEP created the specialties of Artificial Intelligence and Cybersecurity between 2022 and 2023, both in collaboration with the industry and aligned with its needs. Currently, these programs have 79 and 1266 students, respectively.	MEP INA	MNC-EFTP-CR COMEX PROCOMER CONARE CONESUP	Collaboration between academia and industry to design qualification standards and the content required for training programs.	Medium (1 - 2 years)
Strengthen the skills and competencies of teaching staff in STEM areas, focused on the area of semiconductors. National Plan for Science, Technology, and Innovation - PNCTI.	• Train teachers in topics related to the semiconductor industry. **Example:** Intel, together with the Technological Institute of Costa Rica, created a specialized technical program for semiconductors focused on Signal and Power Integrity as well as Electrical Packaging. This program seeks to complement the knowledge of professionals with STEM bases. Fifty-three people were trained, and the program can be replicated in the future.	MEP INA Universities	MICITT MEP INA COMEX PROCOMER CONARE CONESUP	Collaboration between academia and government to coordinate funding or incentives for professionals necessary for the continuation of academic careers and specialized training. Spaces for collaboration among the academia are also suggested to promote the exchange of knowledge between national and international institutions.	Medium (1 - 2 years)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote the creation of new university baccalaureate and postgraduate programs in the field of semiconductors.	• Generate new programs in higher education related to the semiconductor industry. **Example:** In 2014, the medical devices industry and TEC launched the Medical Devices Master's Degree program. This program is focused on the manufacturing and design processes of more than 60 companies in the sector installed in Costa Rica. Currently, around 200 engineers have graduated from this program.	Universities	COMEX PROCOMER CONARE CONESUP	Collaboration between academia and industry to align the content required for training programs. Collaboration between academia and government to facilitate resources to promote the creation of this and other programs.	Medium (1 - 2 years)
Promote an up-to-date regulatory framework that facilitates the establishment of international universities.	• Design an updated regulatory framework for the promotion of specialized international training centers. **Example:** In 2018, Texas Tech University opened its first campus outside the United States in Costa Rica, offering an academic program based on engineering and business.	COMEX	CONESUP MEP	Collaboration between government and academia to guide inter-institutional coordination and generate a new regulation.	Long (2 - 3 years)

Specific Objective 3: To increase the number of graduates of Electrical, Electronic, Electromechanical, and Computer Science, among other related and technical degrees associated with the semiconductor industry.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Carry out a budget and installed capacity review of academic institutions, such as INA, MEP, and public universities, to prioritize STEM careers, including those related to the semiconductor industry.	• Increase the growth percentage in graduation of students in semiconductor-related careers. **Example**: Between 2020 and 2023, public universities increased the number of diplomas awarded to students in STEM areas by 4% (Blanco Picado et al., 2023). Thus, 40% of public university enrollment is in STEM areas.	CONESUP MEP INA Public Universities	CONARE CONESUP MEP INA COMEX	Collaboration between academia and industry to facilitate the resources that increase the quotas of students in technical and professional training in STEM areas, according to the growth of the industry.	Short (6 months - 1 year)
Promote cooperation agreements with public entities, the private sector, and private universities, among others, that allow the MEP, INA, and universities to expand the installed capacity, infrastructure, academic programs, and professors.	• Generate cooperation agreements between institutions. **Example:** The Technological Institute of Costa Rica has created specialized programs for the medical devices industry. To this end, both TEC professors and staff from the companies in the business park were allowed to teach the courses. This allowed the program's contents to be adapted to the sector's needs since theoretical and practical content were incorporated.	MEP INA Universities	CONARE CONESUP MEP INA COMEX PROCOMER	Collaboration between academia and industry so they can agree on the required content, provide infrastructure, equipment, and teachers, and define priorities. Spaces for dialogue among the academia are also suggested to facilitate collaboration between different entities of higher and technical education, including between public and private institutions.	Short (6 months - 1 year)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote the creation of a scholarship fund or conditional cash transfers with a gender focus for the promotion of careers specialized in semiconductors.	• Encourage the participation of women in STEM careers linked to the industry. **Example:** The Costa Rican Innovation Promoter enabled a call focused on young women named STEM Talent in 2023 to award 135 scholarships to study technical careers. Initiatives like these speed up the closing of this gap and address people who were unable to access free college or technical education but are interested in pursuing a STEM program.	MICITT INA MEP Costa Rican Promoter of Innovation and Research	MICITT INA International Organizations Public Universities	Collaboration between government and academia to facilitate resources that foster the promotion of professionals and technicians in STEM areas. Collaboration between government and international financial institutions to provide support for the creation of the fund.	Medium (1 - 2 years)
Create a call for incentives for specialized training in Free Trade Zones, which includes semiconductor training programs.	• Provide an incentive for companies in the System by providing support in specialized training programs **Example:** In 2023, the first call for non-reimbursable funds for companies in Free Trade Zones was launched. In this call, 21 companies benefited from counterpart funds for training in highly specialized topics, such as cybersecurity, artificial intelligence, and semiconductors.	COMEX PROCOMER INA	COMEX PROCOMER INA Institutions that are part of the Inter-institutional Committee of the Trust Universities	Collaboration between government and industry should coordinate semiconductor companies' participation in the call for matching funds and identify relevant courses.	Short (6 months - 1 year)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote the creation of competency-based continuing education programs (boot camps or free courses), which complement technical and professional profiles to reconvert them for the semiconductor industry.	• Promote personnel training through refresher programs in semiconductor knowledge areas. **Example:** Since 2018, RICE University (in the United States) has developed a boot camp specialized in innovation for medical devices, in which graduates of engineering and sciences such as chemistry and physics participate. These courses are comprised of an intensive five-day training that encompasses the fundamentals of innovation in the medical devices industry. The industry participates in this program and is part of the recruitment process for students who complete it.	MTSS INA Universities	MTSS INA Universities	Collaboration between government and academia to provide resources to streamline the teaching of English with public or private providers. Collaboration between government and international financial institutions to create a scholarship fund to finance these courses for companies.	Medium (1 - 2 years)
Generate and execute vocational guidance programs from early childhood to higher education.	• Increase the number of students impacted by career guidance programs. **Example:** The Ministry of Education has a STEM education strategy, which includes the "Orienta2" program. This program encompasses information and vocational guidance activities in science and technology with a gender focus and information available to students and parents.	MEP	Universities Enterprises Non-Governmental Organizations on Education	Collaboration between government, academia, and industry to coordinate access to educational and budgetary content to strengthen education and inclusive vocational guidance from early childhood.	Medium (1 - 2 years)

Axis 2: Bilingualism

Vision: To graduate the entire population that is pursuing technical and professional careers related to semiconductors with an advanced level of English.

According to the results of the survey conducted by COMEX in 2023, bilingualism is one of the priorities for the semiconductor industry. Considering that foreign-invested enterprises represent the main sources of job creation, English language proficiency is an indispensable skill for employability.

General Objective: To improve the level of English of professionals and technicians trained in the semiconductor area to generate a critical mass of professionals with an English B2 level[3].

Specific Objective 1: To incorporate English as an essential skill in the exit profile of technical and professional students in STEM careers.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Implement training programs in language skills for employment at a technical and professional level. PNDIP 2023-2026 and training for employment component – AE5 of the Brete Strategy.	• Increase the number of people trained in English at a B2 level. **Example:** In 2023, CONARE, in the agreement of the Liaison Commission for the Financing of State Higher University Education (FEES), assumed the commitment by 2026 that 27.6% of graduates from public universities would obtain a B2 English degree according to the Common European Framework.	MEP INA CONARE CONESUP	INA MEP CONARE CONESUP	Collaboration between government and academia to provide resources to streamline the teaching of English with public or private providers.	Medium (1 – 2 years)

[3] According to the Common European Framework of Reference for Languages (CEFR) there are 6 levels: i) A0, Beginner; (ii) A1-A2, Basic, (iii) A2-B1, Pre-Intermediate; (iv) B1, Intermediate; (v) B2, Intermediate – High; (vi) C1-C2, Advanced.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote the creation of a scholarship fund for bilingual training (Spanish - English) for technical and professional persons in the areas of engineering and sciences related to the semiconductor industry.	• Increase the number of people trained in English. **Example:** In Costa Rica, Sykes created its own English academy, which supports the improvement of the language level of people who meet the profile to work in shared service centers. This program has received public funding from the MTSS program called "Empléate." A similar specialized model, tailor-made for the semiconductor industry, would allow technicians and professionals to complete their professional profiles.	MTSS INA	MTSS INA Universities	Collaboration between government and academia to facilitate resources to streamline the teaching of English with public or private providers. Collaboration between government and international financial institutions to create a scholarship fund to finance these courses for companies.	Medium (1 – 2 years)

Specific Objective 2: To certify teachers from public and private schools who teach subjects in semiconductor programs in English B2 per the Common European Framework of Reference.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Identify the English language level of university and technical education teachers.	• Apply tests to determine the level of English. **Example:** In 2023, the University of Costa Rica (UCR) donated the English Diagnostic Test (EDI) to 25,000 public school students, including students in schools, experimental bilingual colleges, and technical colleges throughout the country.	MEP INA CONARE CONESUP	INA MEP CONARE CONESUP	Collaboration between government and academia to facilitate financing, implementation, and consolidation of results.	Short (6 months - 1 year)
Promote the creation of a special fund for English training exclusively for semiconductor trainers.	• Promote teacher training in English. **Example:** In Costa Rica, funding for training has traditionally focused on the student population and not necessarily on teachers. However, in 2022, the University of Costa Rica launched its first non-reimbursable fund to promote research for teaching staff and projects focused on innovative education proposals. (Ocampo Hernández, 2022)	MEP INA CONARE CONESUP	INA MEP CONARE CONESUP	Collaboration between government and academia to facilitate financing, implementation, and consolidation of results.	Medium (1 – 2 years)

Axis 3: Attracting Highly Specialized Talent

Vision: To attract and retain highly qualified talent in specialized semiconductor areas to drive innovation and technological development in the country.

General Objective: To generate the optimal conditions to attract specialized talent in areas of high demand for the semiconductor sector.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Create regulatory and legal initiatives that promote the attraction of highly specialized talent and knowledge transfer programs, including the scientific diaspora.	• Increase the availability of highly specialized talent required by the industry. **Example:** Law to Attract International Remote Workers and Service Providers (No. 10.008) provides a new migratory category for remote foreign workers who can remain in Costa Rica and enjoy migratory and tax benefits while performing their work remotely.	COMEX PROCOMER	INA MEP MTSS DGME CONARE CONESUP Ministry of Finance	Collaboration between government, academia, and industry to improve the conditions for attracting this talent.	Medium (1 - 2 years)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote job opportunities in Costa Rica internationally.	• Development of promotional campaigns to attract foreign professionals to job opportunities in Costa Rica. **Example:** Following the approval of Law 10.008, the Costa Rican Tourism Board (ICT) launched a campaign and microsite to attract "digital nomads" to visit Costa Rica (https://www.visitcostarica.com/en/costa-rica/digital-nomads)	COMEX PROCOMER	ICT MREC	Collaboration between government and international recruitment agencies, diplomatic representations abroad, and international offices of PROCOMER.	Short (6 months - 1 year)

Axis 4: Research and Development

Vision: To position Costa Rica as a hub for applied research in semiconductors, generating knowledge and innovative technology for the global industry.

General Objective: To develop local capacities for research, development, and innovation in the semiconductor industry.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Identify funds to promote the creation of laboratories for the semiconductor industry, advanced manufacturing, health sector, and emerging technologies.	• Strengthen the laboratories available to public and private academic institutions. **Example:** CENAT has five high-tech laboratories, including LANOTEC, where academic and applied research is conducted in collaboration with the public and private sectors.	CONARE CENAT PCII Universities	COMEX MICITT	Collaboration between government and academia to facilitate the implementation of laboratories and the use of funds for this purpose. Collaboration between government and international financial institutions to seek funds to allow the creation of more laboratories. Collaboration between government, academia, and industry to identify applied research projects.	Long (1 - 3 years)
Generate a framework of good practices for the promotion of international alliances for R&D.	• Creation and publication of the guide to good practices for the management of innovation and international alliances. **Example:** The Unit for Management and Transfer of Knowledge for Innovation (Proinnova) of the University of Costa Rica has developed training services, consulting for entrepreneurs and researchers on protecting intellectual property, and alliances to transfer knowledge, among other things.	CONARE CONESUP CENAT	COMEX PROCOMER MEIC Universities	Collaboration between government, academia, and industry so that (i) academia can report on its needs with respect to knowledge management and intellectual property and (ii) the industry can share its experiences with alliances in other countries and business requirements. Likewise, opportunities for collaboration with private investors and foundations such as ALIARSE are foreseen.	Short (6 months - 1 year)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote the creation of a scholarship fund focused on doctoral studies, internships, and applied research, among others.	• Increase the number of professionals with doctoral degrees. **Example**: The STEM DOC+ program launched in 2023 focused on financing advanced Costa Rican doctoral students in STEM areas in their projects or research theses using the Incentive Fund executed by the PCII.	MICITT PCII	CONARE Universities	Collaboration between government and academia to facilitate the search for resources and the use of funds for this purpose. Collaboration between academia and international universities, to identify doctoral programs of interest. Collaboration between government and international financial institutions to support the fund.	Short (6 months - 1 year)

Generate a work plan to attract venture investment through public-private partnerships with investors and entrepreneurs.	• Publication and execution of the strategy for the attraction of start-ups and incubators. Costa Rica has not yet ventured into attracting this type of investment. However, the best practices of the OECD and its members can be a reference and starting point for designing this type of strategy. (FDI Center, 2020) **Example:** Invest in Chile, Chile's Investment Promotion Agency, has identified venture capital as one of its key sectors of investment attraction. Chile has tripled in the last decade, surpassing US$1.3 billion in investment and available capital, with more than 280 companies financed.	PCII	COMEX MEIC PROCOMER	Collaboration between government and industry so that investments are directed towards topics of value to the industry, such as laboratories and training. Collaboration between government and academia to coordinate projects that could be the subject of venture capital. Collaboration between government and angel investors, accelerators, and start-up incubators.	Medium (1 - 2 years)

Pillar 2: Incentives 2.0

Global Context and Trends

The design of incentives to attract investment has generated an international discussion, where its wide use in both developed and developing economies has been recognized in order to promote economic activities of interest (OCDE, 2022b). In the specific case of the semiconductor industry, government intervention has become more important compared to other industries due to the high costs associated with its development and production. (Langdon, 2022)

The average cost of building and equipping a new semiconductor factory starts between US$10 billion and US$20 billion (Peters, 2023; Brugmans et al., 2024) and can reach between US$40 billion and US$44 billion in capital expenditures. By 2030, semiconductor companies are expected to invest an estimated US$1 trillion globally in their production factories(Singer, 2021). Likewise, the semiconductor assembly and testing process requires heavy capital investments, mainly in the acquisition of advanced equipment and processes. (Fortune Business Insights, 2022)

On the other hand, the data show that R&D costs associated with the production of chips are increasing. For example, the investment to reduce the size of chips from 10nm to 7nm was US$100 million. In comparison, the reduction from 7nm to 5nm in recent years amounted to US$550 million, without considering the costs associated with manufacturing, testing, and assembly. (Aalbun, 2021)

Faced with this situation, both the European Union (EU) and the United States have recently increased the incentives and subsidies granted to the semiconductor industry. Similarly, a number of countries are actively encouraging the growth of their national ecosystems through new incentives. The subsidies offered for chip manufacturing today are certainly higher and more aggressive and include new types of incentives. (Brugmans et al., 2024)

For example, the United States is investing a significant amount of public resources in this sector through the CHIPS Act: It has allocated US$52.7 billion to finance supplementary emergency allocations, including a US$39 billion incentive program over five years and US$11 billion to promote R&D and workforce development programs. It is also allocating US$500 million for the ITSI Fund and US$200 million for the "CHIPS for America" program to promote workforce growth in the semiconductor sector (U.S. Senate Committee on Commerce Science and Transportation, 2022). Additionally, at the federal level, at least twelve states have enacted new tax incentives, expanding existing ones or creating new economic development funds, with the aim of boosting semiconductor investment in their regions. (York & Bhatt, 2023)

For its part, in 2022, the EU implemented its version of the CHIPS Act, through which it will allocate between US$30,000 and US$50,000 million to promote the self-sufficiency of the semiconductor industry and the digital sovereignty of its member countries by supporting the establishment of new production facilities, supporting start-ups, skills development, and partnership building. Under this initiative, the EU aims to increase its share of global semiconductor production to 20% by 2030 (Johnston & Huggins, 2023). Specifically, France

plans to invest US$1.9 billion in joint semiconductor projects in Europe, while Germany selected 32 semiconductor projects that a US$12 billion investment fund will finance (SIA, 2022). In addition, Spain is making a public investment in semiconductors through the Strategic Project for Economic Recovery and Transformation, which will allocate 13,120 million euros until 2027 to develop the design and production capacities of the microelectronics and semiconductor industry. (Thykjaer & Carreno, 2022)

Asia has followed the same trend with regard to the provision of new incentives. South Korea and China will allocate US$400,000 and US$1 billion, respectively, over the next ten years to promote and strengthen this industry (Errick, 2022). In the case of South Korea, the country launched the *"K-Semiconductor Belt*" strategy that seeks to establish the largest semiconductor supply chain in the world by 2030, offering tax credits for investment in R&D and the creation of facilities to attract more than US$450,000 million of investment in the industry. China, for its part, updated its tax and financial incentives to promote its integrated circuit industry, including corporate tax exemptions of up to 10 years for advanced technology and other favorable measures. (SIA, 2022)

In addition, Japan approved US$6.8 billion in financing to boost domestic investments in semiconductors, seeking to double domestic revenue in chips to US$114 billion by 2030. Part of this financing includes US$410 million for production, US$960 million for next-generation silicon R&D, and US$5.4 billion to fund production capacity for innovative chips. A portion of this sum will cover up to 50% of the cost of building a Taiwan Semiconductor Manufacturing Company (TSMC) plant, with an initial investment of up to US$2.12 billion from the company, in addition to an additional US$500 million contributed by Sony to create its subsidiary in Japan (SIA, 2022). According to (Errick, 2022), the subsidies offered by Asian countries to this industry have contributed positively to the exponential increase of its production and market share, demonstrating the impact of these incentives on companies.

On the other hand, countries without consolidated ecosystems in the industry, such as India and Spain, are implementing programs to promote their internal growth. (Brugmans et al., 2024) Recently, India announced that it will allocate US$30 billion to become a global semiconductor and electronic component manufacturing hub, including US$10 billion for the development of the semiconductor and display ecosystem and US$7.5 billion for incentive programs. The Indian government plans to fund up to 50% of factory set-up and cover 50% of the eligible expenses of 100 semiconductor design companies. (SIA, 2022)

While changes in macroeconomic conditions have created new opportunities in the semiconductor sector, national and federal strategies designed to foster and strengthen the semiconductor industry are offering an unprecedented amount of resources and incentives.

All these incentives influence the selection of new destinations for the installation of the various processes associated with the manufacture, testing, and assembly of semiconductors. When considering their expansion, companies attach great importance to subsidies provided by different countries. (Brugmans et al., 2024) For example, the level of subsidy has a significant impact on reducing the payback period of factory investments and is an even more decisive element than the location itself. A subsidy equivalent to 45% of the investment required can reduce the payback period to 6.5 years, compared to 10 years for unsubsidized installations. (Brugmans et al., 2024) These data reinforce the idea that countries committed to attracting FDI from this industry must necessarily develop and offer attractive incentives to achieve this.

Examples of incentives currently used by other jurisdictions include tax credits, cash grants, and tax breaks. Policies focused on tax credits are used to stimulate investment in various economic aspects, so they include incentives related to employment, investment, sustainable production, and local procurement, among others. For example, some countries provide significant credits for R&D equivalent to a percentage of salaries or even all income generated abroad. Others encourage the generation of employment and the training of workers. In addition, the granting of credits related to specific taxes is observed.

In terms of cash grants, more and more countries are granting economic support to FDI companies on their investment expenditures (land or construction), job creation, R&D development, and value-added tax. There are also specific subsidies linked to assets, with variations according to certain parameters, such as geographical location and amount of employment generated. On the other hand, the tax exemptions identified are aimed at benefiting investment, salaries, buildings for R&D, and startups, with percentages that vary depending on the sector and the activity carried out.

Among the most relevant incentives for the success of the semiconductor industry, those focused on R&D stand out. This is considering the high costs associated with research to increase the efficiency of these components and the development of new microchips. This process has an impact in the future on the reduction of manufacturing costs (Aalbun, 2021).

According to (OCDE, 2022c) the Ministry, investment in R&D activities is essential to drive innovation and economic growth. Currently, 33 of the 38 OECD countries and 22 of the 27 EU members offer tax relief for R&D spending, which represents a 50% increase compared to the number of countries that offered incentives for this sector in 2020. The trend is also reflected in the share of tax relief in total government support for R&D among OECD countries, which increased from 36% in 2006 to 55% in 2020. In the EU, fiscal aid to R&D doubled, from 27% of total public aid in 2006 to 55% in 2020.

In the semiconductor industry, the importance of investing in R&D is reflected in the significant increase in expenses related to this activity by several leading companies in the sector. In 2022, the Semiconductor Manufacturing International Corporation (SMIC) allocated US$733 million to R&D, an increase of 14.8% over the previous year. (Statista, 2023b) In that same year, TSMC increased its R&D budget to more than US$13 billion, while Qualcomm invested US$8.2 billion in these activities. For its part, Intel Corp. also increased its R&D expenses, reaching US$17.5 billion in 2022. Other major companies such as Micron, NXP Semiconductors, Nvidia, Samsung, and ST have followed this trend of increasing R&D spending in recent years (Amon et al., 2022).

In response, the R&D incentives associated with this industry have also increased in recent years. For example, the United States allocated more than US$200 billion to investment in semiconductor R&D through the CHIPS Act. The Department of Commerce has allocated US$11 billion for R&D initiatives, including the creation of the National Semiconductor Technology Center (NSTC) to boost R&D in semiconductor manufacturing and the launch of the National Advanced Packaging Manufacturing Program and the Semiconductor Institute, Manufacturing USA, aimed at improving assembly, testing, and packaging capabilities. The R&D program on microelectronic metrology is also being implemented through the National Institute of Standards and Technology (NIST) to advance measurement science and manufacturing capabilities in that sector (U.S.. Senate Committee On Commerce Science and Transportation, 2022). At the federal level, the incentives consist of US$200 billion for

scientific R&D and commercialization and US$13 billion for semiconductor R&D and workforce development. (York & Bhatt, 2023)

An additional element that must be considered in the global context is the implementation of the Base Erosion and Profit Shifting (BEPS) project promoted by the OECD and the European Union. This initiative seeks to eliminate, through international standards, harmful tax incentives that generate harmful tax competition.[4], by applying a Global Minimum Tax of 15% to multinational companies (MNCs) with high revenues to redistribute their profits and mitigate tax competition (OECD, 2022a). In short, this project increases the urgency of analyzing the incentives that are granted to investment, including those that are aimed at the semiconductor industry.

Certainly, the sharp international competition to attract FDI in the semiconductor industry and the global scenario put pressure on Costa Rica to review the elements offered to foster an attractive investment climate. At the same time, it presents a valuable opportunity for the country to improve the incentives it offers to investment, addressing the specific needs of key sectors for the country, such as the semiconductor industry. Staying competitive in this environment would not only facilitate the attraction of investment but provide an advantage for the development of this industry. Still, it would also improve the conditions of the country, impacting the general well-being of the population.

Current Situation in Costa Rica

Costa Rica has skillfully demonstrated how to capitalize on its assets to attract investment, leveraging its highly skilled workforce, democratic stability, legal security, and strategic geographic location as differentiating characteristics. These elements of competitiveness, among others, have led to a significant transformation. The country has evolved from exporting a few traditional products to a limited number of markets to exporting more than 4,000 products with a higher added value aimed at more than 160 destinations. This progress is not limited to the area of goods, as the services sector has also experienced remarkable growth. By 2021, this sector contributed 67.7% to the Gross Domestic Product (GDP), an advance that is largely attributed to the successful attraction of investments in various economic sectors. (Spanish Ministry of Economy, Industry and Business, 2022)

However, Costa Rica faces a major challenge in the promotion of R&D activities due to the lack of incentives aimed at this sector. This gap must be addressed as a priority to ensure that the country is competitive in a global environment that is increasingly dependent on research and innovation. Consequently, there is an opportunity to design public policies focused on promoting R&D, which would enhance the efforts of the semiconductor industry to attract investment and ensure that the population benefits from the growth and development associated with innovation.

[4] Pernicious tax practices refer to tax havens and preferential tax regimes that affect the location of geographically linked activities, such as financial and other service activities, including the provision of intangible assets, in order to artificially transfer profits. This erodes the tax base of other countries, distorts trade and investment patterns, and undermines the fairness, neutrality, and social acceptance of tax systems in general (OECD, 1998).

In this regard, the country must take decisive measures to close this gap, implement effective policies, allocate adequate resources, and promote public-private collaboration to promote incentives focused on R&D for the semiconductor ecosystem in Costa Rica.

Therefore, despite the evident growth of FDI in Costa Rica in recent decades, there is a need to consider additional and new-generation incentives in light of the new incentives offered by different countries and the new rules of international taxation. This will allow the country to remain a competitive destination for attracting investment, especially in sectors of interest, such as the semiconductor industry. In this sense, the following work plan is drawn up to strengthen the incentives granted by the country to attract investment related to the semiconductor industry.

Action Plan

Costa Rica is at a key moment to design and implement new-generation incentives that position it as a highly attractive destination for the semiconductor industry. To achieve this goal, the country must close the existing gap in terms of incentives for R&D while adjusting to the new international taxation standards.
Beyond the direct benefits for the semiconductor sector, the measures are proposed as part of a comprehensive strategy, which would have a positive impact on other related and innovation-oriented industries, generating potential links and synergies within the sector, thereby boosting the country's growth and economic diversification.
Based on the above, the following action plan is present. The plan aims to identify concrete actions for designing the public policy tools required for Costa Rica to complement its FDI attraction strategy by strengthening the incentives offered by the country for the semiconductor industry. This is in order to face the particularities of the global environment, including the new rules in international taxation, and promote the strengthening and development of the semiconductor industry.

Vision: To attract investment to Costa Rica, using new incentives as a tool to encourage greater investments in sectors of interest to the country, including the semiconductor industry.

General Objective: To strengthen and modernize Costa Rica's FDI incentives, consider new global trends, and implement new-generation incentives that allow the country to update its macro FDI strategy and promote the growth and advancement of the semiconductor industry in the country.

Specific Objective 1: To develop a public policy strategy that includes incentives for R&D activities in compliance with international standards due to the importance and direct link of these activities with the value chain to promote the evolution of the semiconductor industry.

Specific Objective 2: To formulate a comprehensive public policy strategy to strengthen the incentives that the country grants to FDI, with the purpose of keeping Costa Rica competitive in the face of intense international competition to attract foreign investment, including incentives for the promotion of technology-based innovation companies and convergent technologies that encourage local business development, the productive chain engagement in global value chains and the generation of national knowledge, in compliance with the new rules of international taxation.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Develop incentives that encourage the development of R&D activities in compliance with international standards.	• Attract foreign investment in R&D activities to strengthen the semiconductor ecosystem, including related industries	COMEX	MICITT PROCOMER National Registry CENAT Academia	Collaboration between government, academia, and industry, since the designed incentives will have to be validated by the industry, both before and after implementation. For this reason, coordination with the private sector is projected, including business chambers, universities, research centers, and the OECD, among others.	Medium (1 - 2 years)
Strengthen the incentives offered by Costa Rica to boost its competitiveness in attracting and retaining FDI, including incentives for the promotion of technology-based startups.	• Foreign investment established in the country, including FDI in the semiconductor sector, by strengthening current incentives and considering new generation incentives.	COMEX	PROCOMER Ministry of Finance Innovation Promoter/ MICITT	Collaboration between government, academia, and industry, since the designed incentives will have to be validated by the industry, both before and after implementation. For this reason, coordination with the private sector is projected, including business chambers, universities, research centers, and the OECD, among others.	Medium (1 - 2 years)

Pillar 3: Investment Attraction and Prospecting Exercise

Global Context and Trends

A high geographical concentration characterizes the semiconductor industry. Currently, the United States, China, South Korea, Japan, and Taiwan dominate global production, accounting for more than 80% of the market. The United States, at the forefront of R&D, has a solid industry with leading companies such as Intel, Qualcomm, and NVIDIA. China, on the other hand, has made significant investments in recent years, becoming a strong competitor. South Korea, with Samsung and SK Hynix, and Taiwan, with TSMC, are also key players in this scenario.

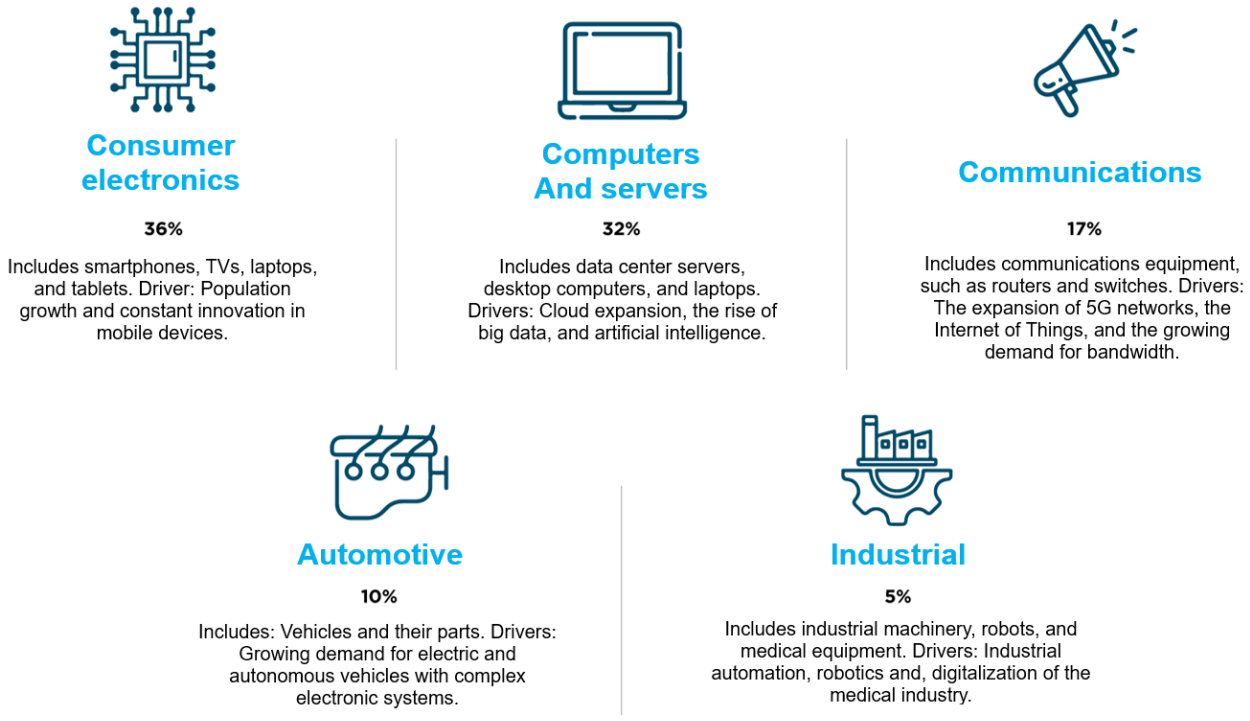
In 2022, more than 1.3 trillion chips were consumed worldwide, which equates to approximately 170 chips per person. This figure is expected to increase significantly in the coming years, with forecasts pointing to a consumption of 2 trillion chips and the sector becoming a US$1 trillion market by 2030. (WSTS, 2023; Gartner, 2023)

This is due to the growing demand for electronics worldwide, the adoption of technologies such as artificial intelligence (AI), virtual reality (VR) and augmented reality (AR), IoT, and the implementation of 5G.

In addition, the industry's rapid growth drives investments in new semiconductor factories. In recent years, companies such as Intel, Samsung, TSMC, and GlobalFoundries have announced significant investments totaling more than US$200 billion (UNCTAD, 2024). These investments will not only increase production capacity but also contribute to diversifying the global semiconductor supply chain, an issue of great importance for economic and geopolitical security.

To contextualize it, the following figure shows the percentage represented by each of the industries with the highest demand for semiconductors, the main products they include, and the driver of that demand:

Figure 1. Semiconductor consumption by industry



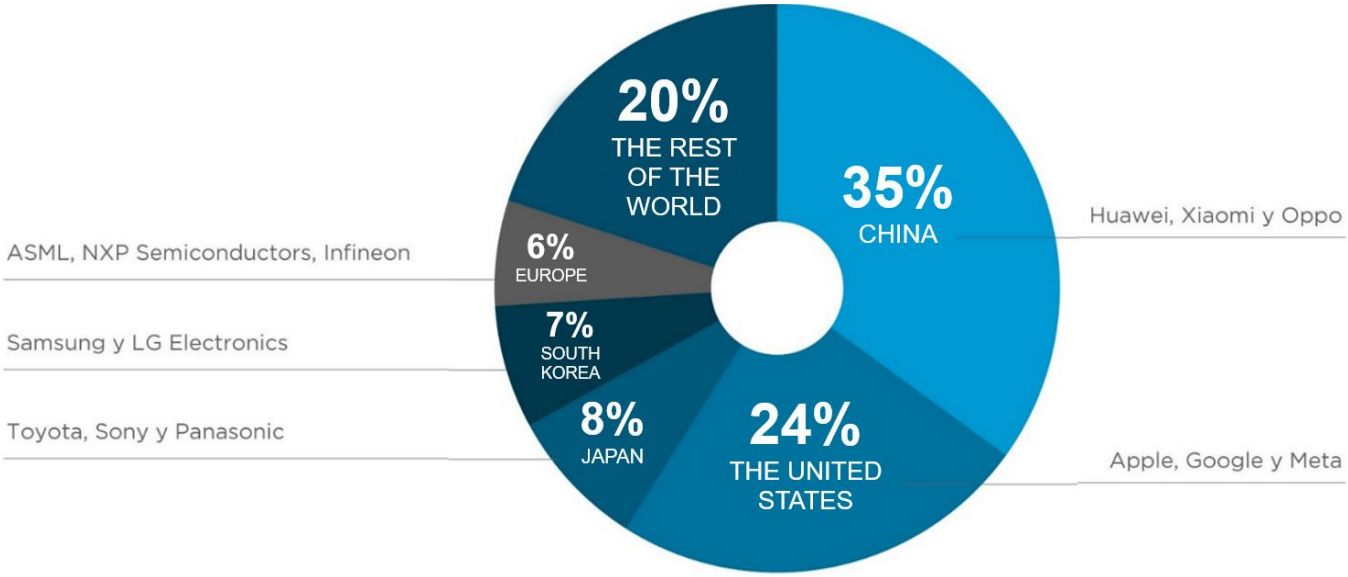
Source: PROCOMER with data from IC Insights, 2023

As can be seen, the consumer electronics industry presents the highest demand, with 36% of the total, driven by the growing innovation in mobile devices, followed by the computer and server industry (32%), the communications industry (17%), the automotive industry (10%), with vehicles that require a greater amount of semiconductors for their operation, and, finally, the industrial industry (5% of the sector's demand).

The defense industry is also a major consumer of semiconductors, with a growing demand for microchips for weapons systems, radar, navigation systems, and military communications. This industry converges with the segments explained above. (Gartner, 2023)

Similarly, the main countries or regions that consume semiconductors at a global level are exposed, with the most important companies in the sector:

Figure 1. Top Global Semiconductor Consumers



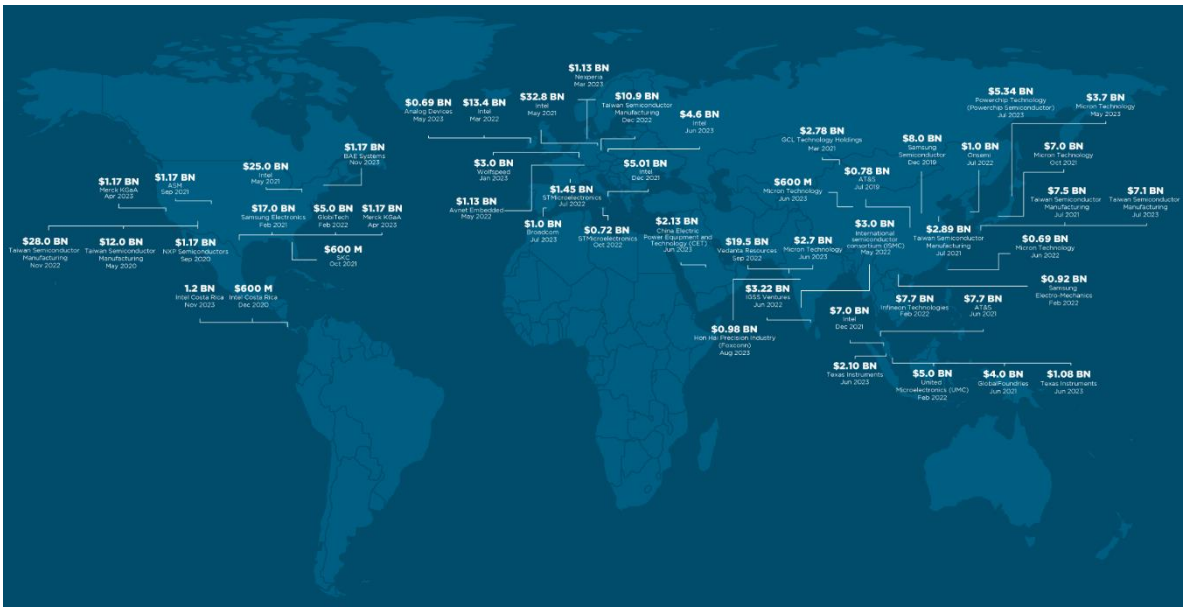
Source: PROCOMER with data from IC Insights (2023).

As detailed in the chart, China is the world's largest semiconductor market, with 35% of global consumption, and its consumption of microchips is expected to continue to grow, thanks to the expansion of the middle class and the development of emerging technologies such as 5G, IoT, and AI. In second place is the United States, with 24%, a leader in the R&D of new technologies in the sector, which contributes to its influence on the global market. It is followed by other major consumers in the global market as Japan (8%), South Korea (7%) and Europe (6%).

In terms of consumption in the rest of the world (20%), Taiwan stands out as a major producer of semiconductors. Moreover, in countries such as India, Vietnam, and Indonesia, the demand for microchips is expected to grow in the coming years due to the rapid development of their tech industries and the adoption of digital technologies. In Latin America, although there is relatively low consumption of semiconductors compared to other regions, it is projected to grow as digitalization and infrastructure modernization drive demand.

In this regard, it is important to mention that FDI flows in the semiconductor industry have experienced exponential growth, marking significant milestones in recent years. According to (UNCTAD, 2024), global FDI reached US$52 billion in this sector in 2022, an increase of 22% from the previous year, driven by growing demand in many sectors, ranging from consumer electronics to automotive, medical, and artificial intelligence. Figure two highlights the most significant investments made by semiconductor companies in the world since 2020.

Figure 2. Main investments made in the semiconductor sector



Source: PROCOMER, with data from FDI Markets, 2024.

These investments span a wide range of technologies and applications and represent a significant driver for the industry's growth. As noted, the United States is an important destination for investments in the semiconductor industry. This is due in part to the CHIPS Act, which provides tax incentives for semiconductor production in the country.

It should be noted that, due to the global reconfiguration of the supply chain, investments in this sector have been made in countries that are not traditionally leaders in semiconductors. For example, Saudi Arabia announced an investment of US$8 billion for a new chip design center; a new processor plant, valued at US$4 billion, will be built in Spain, and Italy received investments exceeding US$2 billion for semiconductor manufacturing.

Following the trend of the United States, Latin America has experienced remarkable growth in this sector in recent years due to the need to diversify the supply chain. The COVID-19 pandemic highlighted the fragility of the global semiconductor supply chain, which has led the Latin American region to seek to reduce its dependence on imports from Asia and develop more resilient local production, which is why several governments in the region have implemented policies that include tax incentives, the creation of free zones, and investment in infrastructure. The facilitation of investments through simplified processes, among others.

In the future, this upward trend in FDI flows in the semiconductor sector is expected to persist in the coming years. UNCTAD (2024) forecasts an average annual growth of 8% between 2023 and 2028. This increase will be driven by a number of factors, including the growing demand for semiconductors in key sectors, the imperative need to expand semiconductor production capacity, and the growing importance of ensuring supply chain security for these critical components.

At the regional level, Costa Rica is a major recipient of FDI in the semiconductor sector. This is especially important at a time when Latin America is positioning itself in the international spotlight as an attractive option for investments in the semiconductor sector, and the country can attract these investments thanks to its strong value proposition. Investment amounts in manufacturing segments, including assembly, testing, design, and research and development, are estimated to be approximately US$2 billion due to investments made by companies such as Intel in 2020 and 2023.

According to the survey conducted by COMEX (2024), the country boasts a semiconductor ecosystem with more than a dozen companies that employ 5000 professionals directly in the segments of this value chain, ranging from design to assembly, testing, verification, and R&D.

It is important to note that this number of professionals only includes those directly involved in the semiconductor value chain. In addition to these, semiconductor companies established in Costa Rica are not only limited to these specific areas; they are also strengthening their operations in other sectors, from corporate service centers (including finance, human resources, logistics, customer relations, marketing, among others) to more sophisticated services such as cloud computing, cybersecurity, data analysis, and more, which are also robust in the country.

These characteristics make Costa Rica an ideal destination both for the installation of new companies in the semiconductor sector and for the growth and expansion of those already operating in the country.

Current Situation in Costa Rica

The historical trajectory of FDI in Costa Rica is directly related to the increase in exports, in line with the various models of economic development that the country has experienced. Over the years, this interaction has been instrumental to Costa Rica's economic growth. For the year 2023, FDI represents approximately 4% of the Gross Domestic Product (GDP), while exports constitute 41%, evidencing the significant contribution of these sectors to the strengthening of the Costa Rican economy.

According to data from the Central Bank of Costa Rica, in 2022 (the latest annual data available), FDI inflows reached US$3.2 billion, which corresponds to a compound annual growth rate of 2% for the period 2017-2022, and the data closing for 2023 is projected to present a similar annual growth. Additionally, in 2022, the value of exports of manufacturing services — a category that includes, among others, the semiconductor industry under the heading of transformation services — reached US$772 million, which represented 6% of services exports (BCCR, 2024).

Regarding the origin of FDI in Costa Rica, the main countries of origin for 2022 were the United States (73%), Switzerland (9%), Colombia (3%), and Mexico (2%). FDI received was 74 percent in the free trade zone regime, 9% in the tourism sector, followed by the real estate segment (8%), and 6% in the financial system. On the other hand, if the areas receiving FDI in the country are analyzed, the manufacturing industry is consolidated as the main sector with a 67% share, followed by tourism and services with 9% each.

These data show that Costa Rica has become an attractive destination for FDI, ranking No. 1 globally in attracting greenfield (fDi Intelligence, 2021) investments. Currently, more than 450 multinational companies from various sectors (advanced manufacturing, services, light manufacturing) have selected Costa Rica to establish their operations, generating more than 250,000 jobs in the country.

The government has assigned PROCOMER, the national agency for attracting and retaining FDI and promoting exports, the mandate to continue positioning the country as an attractive destination for FDI. In compliance with its responsibility, it established an FDI attraction strategy in June 2023 to comprehensively and centrally address the investment process with a clear priority: Diversification.

This priority includes the diversification of territories where FDI is established, with emphasis on areas outside the GAM; of the types of investment that are established in the country through the consolidation of greenfield projects and the development of other investment models such as brownfield, joint ventures, and mergers and acquisitions; in addition, the origin of the investment, attracting more projects from different geographies, and finally the diversification of new sectors, through the reinforcement of consolidated sectors but adding the attraction and development of developing sectors and the future.

This is how PROCOMER has identified the semiconductor industry as a strategic sector for the economic development of Costa Rica as part of its strategy to attract investment, install and retain companies in this sector based on the country's value proposition and the fulfillment of the main drivers the industry is looking for to select a destination country. Specifically, Costa Rica is a key destination for the semiconductor industry for the following reasons:

- **Sustainability:** Reducing the environmental impact of the semiconductor manufacturing process has become a global trend due to its high consumption of resources such as water and electricity. To reduce their environmental footprint, manufacturing companies are transforming their energy mix to include more energy from renewable sources. Intel, for example, has pledged to use 100% renewable energy in its global operations by 2030. TSMC has set a goal of getting 25% of its electricity from clean energy by the same year. (MRL Group, 2023)

  Costa Rica is a strategic ally for semiconductor companies seeking to align their commercial interests with the sustainable agenda. In this context, consumers have increasingly begun to value the impact on the environment as a differentiating element in their purchasing decisions.

  The country has stood out internationally for its commitment to environmental conservation. Since 1972, it began a process aimed at preserving 26% of its territory. It has achieved 60% forest coverage (World Bank, 2022), is currently home to 6.5% of the world's biodiversity (UNDP, 2019), and has been recognized as World Earth Champion. (UNEP, 2019)

  Costa Rica's environmental policies have been supported by clear actions, including a continued commitment to the Sustainable Development Goals and the diversification of its energy matrix. With regard to electricity, the country meets the

national demand with 98% renewable sources and has planned to increase its production of solar and wind energy by 2040 (ICE, 2019). This means that companies that set up in Costa Rica automatically reduce their carbon footprint, making the country a strategic ally to generate impact and allow the development of business strategies aligned with sustainable development goals.

- **Strategic Geographical Position:** The United States represents 24% of global semiconductor consumption (Statista, 2023a) and has potential for industry growth in that country and the rest of the American continent. Costa Rica is in a privileged geographical position in a context where nearshoring has become more relevant in international trade.

  The country has maritime access to the Pacific and Atlantic Oceans and direct connections to major airports in the United States. Its proximity to North and South America facilitates logistics and access to a wide network of suppliers. According to (Deloitte, 2024), Costa Rica is the only country in Central America that has proven experience in nearshoring mainly due to its trade openness policy and the country's strong relationship with North America.[5] and Europe[6]. Costa Rica's location also facilitates company operation, as similarity in time zones reduces supply chain vulnerabilities and production costs.

- **Legal Certainty and Transparency:** Costa Rica is one of only two countries in Latin America classified as "complete democracies" and one of only 24 countries worldwide that are part of that category (The Economist Intelligence Unit, 2023). This shows that the country has a robust legal system recognized for its transparency and stability.

  In 2021, the country became the 38th member of the OECD. Thus, the country benefits from a cyclical assessment of its policies on investment, international trade, and ease of doing business and can implement the required adjustments and improvements. In addition, the country is a member of the World Intellectual Property Organization (WIPO) and has signed several international agreements that guarantee the protection of inventors' rights. Therefore, the country recognizes the importance of intellectual property and has a solid legal framework for its protection.

  These characteristics make Costa Rica an ideal destination for investment related to the semiconductor industry. The legal certainty and stability of the investment destination will be necessary elements in the diversification of the supply chain as the industry seeks to expand to safe and reliable destinations to mitigate the vulnerabilities associated with the current structure of the chain and to ensure the protection of sensitive technologies.

- **Trade Policies:** The country has built a strong trade platform, with 16 agreements governing the country's foreign trade with 51 trading partners accounting for two-thirds of global GDP. These agreements together cover 93.4% of exports of goods

[5] The United States is the main export partner with more than 40% of the value of imports and exports in the second half of 2023 (INEC, 2023) and Mexico ranks third in the value of imports.
[6] Germany, the Netherlands and Belgium are among the main trading partners (INEC, 2023).

and 85% of imports of goods. Costa Rica has the ambition to continue expanding this platform: the agreement negotiated with Ecuador is in the process of legislative approval; the negotiation of a treaty with the United Arab Emirates has been finalized and is ready to be signed; the country is negotiating the Agreement on Climate Change, Trade and Sustainability (ACCTS); is in the process of joining the Digital Economy Partnership Agreement (DEPA); it has applied to be part of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the Pacific Alliance, and has announced an upcoming negotiation with Israel.

- **Skilled Workforce:** The country has a strong education system and a literacy rate of 99%. The quality of Costa Rican talent is one of the main reasons why the country has managed to attract, retain, and diversify FDI in strategic sectors with high-added value, such as digital services, medical devices, and semiconductors. The trajectory of the operations of world-renowned companies such as Boston Scientific, Intel, Amazon, and IBM, among others, has been similar, as they began with operational processes and evolved into highly sophisticated processes, which have allowed the country to climb in global value chains. The trained, bilingual workforce with a vision of continuous improvement has been the great differentiator for 450 multinational companies that export goods and services around the world.

  Understanding that workforce skills are continuously transforming, the country is committed to the development of the advanced manufacturing ecosystem. As detailed in Pillar 1 of Talent and Workforce, Costa Rica has defined the steps to accelerate the training of specialized talent for the semiconductor sector. The country is already aligned with the needs of the industry and has more than 25 years of experience in the training of this type of talent, so it already has installed capacity, a number of professionals and technicians already trained, and the opening of collaboration with the semiconductor industry for talent training, unlike other countries in the region.

- **Digital Infrastructure and Cybersecurity**: Digital infrastructure is a fundamental element for the progress of the semiconductor industry in the country, which also contributes to reducing the digital gap and promotes the advancement of the digital economy. The government has made a decisive commitment to drive this issue forward with actions such as the rollout of the 5G network and plans to implement the 6G network by 2030. Within this framework, MICITT leads the National Telecommunications Development Plan 2022-2027, with the aim of consolidating our country's position in the global digital sphere and enhancing its competitiveness. This plan includes initiatives aimed at the expansion of critical infrastructures and the promotion of cutting-edge technologies, ensuring a robust environment for technological progress and digital inclusion.

  Costa Rica has also adopted key measures to strengthen cybersecurity, recognizing its essential importance in protecting the national digital infrastructure and supporting the semiconductor industry. The National Cybersecurity Strategy 2023-2027 details actions to expand cybersecurity capabilities, both in the safeguarding of critical infrastructure and in the security of industrial processes linked to high technology.

- **Building Resilient and Secure Supply Chains:** The country is in a strategic position for building resilient and secure supply chains. It has an ecosystem of more than 600 local suppliers in key areas for the development of the semiconductor industry, which can provide components, services, and technical know-how to support strategic stages of the semiconductor value chain, having a local response to the needs of global companies.

- **Geopolitical Considerations:** Costa Rica is a politically stable and democratic country, has no military, and maintains diplomatic relations with most countries in the world. This is of great importance for the semiconductor industry since, within the friendshoring trend, Costa Rica is positioned as a country that shares the same values and priorities as the countries in the region that participate in the semiconductor value chain, such as Mexico, Canada, and the United States, and has strong trade relations with Central America. As indicated above, Costa Rica is a key partner in the redistribution of the value chain, as it offers solutions to global vulnerabilities.

- **Infrastructure**: The country has modern and efficient infrastructure, including ports, airports, roads, and telecommunications. Proof of this was the construction and inauguration of the Paso Canoas Integrated Control Center on the border between Costa Rica and Panama, which, for the first time, allows Costa Rican and Panamanian authorities to carry out their control processes in the same facilities, with a single stop for passengers and carriers, increasing efficiency and reducing wait times by 50% and facilitating trade. This event is part of the Cross-Border Integration Program that seeks to strengthen Costa Rica's competitiveness through the modernization of its land border posts with an investment of US$100 million.

  The country also offers a wide range of business support services, such as free trade zones and industrial parks.

- **Ability to Empower Entrepreneurship:** Costa Rica has a vibrant entrepreneurial ecosystem. It has a number of institutions that support entrepreneurship, such as incubators, accelerators, and funding programs.

- **Incentives:** Costa Rica has designed different mechanisms for applying tax incentives that promote company growth, the attraction of foreign companies, and the promotion of investment in specific sectors. These incentives allow the installation of global companies in modern and efficient free trade zones, with competitive tax incentives such as income tax and customs duties, among others. In 2022, Costa Rica announced 11 new measures as part of the incentives to attract investment and strengthen territorial competitiveness outside the Greater Metropolitan Area. In response to the changing environment and global challenges, the country continues to adapt and identify new ways to strengthen the existing incentive framework considering the new international taxation rules, as detailed in Pillar 2 - Incentives 2.0.

In addition, the country has a proven track record in the semiconductor sector. Costa Rica has successfully attracted and hosted operations from leading global firms in the electronics

and advanced manufacturing sectors, demonstrating the ability to support high-tech industries with more than 25 years of experience. Prominent companies such as Intel, Teradyne, R&D Atanova (belonging to the Japanese corporation ADVANTEST), and Qorvo have established their operations in Costa Rica to develop strategic aspects of their production chain, such as assembly, testing, and distribution processes, design, research, and development, with significant opportunities to diversify and strengthen this industrial base.

However, to fully capitalize on these opportunities, it is imperative to develop a specific action plan aimed at attracting key segments such as assembly, testing, packaging, and design. Not only can these segments drive the growth of the sector, but they can also foster innovation, improve global competitiveness, and generate quality employment. (Gutiérrez Wa-Chong, 2023)

To achieve this objective and carry out the action plan in the following section, PROCOMER provides investors with complete attention, accompanying them in all stages of the investment cycle with services at no cost to the company, such as:

- **Pre-Investment Phase:** PROCOMER information for investors to make informed decisions based on data. This includes reports and trends of macroeconomic data, social indicators, comparative analysis with competing countries, financial models such as discounted cash flow (DCF) and profit and loss statement (PnL) analysis, customized presentations, and contacts with key stakeholders.
- **Accompaniment in Decision-Making:** PROCOMER supports investors in site selection, legal requirements, recruitment, and contact with institutional actors and established companies to learn first-hand about success stories.
- **Aftercare Service:** PROCOMER offers a special service to mitigate any inconvenience that the company experiences in the country. A dedicated team follows up on cases where the company has difficulty with a public institution.
- **Human Talent Development:** PROCOMER, in conjunction with established companies and academia, directs numerous initiatives for the training of professionals, training, job fairs, and allocation of financing resources for talent development.
- **Access to the Free Trade Zone Regime:** As mentioned above, PROCOMER administers the free zone regime that offers competitive tax incentives and facilitates the process for companies to operate in the country.
- **Offices In Costa Rica and Around the World:** thanks to its international presence, PROCOMER approaches companies in the semiconductor industry, promoting Costa Rica as a solid, attractive destination with experience in the industry.

Action Plan

Vision: To become the reference hub for the semiconductor industry in Latin America, attracting investments in assembly, testing, packaging, and design, promoting the generation of high-value jobs and the technological development of the country.

The semiconductor industry is one of the most important and dynamic in the world, and its growth has been exponential in recent years. Costa Rica, with its strategic location, qualified human talent, and favorable climate for foreign direct investment, has the potential to become a major semiconductor manufacturing and export hub. Within the framework of the "Critical Roadmap for the Strengthening of the Semiconductor Ecosystem in Costa Rica," PROCOMER, Costa Rica's export and foreign direct investment promotion agency, has a fundamental role in attracting semiconductor FDI to the country.

General Objective: To position the strategy to attract foreign direct investment (FDI), considering the specific particularities of the semiconductor industry for the assembly, testing, packaging, and design segments.

Specific Objective 1: To position Costa Rica as a strategic destination for the installation of operations in the semiconductor industry, with emphasis on the assembly, testing, packaging, and design segments.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Design and implement lead generation campaigns, using databases and automated tools for this purpose.	• Obtain leads and maintain a database with identified and contacted prospects to generate a solid pipeline of potential customers for semiconductor companies interested in investing in Costa Rica, their level of interest, and their plans. **Example**: Meetings with potential companies to present a country value proposition, follow-up, and accompaniment from PROCOMER.	PROCOMER	N/A	N/A	Short (6 months – 1 year)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Participate in events and fairs specialized in semiconductors.	• Attend events and fairs specialized in semiconductors to promote Costa Rica as an investment destination and generate key contacts with decision-makers. **Example**: International fairs such as SEMICON Europe and visits to technology hubs such as Silicon Valley.	PROCOMER	N/A	N/A	Short (6 months – 1 year)
Provide pre-and post-establishment support to investors.	• Provide specialized accompaniment to support companies in making informed decisions. **Examples:** These include specialized information, international benchmarking, macroeconomic and financial data, business agendas, contacts with key stakeholders, and aftercare services.	PROCOMER	N/A	N/A	Short (6 months – 1 year)
Design communication campaigns to position Costa Rica as an attractive destination for semiconductor companies.	• Position the country as a destination for investment in the semiconductor industry and related industries through communication campaigns. **Example**: Presence of Country Brand (*Marca País*) at the most important events in the industry.	PROCOMER	N/A	N/A	Short (6 months – 1 year)

Specific Objective 2: Identify and establish contact with strategic suppliers to the semiconductor industry that may consider establishing operations in Costa Rica. The purpose is to strengthen the local market and take advantage of the country's geographical location to expand its reach to other regions of the world, thus consolidating Costa Rica's position as a strategic destination in the global semiconductor value chain.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Using market intelligence, identify key suppliers to the semiconductor industry with investment potential to supply Costa Rica locally and internationally.	• Position Costa Rica as a hub of the semiconductor industry, attracting investment not only in manufacturing and assembly but also in complementary and related industries, expanding the country's industry ecosystem. **Example:** The medical devices industry in Costa Rica has been successful not only in attracting direct manufacturing and assembly (OEM) but also in creating a complete ecosystem integrating specialized suppliers, innovation, and research and development. This ecosystem has a hub of more than 100 companies that collaborate, including suppliers, OEMs, and Contract Manufacturers.	PROCOMER	N/A	N/A	Short (6 months – 1 year)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Gather information on the needs of established or potential semiconductor companies to strengthen local suppliers to the Costa Rican semiconductor industry.	• Gather information on the needs of semiconductor companies in Costa Rica. • Offer technical assistance to local companies so that they can improve their products and services and meet the requirements and standards of semiconductor companies. **Example:** Specialized listings of potential local suppliers.	PROCOMER	MEIC MICITT Academia National System for Quality	N/A	Short (6 months – 1 year)

Pillar 4: Regulatory Framework - Simplification of Procedures and Facilitation of Trade and Investment

Global Context and Trends

Achieving supply chain resilience remains the main challenge for the global semiconductor industry (Schuh et al., 2022). This dynamic and ever-changing industry must be able to respond effectively and quickly to changes between supply and demand, and the risks inherent in its supply chain. However, this resilience does not depend solely on the processes required in semiconductor manufacturing or on the behavior between supply and demand. The industry needs to have, at a regulatory level, the necessary flexibility to constantly adapt to an environment as changing as the one that, by definition, characterizes the semiconductor sector.

Therefore, the design of an adequate investment climate, which, at the level of the regulatory framework, allows governments to operate in a transparent, agile, and efficient manner, is essential to promote the adaptability that the sector seeks so much. The trend towards investment and trade facilitation and simplifying administrative procedures in favor of users has been reflected in numerous government measures that several countries have adopted to increase their competitiveness and provide effective solutions to the private sector.

Some of these changes have been brought about by the realization that investment facilitation is a vehicle for generating economic growth, especially in developing countries (UNCTAD, 2023).

In this context, the World Trade Organization (WTO) promoted the recently concluded negotiations of the Investment Facilitation for Development Agreement (AFID). Costa Rica has actively participated in this process, contributing its extensive experience as an investment destination.

The main objective of this Agreement is to ensure the transparency of administrative measures, simplify administrative processes, adopt measures that facilitate investment, and promote international cooperation. To achieve this, WTO member countries have acquired obligations related to the publication of measures, the standardization of public information, the simplification and streamlining of administrative procedures, the establishment of single points of contact, and the creation of single investment windows that provide legal certainty on the procedures required by investors. Both at the time of establishment and during the operations phase (WTO, 2023).

In addition, the countries have also focused on agreeing on good practices on the streamlining and simplification of procedures. An example of this is the work led by the OECD's Committee on Better Regulation, whose mandate is to assist member countries in strengthening their capacity to generate quality regulatory reform. Specifically, this Committee offers recommendations on how to design better governance systems and implement public policies at the national and regional levels based on good practices of simplified regulation and regulation based on clear and transparent evidence, which is more accessible to national and foreign users. Therefore, the simplification of procedures has become a common international practice that promotes the facilitation of investments and is

being implemented by numerous governments, without Costa Rica being the exception (OECD, 2012).

Having a regulatory framework that affects all the critical stages of investment - attraction, establishment, and operation can have a significant impact as it allows institutions to function efficiently, generating certainty and security for the investor. Specifically, the semiconductor industry has identified priority areas of public policy that could positively impact the investment climate for this sector. Some of these areas are health, environment, migration, and intellectual property.

Current Situation in Costa Rica

Costa Rica is aware of the importance of ensuring a flexible and state-of-the-art investment climate with public policies that facilitate investment and trade. For this reason, the country actively participates in different regional and multilateral initiatives in these matters in order to generate a regulatory framework based on best practices. As a result, reforms have been promoted that contribute to the generation of an environment characterized by legal certainty, transparency, and sustainability. Against this backdrop, the government wishes to continue to chart the path to a practical and flexible regulatory ecosystem for the semiconductor industry, enabling it to navigate and mitigate the particular risks presented by its supply chain.

The simplification of procedures and regulatory policy in Costa Rica are under the guidance of the Ministry of Economy, Industry and Commerce (MEIC), whose mandate includes coordinating the efforts to simplify procedures of the entire Public Administration in order to create an efficient and transparent State. It seeks to design a modern regulatory framework in accordance with international best practices, which promotes the competitiveness of companies and allows the review and continuous improvement of regulations. In addition, this regulatory improvement policy is implemented transversally for the Public Administration in accordance with Law 8220, "Protection of Citizens from Excessive Administrative Requirements and Procedures," with the aim of simplifying administrative processes for their efficiency, speed, and integration.

It should be noted that the process of simplifying procedures has a participatory element in Costa Rica. For example, a recent guideline issued by the MEIC called "Regulatory Improvement Measures to Eliminate Procedural Obstacles" established a consultation period on procedures that can be improved to receive inputs to coordinate subsequent inter-institutional work aimed at modifying regulations, eliminating duplications, and streamlining procedures. This allows companies to give timely feedback on critical management for their industry.

In order for the country to continue to be an ideal ally of the semiconductor industry and to strengthen the existing regulatory framework, a pillar has been proposed that seeks to address the public policy priorities for the sector through four major axes that will contribute to the improvement of the investment climate, and will have a direct impact on the semiconductor ecosystem: (i) regulations related to procedures before the Ministry of Health, (ii) migratory procedures that facilitate investment, (iii) procedures related to the protection of intellectual property, and (iv) trade facilitation measures.

Axis 1: Regulations Related to Procedures Before the Ministry of Health

Costa Rica is recognized nationally and internationally for the relevance and special protection it grants to health, which is protected as a human right at the constitutional level.[7] In this context, Law No. 5395 "General Health Law" establishes the legal bases for the public trade and consumption of products of health interest, as well as the power of the State – through the Ministry of Health – to supervise that the use of these products does not pose a risk to people or public health.

The protection of the health of the inhabitants, together with the control of products for human use and consumption, must be designed and implemented in a coherent, agile, and expeditious way so that the investor can comply with the requested requirements. Therefore, creating policies and procedures that safeguard the right to health of its inhabitants and, at the same time, facilitate the investment climate in the country is part of the responsibilities of the Costa Rican State.

Due to the enormous relevance of the cross-border trade of chemical products as a critical input in the production chain of semiconductor manufacturing, it was identified that the operationalization of the process of granting sanitary registrations of chemical products is an issue of priority attention for the sector. This is a highly complex and specialized sector, and, therefore, each phase of its chain involves the use of high-quality inputs – such as chemical products – subject to the highest quality standards and international certifications. Consequently, chemical registration is a frequently used procedure in industry. Therefore, the certainty and speed of this procedure would have a direct impact on the semiconductor industry and would allow adequate planning of companies' operations.

Currently, Executive Decree No. 40705-S of August 17, 2017, "Technical Regulation RTCR 478:2015 for Chemical Products, Hazardous Chemicals, Registration, Import, and Control" (Regulations for the Registration of Chemicals) defines the hazardous substances, products or objects of a radioactive, oxidizing, flammable, corrosive, irritating or other nature that the Ministry of Health must regulate. According to this standard, anyone involved in the importation, manufacture, handling, preparation, repackaging, storage, sale, distribution, transport, and supply of chemicals must ensure that these activities are carried out under conditions that allow them to eliminate or minimize the risk of such products to the health and safety of people and the environment. Therefore, the commercialization or use of these dangerous chemicals requires the processing of a sanitary registration granted by the Ministry of Health.

The greatest opportunity for improvement identified in the sanitary registration process consists of the Ministry of Health's management time. The installed capacity cannot process the number of applications received within the required deadlines. To solve this problem, the Ministry of Health recently signed an agreement with the Professional Association of Chemists of Costa Rica, which has resulted in a considerable decrease in waiting times and delayed applications. However, this is a temporary solution.

Without this agreement, the chemical registry could be processed in up to three months instead of the 15 days established by law. Thus, it is imperative to work on a more efficient procedure for chemical registrations, which allows the institution in charge to design a simpler and more expeditious procedure in favor of the user without sacrificing the security

[7] Political Constitution of Costa Rica, Article 21.

that the user seeks. To this end, the government has identified the actions that will make it possible to streamline this management.

Action Plan

Costa Rica has identified an opportunity for regulatory improvement related to the registration of chemicals, a critical procedure for the semiconductor industry. To address this issue, several actions are proposed to eliminate requirements and provide the necessary support to the Ministry of Health staff.

Vision: To have an efficient and agile chemical sanitary registration process that meets the needs of the semiconductor industry.

General Objective: To optimize the processes for the sanitary registration of chemical products that are necessary for the semiconductor industry, simplifying the procedures and reducing the time to obtain the registration.

Specific Objectives:

Specific Objective 1: To promote collaboration between regulatory institutions, professional associations, the private sector, and other sectors involved in the improvement of procedures required for the semiconductor industry.

Specific Objective 2: Promote regulations that streamline, digitize, automate, and simplify the authorization processes of chemical products linked to the semiconductor industry.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote the creation and renewal of collaboration agreements with public and private institutions to streamline procedures for chemical registrations.	• Decrease the registration process time. **Example:** In October 2023, the Ministry of Health signed a collaboration agreement with the Professional Association of Chemists of Costa Rica, which expires on May 6, 2024. The result of the agreement was a 92% reduction in procedures in 4 months.	Ministry of Health	N/A	Collaboration between government and industry to identify process streamlining needs. Collaboration between government and professional associations, such as the Professional Association of Chemists of Costa Rica.	Short (6 months - 1 year)
Update Executive Decrees No. 24715-MOPT-MEIC-S, 31363-MOPT, 27008-MEIC-MOPT, 35505-MOPT-S-MEIC-MINAE, 27001-MINAE,[8] On the transportation of hazardous chemicals.	• Simplify administrative procedures related to the transport of chemicals.	Ministry of Health	MOPT MEIC MINAE	Collaboration between government and industry to identify process streamlining needs.	Short (6 months - 1 year)

[8] Executive Decree No. 24715-MOPT-MEIC-S of October 6, 1995, "Regulations for the Land Transport of Dangerous Products", Executive Decree No. 31363-MOPT of June 2, 2003, "Road Traffic Regulations Based on the Weight and Dimensions of Cargo Vehicles", Executive Decree No. 27008-MEIC-MOPT of March 20, 1998, "Land Transport of Dangerous Products, Signage of Land Transport Units for Hazardous Materials and Chemicals", Executive Decree No. 35505-MOPT-S-MEIC-MINAE of April 24, 2009, "Officialization of the Emergency Response Guide for the Transport of Hazardous Materials 2008", Executive Decree No. 27001-MINAE of April 29, 1998, "Regulations for the Management of Industrial Hazardous Wastes". This regulation regulates the land transport of dangerous goods on public roads in the national territory. These products require specific regulations so that they can be moved and transported on public roads; However, the new decree provides for streamlining the procedure for the transport of this type of substance.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Strengthen inter-institutional collaboration between the public and private sectors through the Health, Industry, and Commerce Liaison Commission (COESAINCO)[9] to provide strategic content to the commission's agenda on issues of regulatory improvement in accordance with the needs of the semiconductor sector.	• Promote the strategic management of COESAINCO to improve registration-related processes of interest to the semiconductor industry.	Ministry of Health	MEIC	Collaboration between government and industry to establish the work agenda.	Short (6 months - 1 year)
Promote the digitalization of chemical labeling.	• Decrease registration time.	Ministry of Health	COMEX PROCOMER VUI RACSA	Collaboration between government and industry to identify process streamlining needs.	Medium (1 - 2 years)

[9] In accordance with Executive Decree No. 38894-S of October 9, 2014, the Health, Industry and Commerce Liaison Commission is created, whose purpose is to maintain a more agile line of communication between the Ministry of Health and the institutions and organizations that represent the private and public sector of the trade of products of health interest in Costa Rica to inform about the actions that are being implemented, and improve the regulatory procedures for products of health interest so that they are modern, transparent, agile and efficient. This Commission is made up of the Regulatory Improvement Officer of the Ministry of Health, the Directorate for the Regulation of Products of Health Interest of the Ministry of Health, the MEIC, CCCR, ICRC, ASIFAN, FEDEFARMA, CACIA, ASOCORES, AGEFAR, AMCHAM, UCCAEP, CACECOS and the Costa Rican Chamber of Health. Its functions include: i) Actively participate in spaces for the analysis of regulations and their reforms, related to the sanitary registration of products of health interest in order to promote regulatory improvement. ii) To serve as a forum for dialogue, communication, and agreements between the public and private sectors on the regulation of products of health interest and the procedures and processes related to them. (iii) To develop cooperation mechanisms to implement projects aimed at improving and simplifying registration procedures by the Directorate for the Regulation of Products of Health Interest.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Promote interoperability between the Professional Association of Chemists of Costa Rica and the Ministry of Health's virtual platform, *Regístrelo 2.0*.	• Minimize human intervention to achieve interoperability between the Professional Association of Chemists and Ministry of Health systems.	Ministry of Health	RACSA	Collabortation between the government and the Professional Association of Chemists to coordinate the efforts of this action.	Long (2 - 3 years)
Promote agreements with the semiconductor industry to train employees and external users on the use of the *Regístrelo 2.0.* digital platform.	• Encourage informed use of the *Regístrelo 2.0.* platform to minimize the precautions for registration requests.	Ministry of Health	N/A	Collabortation between government and industry for the signing of training agreements.	Short (6 months - 1 year)

Axis 2: Immigration Procedures

The general principles of Costa Rica's migration policy are set out in Act No. 8764, the General Law on Migration and Aliens, which confers on the Executive Branch the responsibility for defining the country's migration policy. In general terms, this policy implements inter-institutional actions to provide an effective response to the migratory situation and promote the integration of foreigners in economic, scientific, social, labor, educational, cultural, and sports fields.

The law also assigns the task of developing strategies and public policies aimed at strengthening priority areas for development, as well as economic sectors of state interest, to the General Directorate of Migration and Aliens (DGME) of the Ministry of the Interior and Police. For example, migration policy planning is supported by both relevant public and private institutions. It is based on inputs such as national, regional, or sectoral development plans, as well as annual operational programs related to available qualified human resources. To this end, the reports provided by various entities such as the MAG, MEIC, COMEX, MIDEPLAN, and the ICT are considered, which address the needs of the national productive sectors and foreign investment in terms of existing or insufficient human resources in the country.

In addition, the law empowers the DGME to establish the conditions for the entry and stay of non-residents in the country, defining criteria for the classification of restricted visas, consular visas, and visa-free entry. In this regard, the Regulations for the Granting of Entry Visas to Costa Rica establish that the entry and permanence of specialized human talent can be carried out through two categories: temporary residence and special categories. Within the temporary residence, the DGME grants entry and stay authorizations for a defined period, which may be longer than one hundred and eighty days and for up to two years, with the possibility of extension for an equal period.

Within these categories, specialized human talent, fundamental for the semiconductor industry, can reside in the country under the following migratory subcategories: Scientific, Professional, Intern and their dependents; Executive, Representative, Manager, Technical Staff and their dependents; Specialized employee in a dependent relationship and their dependents; Investor and their dependents; o Specialized Technician and their dependents.

In addition, the DGME may authorize foreigners' entry and stay in the country through special migratory categories to regulate migratory situations that, by their nature, require different treatment from the rest.

Under this category, the specialized human talent required by the semiconductor industry can remain in the country under the following special migratory subcategories: Student, Researcher, Teacher, Volunteer, Transfer Personnel, and worker of a specific occupation to work with a legal entity.

Although the legislation establishes a maximum of 90 days for the resolution of an application, this deadline is not met. Rather, the rate of returns or preventions is close to 90% of cases.

Therefore, due to the difficulty of regularizing the migratory status of the specialized human talent required by the semiconductor industry, the processing times of migratory applications are an opportunity to improve the investment climate for this industry.

In this context, the need to strengthen the applicable regulatory framework is identified to encourage the entry and permanence of specialized human talent for the semiconductor industry and contribute to closing the existing skills gap.

Implementing this type of regulation is imperative and also brings a number of advantages for the country, such as stimulating knowledge exchange, also known as spillover (Labraga, 2017). This phenomenon involves the transfer of knowledge and skills between international and local professionals, generating a positive impact on the overall development of the workforce and the country's competitive capacity in the global arena.

It should also be noted that the arrival of specialized foreign talent provides a valuable opportunity to promote new R&D+i initiatives within the host country. The diversity of perspectives and approaches coming from professionals with international experience can catalyze the creation and expansion of innovative projects, thus strengthening Costa Rica's scientific and technological base.

Action Plan

To complement the efforts to attract talent that have been proposed in Pillar 1, Axis 3, the government will promote regulatory improvement measures to facilitate the immigration procedures of foreign talent working for the semiconductor industry. In this way, the government will not only work on updating the entry requirements for this talent into the country but will also seek to modernize the associated immigration procedures.

Vision: To design efficient migration processes to facilitate the entry of foreign personnel with knowledge linked with the semiconductor industry, promote the exchange of knowledge and contribute to the country's economic and technological development.

General Objective: To optimize immigration processes to reduce wait times and simplify procedures, promoting the attraction of foreign talent necessary for the semiconductor industry, and facilitating the entry of foreign collaborators.

Specific Objectives:

Specific Objective 1: To improve the process of issuing consular visas to reduce issuance time and simplify procedures.

Specific Objective 2: To streamline the immigration process for foreign recruits and international experts in the semiconductor area.

Specific Objective 3: To simplify and eliminate requirements in the procedures of residencies and stays to reduce the duplication of procedures and documents required.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Simplify the requirements for the consular visa issuance process.	• Reduce wait time and simplify the process of issuing consular visas by implementing agile and efficient mechanisms, such as digitizing the process.	DGME	COMEX MREC PROCOMER	Collaboration between government and industry to effectively communicate the new procedures to those in charge of internationalization in educational centers.	Short (6 months - 1 year)
Simplify the procedure for obtaining residencies and stays.	• Simplify procedures and documents required for the residency procedure.	DGME	COMEX PROCOMER	Collaboration between government, industry, and academia to identify process streamlining needs.	Medium (1 - 2 years)
Promote regulatory and legal reforms to streamline immigration processes for highly specialized personnel.	• Create more agile migration processes with updated regulations.	COMEX	DGME PROCOMER MTSS	Collaboration between government, industry, and academia to identify process streamlining needs.	Medium (1 - 2 years)

Axis 3: Regulations Related to Intellectual Property

Considering the speed with which the semiconductor industry is advancing, SIA has identified that a solid regulatory framework for the protection of intellectual property rights and clarity regarding the efforts to protect it is among the sector's public policy priorities (SIA, 2020). This issue is crucial for the industry, as adequate intellectual property protection promotes innovation and investments in R&D, allows the differentiation of technology and products in the market, encourages the attraction of investment, and mitigates legal risks (Einfolge Technologies, 2024). Therefore, economies seeking to consolidate themselves as an essential part of the semiconductor supply chain must clarify, simplify, and strengthen intellectual property-related processes.

Costa Rica has worked to establish a legal and institutional framework that values and recognizes intellectual property rights as a tool for economic development, innovation, and investment attraction. Over the years, important and decisive steps have been taken to create a robust and modern system for the protection of intellectual property rights in line with the highest international standards.

As a result, Costa Rica has developed a robust regulatory framework for protecting intellectual property rights, consistent with international best practices. For example, intellectual property rights are recognized in Article 47 of the Constitution, which provides that every author, inventor, producer, or trader has exclusive rights over his or her works, inventions, trademarks, or trade names as provided by law.

In addition, the country is a party to 16 international treaties administered by the World Intellectual Property Organization (WIPO). It has made commitments regarding intellectual property rights under numerous Free Trade Agreements in force, such as the United States-Central America-Dominican Republic Free Trade Agreement (CAFTA-DR).

Regarding the protection of intellectual property rights that may be relevant to the semiconductor industry, three types of rights are identified that are already widely regulated in the Costa Rican legal framework: industrial secrets, patents, and the protection of integrated circuit layout designs.

Law No. 7975, "Law on Undisclosed Information," provides for the protection of trade and industrial secrets kept confidential by a natural or legal person to prevent information legitimately under his control from being disclosed to third parties, acquired or used without their consent by third parties, in a manner contrary to honest commercial practices. This protection is offered in the case of secret information, legally under the control of a person who has taken reasonable and proportionate measures to keep it secret. It has commercial value because of its secret nature.

In relation to patents, Law 6867, "Law on Patents for Inventions, Industrial Designs, and Utility Models," provides for 20-year protection through the registration, before the Intellectual Property Registry, of patents for inventions that are new, inventive, and susceptible to industrial applicability.

Finally, layout designs of integrated circuits are protected for 10 years in accordance with Law 7961, "Law for the Protection of Layout Systems in Integrated Circuits," when they are original. That is, they result from the intellectual effort of their designer.

Even considering that Costa Rica already has a robust regulatory framework on this issue, the country has not developed either regulations or capacities in operators of intellectual property rules that are specific to the semiconductor sector due to the lack of demand for the protection of rights relevant to the industry. Therefore, opportunities have been identified to improve the institutional capacity of the Intellectual Property Registry and to simplify the procedures related to the protection of intellectual property rights. It is also important to foresee that the development of the local industry could mean increasing the demand for Land Registry services, so it will be necessary to strengthen and increase its capacity according to the need.

Action Plan

Based on the current state of intellectual property regulations and recognizing the solid foundations that exist in this area, the work plan related to this axis will focus on capacity building for officials and deepening the protection of rights relevant to the semiconductor industry.

Vision: To promote innovation, research, and development through regulations for the protection of intellectual property associated with the semiconductor industry.

General Objective: To strengthen the regulatory and institutional framework for the protection of intellectual property and have trained personnel to register integrated circuit designs.

Specific Objectives:

Specific Objective 1: To promote the creation of specialized regulations for the protection of integrated circuit design.

Specific Objective 2: To generate capacity for the registration of integrated circuits in the Intellectual Property Registry.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Request training for the Intellectual Property Registry through agreements with counterpart institutions.	• Train officials in the protection of intellectual property rights relevant to the semiconductor industry. **Example**: In 2021, the Intellectual Property Registry signed a Memorandum of Understanding with the United States Patent and Trademark Office. One of the purposes of this instrument is capacity building.	Intellectual Property Registry	N/A	Collaboration between government and counterpart institutions to the Intellectual Property Registry, such as the United States Patent and Trademark Office.	Short (6 months - 1 year)
Promote agreements with counterpart institutions to obtain support on regulatory issues related to the semiconductor industry	• Sign agreements that include training and awareness-raising issues on semiconductor industry regulations. **Example:** In 2021, the Intellectual Property Registry signed a Memorandum of Understanding with the United States Patent and Trademark Office. One of its objectives is to improve the administration and effectiveness of intellectual property rights protection systems.	Intellectual Property Registry	N/A	Collaboration between government and counterpart institutions to the Intellectual Property Registry, such as the United States Patent and Trademark Office.	Short (6 months - 1 year)

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Analyze the feasibility of having agreements that facilitate the validation of intellectual property rights for the semiconductor industry.	• Streamline the registration processes related to intellectual property rights for the semiconductor industry in the case of patents and layout designs of integrated circuits aligned with Costa Rican regulations.	Intellectual Property Registry	N/A	Collaboration between government and counterpart institutions to the Intellectual Property Registry, such as the United States Patent and Trademark Office.	Short (6 months - 1 year)

Axis 4: Trade Facilitation

As part of global efforts to diversify the supply chain, the nearshoring trend will be a determining element for the semiconductor industry as it expands into new geographic locations (Deloitte, 2024). This trend, which highlights the importance of structuring supply chains with closer countries and in similar time zones to reduce the effect of possible disruptions, is one of the clear opportunities Costa Rica has to become a benchmark investment destination for this sector.

Due to its strategic geographical position, Costa Rica is already a natural ally for nearshoring within the chain rebalancing efforts led by the United States and the European Union. However, to take advantage of the current situation, it must create the necessary conditions to ensure that the semiconductor industry's supply chain operates quickly and efficiently. These conditions include port, air, and land logistics infrastructure but also customs processes that dictate, on many occasions, the pace of normal operations for companies in the country. Improved customs infrastructure and procedures are key enablers for the flow of international trade in general. However, the semiconductor industry needs to have the right road, port, and airport platform that meets its needs. It is in this sense that, within the framework of the Roadmap, specific actions were identified that could contribute to its strengthening.

As part of its commitment to trade facilitation, Costa Rica ratified the WTO's Trade Facilitation Agreement (TFA) in 2017, as this instrument seeks to promote the simplification and streamlining of procedures for exporting, importing, and transiting goods at the international level. This agreement contains specific provisions aimed at improving efficiency in the movement, clearance, and release of goods at borders, including those in transit. At the same time, it establishes measures to foster effective cooperation between supervisory authorities on issues related to trade facilitation, as well as technical assistance and capacity-building measures, with the aim of supporting countries in the implementation of these trade facilitation measures.

The country has made significant progress in implementing TFA commitments, reaching a compliance level of 97.9%. However, there are still provisions notified in Category C that need to be addressed, specifically with regard to Articles 10.1.1 and 10.2.2 of the TFA. Article 10.1.1 requires members to review and, as appropriate, take measures to minimize the complexity of formalities and documentation requirements in connection with the import, export, and transit of goods. This involves ensuring that these measures are adopted and implemented in a way that facilitates the rapid release and clearance of goods, reduces time and cost to traders, is the least trade-restrictive measure, and is eliminated if no longer needed.

Article 10.2.2 of the TFA, on the other hand, provides that where a governmental body of a Member already has in its possession the original of a requested document, any other body of that same Member shall accept, where appropriate, a hard or electronic copy provided by the body in possession of the original, Instead of requiring the original document again. This seeks to facilitate and streamline processes by allowing the use of copies instead of original documents where possible.

To advance compliance with these provisions, COMEX carried out a review study of the formalities and documentation requirements related to the import, export, and transit of goods at the Land Border Posts. The aim was to identify the original documents and copies required in foreign trade processes and identify opportunities to improve these processes.

The purpose of the study was to propose concrete recommendations to the relevant authorities to eliminate the request for copies, unnecessary documentation, or documentation that can be consulted by digital means in order to optimize foreign trade procedures and fully comply with the commitments of the TFA. As a result of this study, policy MH-DGA-PRO05-INS-003 was issued in November 2022, which seeks to simplify, digitize, and eliminate the documents required at land border posts, contributing to the efficiency and transparency of customs processes in the country. In the same vein, the State Phytosanitary Service issued instructions NI-0001-2024 and NI-0002-2024 requesting its phytosanitary inspectors at the land border posts of Peñas Blancas and Paso Canoas to eliminate the practice of requesting copies of foreign trade documents for procedures before this institution.

As part of this exercise to review documentation requirements and formalities, the Technical Secretariat of the National Council for Trade Facilitation (CONAFAC)[10], with the support of PROCOMER, will study the documentation required for maritime operations and areas for a complete diagnosis of documentation requirements and requests related to international trade operations. Upon completion of this exercise, Costa Rica will notify the WTO of full compliance with the TFA. These results will have an impact on the management of procedures required to move sea and air cargo from the semiconductor industry since many of the required inputs use these transport routes.

On the other hand, while these efforts are essential for improving the competitiveness and flexibility of business operations, there are still challenges that require attention. The primary sources consulted indicate that the semiconductor industry faces obstacles that affect its efficiency and competitiveness in Costa Rica. Among these challenges are the dispatch times of goods, which, in the event of any unforeseen event, can delay supply chains and affect the ability of companies to respond to market demand.

Road, logistics, and port infrastructure also require improvements to adapt to this industry's needs, including the modernization of facilities and the optimization of logistics processes. Seaports are critical links in the global supply chain, and their efficiency has a direct impact on the competitiveness of companies that depend on maritime transport.

In this sense, the country must implement specific measures aimed at addressing these challenges and strengthening capacities for their proper management, which are also linked to the semiconductor industry, such as capacity building of institutional human resources and investment in technology to streamline and digitize foreign trade procedures. Likewise, it is important to continue promoting the structural measures underway to promote the development of road and port infrastructure, such as the modernization of existing ports or

[10] The National Trade Facilitation Council (CONAFAC) was established in compliance with the WTO's TFA in 2017. Its main objective is to coordinate internally and implement the provisions of that agreement. This body is composed of five representatives of the private sector and seven vice-ministerial representatives, each in charge of specific areas related to international trade. This multidisciplinary structure makes it possible to comprehensively address aspects related to trade facilitation, ensuring effective coordination between the different sectors involved.

the construction of roads and new terminals that comply with international standards and are in line with the growth of Costa Rica's investment attraction and exportable supply.

Action Plan

The plan presented below is aligned with the Priority Agenda for Trade Facilitation and the actions outlined in the work plan of CONAFAC, an inter-agency coordination forum with the participation of five high-level representatives of the private sector and seven institutional leaders. This Agenda, declared of public interest through Executive Decree No. 42065-MP-COMEX, is composed of a series of measures aimed at improving the operability and trade flow at land border posts, ports, and airports through the use of technological platforms as a catalyst to improve, integrate and decentralize access to information by the main actors in international trade. It also promotes, among other initiatives, the use of technological platforms as a catalyst to improve, integrate, and decentralize access to information by the main actors in international trade.

Each action of this plan is directly or indirectly integrated with the instruments described and was developed in collaboration with the competent authorities, the private sector, and academia.

Vision: To become a benchmark for efficiency in facilitating international trade through the implementation of innovative measures that optimize foreign trade processes and port infrastructure, thus promoting the country's competitiveness and sustainable development.

General Objective: To optimize the country's trade flow by streamlining foreign trade procedures and modernizing port infrastructure. Focus on reducing clearance times and strengthening company competitiveness, with special emphasis on the semiconductor sector.

Specific Objective 1. To train personnel involved in port and foreign trade operations through specialized training programs to improve efficiency in meeting the needs of the private sector, with emphasis on the semiconductor industry.

Specific Objective 2. To promote actions to increase the number of personnel of control institutions to improve efficiency in the provision of their services, with emphasis on the semiconductor industry.

Specific Objective 3. To promote the implementation of advanced port management practices and infrastructure improvements, ensuring efficient operability.

Specific Objective 4. To develop a detailed study on the requirements and formalities of documentation required at the Moín Container Terminal (TCM) and Puerto Caldera to simplify, digitize, and speed up procedures for users.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Strengthen the training of personnel in charge of foreign trade procedures, including those who must manage companies in the semiconductor industry or related industries.	• Train personnel to ensure efficiency in the provision of an adequate and efficient service.	COMEX	PROCOMER International Organizations Other Governments	Collaboration between government, academia, and industry to coordinate training activities.	Short (6 months - 1 year)
Identify mechanisms to ensure that control institutions, such as Customs, Migration, Agriculture, and Health, have the necessary personnel to maintain the flow of trade at major ports, airports, and land border posts.[11]	• Evaluate the possibility of increasing the number of personnel for the provision of efficient and effective control and service at the country's land border ports, ports, and airports.	Ministry of Finance	COMEX STAP	N/A	Medium (1 - 2 years)
Boosting the development of capabilities and implement best practices in port management and operational capacity.	• Improve port management and operations.	INCOP MOPT	COMEX PROCOMER	Collaboration between government, industry, and international organizations to identify best practices.	Medium (1 - 2 years)

[11] This action includes the possibility of excluding the creation of this type of position from any budgetary constraint, given that these positions are essential to ensure strategic services for the country.

Activity	Objective	Responsible	Inter-agency cooperation required	Collaboration Opportunities	Term
Carry out an exhaustive study on the requirements, formalities, and documentation in Moín, Caldera, and the Juan Santamaría International Airport.	• Identify more efficient and simplified procedures for infrastructure users.	COMEX PROCOMER	CONAFAC	Collaboration between government and industry to identify process streamlining needs.	Short (6 months - 1 year)
Advance in the bidding process for the selection of the new operator of Puerto Caldera through the work schedule with the International Finance Corporation (IFC) for the structuring and due diligence of the new international public tender.	• Launch of an international public tender for Puerto Caldera.	MOPT INCOP	COMEX	N/A	Long (4 years)
Promote short-term operational actions to improve Puerto Caldera's fluidity while the bidding process is being carried out.	• Improve port fluidity through short-term operational actions.	MOPT INCOP	COMEX CONAFAC	Collaboration between government and industry to identify process streamlining needs.	Long (4 years)

Next Steps

To ensure the follow-up and implementation of the Roadmap for the Strengthening of the Semiconductor Ecosystem in Costa Rica, this inter-institutional effort is supported by an executive decree that (i) declares the semiconductor industry and related industries to be of public interest, (ii) establishes COMEX as the Technical Secretariat for the operationalization of public policy initiatives related to the sector; (iii) establishes inter-institutional coordination in the efforts to attract and retain investment in this industry led by COMEX, and (iv) indicates that COMEX will promote strategic alliances with other countries and entities that contribute to the establishment, growth and development of these industries.

Based on this legal framework, COMEX, through the Directorate of Investment and Cooperation, will form intersectoral working groups (government, academia, and the private sector), as appropriate, to detail each of the pillars of the public policy described above and implement them within the indicated deadlines.

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Annex 1: Main Results of the Survey on the Demand For Technical-Professional Talent For the Semiconductor Industry