

# Costa Rica's Technology Strategy

ROOTS AND OUTCOMES

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*Electronics and medical services are growing sectors in Costa Rica, which now has the most software exports per capita in Latin America. The country's transformation into a knowledge-driven economy is led by high-tech transnational and domestic companies and by well-crafted government policies, but also has deep roots in national educational and political systems. In this article\* Andrés Rodríguez-Clare discusses how these developments came about and what other countries can learn from the experience. He is Visiting Lecturer in Public Policy at Harvard University's John F. Kennedy School of Government, and headed the Council of Presidential Advisors in Costa Rica, 1998–2002.*

## ARRIVING AT A STRATEGY

Over the last decade Costa Rica has made a tremendous leap forward in the development of a technology and knowledge-driven economy. Perhaps the better known part of the story is that an important group of high-tech transnationals decided to establish manufacturing plants in the country. This group includes not only Intel and several other companies in the electronics sector (e.g., Remec, Sawtek, Conair, Reliability, Protek, Sen-

sortronics, Colorplast), but also several companies in the medical devices sector, such as Abbott and Baxter. The country also appears to be benefiting from the information-technology-led restructuring of large corporations, with the establishment of Procter and Gamble's Global Business Center in the country (the largest GBC in the world), as well as other service centers such as Western Union and IT technical support provider Sykes.

The growing importance of knowl-

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edge and technology in the economy does not end with high-tech transnationals. It reaches deeper into the economy, as evidenced by several domestic companies that are successfully competing worldwide in knowledge-intensive sectors. The clearest example is the phenomenal growth of the domestic software sector, so

leader who convinced the country to move in a particular direction. No specific legislation or "grand national vision" is responsible. Moreover, there are important disagreements within the country about the measures, reforms and adjustments that have to be made for Costa Rica to be successful in this new

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that today Costa Rica has the highest level of software exports per capita in Latin America. Two very significant signals of the country's potential in software and design come from recent decisions by Intel. First, it decided to go beyond the assembly and testing plant it established in 1998, and establish in Costa Rica a center to develop software for the company and contribute to its semiconductor design processes. Second, through its venture capital fund, it invested in one of the most promising software companies in the country. All this goes together and is reinforced by the existence in the country of internationally recognized centers of high quality training, education and research, such as Harvard-associated INCAE, Earth, CATIE, and INBio.

At the outset it should be emphasized that the positive technological developments experienced by Costa Rica in the last years are not the result of any collective and explicit decision. They are not the product of some charismatic

stage of development. There are profound divergences about, for instance, the role of the state and the private sector in the delivery of public services, most notably telecommunications. And this should be no surprise. One cannot expect an open and pluralistic democracy like Costa Rica to achieve the kind of long-term and unified national vision that was found in countries like Japan, Taiwan and Singapore.

Costa Rica's recent string of achievements in the technological area are the result of a series of mutually reinforcing policies and events (some of them dating back to the 19th century) that have converged in the last years. What is important, however, is that there is no significant opposition to a development strategy based on technology and human capital, with high-tech transnationals playing a key role. This is perhaps because there is no clear alternative to this strategy; or perhaps because the momentum accumulated in recent years behind these

developments seems unstoppable. This momentum becomes evident when one sees several different institutions — from the national agency in charge of attracting foreign investment to the public universities, from the ministry of education to the national institution in charge of telecommunications — all moving ahead with programs and projects that in complementary ways support the transition of the economy towards the new knowledge-intensive stage.

### THE ROLE OF HISTORY

The process for arriving at Costa Rica's current "national strategy" even goes back to the first half of the 19th century, with the strong emphasis on the importance of education for democracy and development. At the beginning of the 20th century Costa Rica's literacy rate was among the highest in the Americas. This commitment to education was later reinforced with the creation of the first public university of the 20th century in 1940, followed by the creation of three more

model, and also for the state-owned companies and institutions in telecommunications, electricity, agriculture, industry, water supply, and infrastructure.

In terms of education, the 1980s were worse than a "lost decade" for Costa Rica. High-school enrollment rates fell significantly, only to recover to 1980 levels by the end of the 1990s. One 1980s initiative — the installation of computer labs in schools — later contributed significantly to the country's prospects for developing a technology- and knowledge-driven economy. Later recognized around the world for two revolutionary characteristics, the program concentrated on elementary schools, so that it could make a deeper impact on students; and it did not focus on teaching computer skills, but rather used the computer as a tool to aid in the general learning process. Two other developments during the 1970s and 1980s that would also prove important for the new economy were the growth of private universities and the creation of technical or vocational high schools

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public universities in the 1970s. The public universities generated the supply of scientists and engineers needed for the industrial sectors that grew in the 1960s and 1970s under the import substitution

and public junior colleges. Without the investment in education that took place for almost two centuries, the current prospects for growth based on human capital would of course be impossible.

After the crisis of the early 1980s, Costa Rica had to abandon the import substitution model, and moved to an export promotion model. This was based primarily on trade liberalization (and access to the US market through the Caribbean Basin Initiative) and two systems of fiscal incentives: the Export Processing Zone regime and the Export Contract.

The Export Processing Zone regime allowed companies to import all their inputs and equipment tax free and avoid paying income tax for eight years, paying only 50 per cent of taxes due for the next four years. This system was designed to

change their orientation from the domestic and Central American Common Market towards competing in open and competitive world markets. A parallel objective was to diversify the country's agricultural exports from heavy dependence on coffee and bananas. The subsidy was also justified as a way to compensate exporters for inefficiencies in public services such as electricity, telecommunications, and ports, as well as the high costs of financial services like insurance and banking caused by the quasi-monopolistic structures that remained in those sectors.

The strategy of trade liberalization,

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attract foreign direct investment (FDI) and eventually became a key element in attracting high-tech transnationals. A study by FIAS (Foreign Investment Advisory Service, a joint service of the International Finance Corporation and the World Bank) concluded that Costa Rica's "free trade zone legislation has resulted in one of the better export-processing zone systems in the developing world" (FIAS, 1996: vi).

Through the Export Contract, companies not only enjoyed an income-tax holiday and tax-free imports of equipment and inputs, but also received a generous subsidy equivalent to 10 per cent of the value of their exports. This system was designed to help domestic companies

export promotion and attraction of FDI paid off, and the country attained moderate rates of growth in the second half of the 1980s and early 1990s. It soon became evident, however, that the system placed a heavy burden on the fiscal system. Public debate during the 1990s revolved around incentives, trade liberalization, and structural reform. The private sector argued that incentives and some degree of protection to local industry were necessary to compensate for inefficiencies and distortions that existed mainly in the financial sector and public services. Economists and some policy makers argued that both incentives and distortions had to be eliminated simultaneously through structural reform. This

process was very difficult and frustratingly slow because of strong opposition from public sector unions and the difficulty of passing reform bills through congress (where the governing party lacked a strong majority and congressional procedures encouraged filibuster practices).

During these years of debates about structural reform, political candidates and governments talked about policies and programs to support science and technology, but there was little substance and little funding, leading to small programs that generally had little impact on the economy. So neither the big debate in the political arena nor the public policies related to science and technology did much to determine the new vision. What really made the difference was happening elsewhere, behind the doors of CINDE.

## THE CINDE STORY

The transition to the new export promotion model was accompanied and supported from the beginning by the Costa Rican Investment Board (CINDE). A private nonprofit organization, CINDE was founded in 1983 by prominent business people, supported by the Costa Rican government and financed by grants from the US-AID. Its broad objective was to help in the development of the economy, but the attraction of FDI was always one of its top priorities. It assists foreign investors in establishing operations in Costa Rica.

Through time, it gained very relevant expertise in promoting the country abroad

and attracting FDI, mainly for agriculture and manufacturing sectors that are unskilled-labor-intensive, especially clothing assembly plants (*maquiladoras*). Its success was in large part due to its institutional nature (nonpolitical, nongovernmental), which allowed it to have continuous programs and a long-term strategy without being affected by periodic changes in government.

In the early 1990s CINDE realized that the country was losing competitiveness in unskilled-labor-intensive industries to other members of the CBI and also due to the North American Free Trade Agreement (NAFTA), which would give Mexico better access to the US market than CBI members. At the same time, it was losing the US-AID funding it had enjoyed from its creation. It therefore decided to focus FDI attraction efforts on skilled-labor-intensive industries, in a few sectors that better matched Costa Rica's relatively high education levels.

For its 1993 strategic plan, CINDE focused on electrical, electronic and telecommunication industries. These not only required higher skilled labor, but were also experiencing fast growth in the US, and strong competitive pressures were forcing companies to search for low-cost locations around the world. These sectors seemed a particularly good match for Costa Rica because of its good supply of technicians and engineers at relatively low cost, the widespread knowledge of English, and the country's well known political sta-

bility, democracy, developed legal system (i.e., rule of law), and low levels of corruption. Moreover, there was a high quality of life, with good access to health services, nightlife and cultural amenities, natural resources and ecotourism (for which the country was increasingly better known). In fact, several companies in the electronics sector were already established in the country, among them Motorola, Trimpot, Sylvania, and Espion.

The year 1995 confirmed that this strategy was right. DSC Communications Corporation decided to establish a manufacturing plant in Costa Rica — the largest industrial investment in the country up to then and the first Printed Circuits Board (PCB) assembly plant in the country. Sawtek Inc., Merrimac Industries, and Remec also chose to invest in the country. Thanks to these successes, CINDE acquired a deeper understanding of the industry. It realized for the first time that, though Costa Rica had a unique competitive advantage for these sectors over other CBI members (Mexico, El Salvador, the Dominican Republic), it was now competing against countries in other regions (such as Ireland, Chile, Israel, and Thailand).

Thanks to this increased understanding of the electronics industry, CINDE learned that Intel was starting the site selection process for an assembly and testing plant for one of their newest chips, but Costa Rica was not on the “long list.” Despite some skepticism from their highest authorities, CINDE’s specialists on

FDI attraction started a campaign to get it on the list. They put together an effective presentation for Costa Rica, which was entered on Intel’s list in November 1995.

After Intel’s visit to Costa Rica in April 1996, Costa Rica became a top contender in the list, which at that stage included Argentina, Brazil, Chile, China, India, Indonesia, Korea, Mexico, Puerto Rico, Singapore, Taiwan, and Thailand. The best source of information about Intel’s site-selection process is a study by Deborah Spar (1998), which I have complemented with personal interviews with Intel and CINDE representatives.

With three plants already in Malaysia, China and the Philippines, Intel decided to diversify and dropped Asian countries from the list. Many additional research visits by Intel to different locations narrowed the list to four countries: Brazil, Costa Rica, Chile and Mexico. By November 1996 the other three countries were dropped for various reasons, and Intel announced its choice of Costa Rica. Four factors led Intel to choose Costa Rica:

- The general characteristics of the country provided a favorable basis to attract skill-intensive FDI. In addition to the same characteristics which CINDE had identified in 1993 (see above), favorable factors included a nonunion work environment; a “pro-business” environment with a favorable attitude towards FDI; a good package of incentives that had clearly defined procedures and conditions and was

not subject to arbitrary negotiation (the EPZ system); and good location and transportation logistics.

- The country's growing emphasis and success in attracting high-tech FDI gave credibility to Costa Rica's case that it had the professional human resources required for an operation like Intel's. When Intel talked to several high tech-transnationals in the country during its site-selection process, the glowing reports and optimism of these executives were decisive in moving Costa Rica to a top position on Intel's list of countries for possible investment.
- The existence of an aggressive, effective and knowledgeable foreign investment promotion agency like CINDE was very helpful. CINDE was important in convincing Intel to consider locating in Costa Rica and helping Intel's people conduct research and obtain the credible and consistent information they demanded. It had links and credibility with the government and played a key role in arranging successful meetings between Intel executives and government authorities.
- The Government quickly understood the importance of an Intel investment in the country. The president personally met Intel executives and conveyed a very strong interest in its investment.

He also motivated and coordinated the rest of the Government to help Intel as much as possible within the existing laws and regulations. The Government was very diligent in responding to Intel's concerns in areas like education, electricity and taxes.

The Government's responses were not special concessions made to Intel, but were generally applicable to other companies as long as they met the required conditions. In this sense, it could be argued that these were not concessions, but rather Intel-inspired reforms to improve the country's competitiveness. For example, education reforms included the addition of a one-year "certificate" program focused on technical skills and physics/chemistry competency and a one-year "Associate Degree" program focused on semiconductor manufacturing. Regarding electricity, rates were very high, so the Government asked the regulator to establish a new lower rate for energy-intensive industrial facilities. These incentives were valid generally, not just for Intel, and this is perhaps the main reason why there was almost no opposition to Intel's investment nor to the incentives it received.

With Intel's decision to establish its assembly and testing plant in the country, it became clear that attracting high-tech transnationals to the country was feasible and potentially effective as part of the development strategy of the country. What was until then a CINDE strategy became a national strategy.

## THE FIAS STUDY AND SUBSEQUENT STRATEGIES

CINDE was aware that other weaknesses in Costa Rica's economy needed to be addressed if the country was to be successful in attracting FDI in electronics. Moreover, it needed a deeper understanding of the electronics industry so as to better design its FDI attraction efforts. With this in mind, CINDE hired FIAS in 1996 to develop "A Strategy for Foreign Investment in Costa Rica's Electronics Industry." The study's main finding was that:

*"There is a basis for substantial expansion of foreign direct investment in the electronics industry in Costa Rica... The niches for Costa Rica would not involve mass market products, but rather those with smaller production runs that require relatively large inputs of skilled labor for set-ups and testing. The most attractive niches can be grouped into four basic technology areas, as follows: power technologies, PC cards and surface mount technologies, system integration technologies, call centers... Such*

*education advantage covers a wide range, from operatives to technicians and engineers. There is also a wide-spread knowledge of English."*

The FIAS study also suggested promoting sectors that support the electronics industry, such as plastics, metal working, mold making and equipment service and repair. This would help develop "clusters" and increase competitiveness in these areas. It was recommended to do this through attracting FDI in these areas, as well as through backward linkages to develop such industries domestically. Finally, FIAS noted several obstacles to developing the electronics sector in the country and recommended improvements in intellectual property rights legislation, telecommunications and transportation infrastructure, the public system to support training, and the low quantity of graduating technicians and engineers with English proficiency.

CINDE used the FIAS study to define its strategic plan for the following years, starting with its 1997 plan objective to position Costa Rica as "the emerging electronics manufacturing center in the

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*The main advantage Costa Rica has to offer the world electronics industry is a labor force that is relatively well educated in relation to its cost.*

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*products draw heavily on the main advantage that Costa Rica has to offer the world electronics industry: this is the labor force that is relatively well educated in relation to its cost. The*

*Americas."* The idea of developing clusters in certain skill-intensive sectors was later reinforced by "Competitiveness Agenda for Central America towards the 21st Century", carried out jointly

by INCAE and the Harvard Institute for International Development (led by Michael Porter and Jeffrey Sachs).

In following years, additional CINDE research led to including the medical devices sector among its targeted sectors. Success came early in a 1998 decision by Abbott Laboratories to establish a sophisticated \$60 million manufacturing plant in the country, and Baxter's decision to

rights protection in compliance with the Uruguay Round, and develop better access to foreign markets through free-trade agreements with countries such as Mexico, Chile and Canada.

## THE IMPACT OF INTEL ON COSTA RICA

When Intel announced its decision to invest in Costa Rica, it projected an

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*Objective: position Costa Rica as "the emerging electronics manufacturing center in the Americas."*

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expand its presence with a \$30 million investment. New opportunities opened up later in the business services sector with Procter and Gamble's decision to establish a Global Business Center for the Americas, with the expectation of hiring up to 1,500 professionals.

Today, Costa Rica is following a strategy that appears to enjoy strong support from many different groups. That includes not only CINDE's continuing efforts to attract high-tech transnationals, but also a program sponsored by Inter-American Development Bank to help small and medium enterprises become their suppliers, and initiatives to increase the human resources needed for the new development model. This is complemented by more general policies to improve telecommunications (especially for the Internet and data transmission), improve infrastructure through private sector participation, improve intellectual property

investment of between \$300 and \$500 million. By December 1999, it had already invested \$390 million and was employing more than 2,200 people, including over 500 professional employees, most of them engineers. Average wages for Intel employees were 50 per cent higher than the average in the manufacturing sector. For an economy with a GDP less than \$12.5 billion in 1997 and a labor force just over one million people, this was an extraordinarily large investment. In fact, in 1999 Intel accounted for more than 60 per cent of the total growth experienced and almost 40 per cent of total exports. In 1999 Costa Rica ran a trade surplus for the first time in decades.

Of even greater interest and relevance is the impact Intel had on Costa Rica's ability to attract high-tech FDI and the economy's general competitiveness in skill-intensive industries. Intel's invest-

ment decision became news worldwide and tremendously improved the country's image as a viable economy and attractive investment location for high-tech companies. In a 1999 survey among possible investors, 72 percent of respondents claimed they had heard, seen, and read more about Costa Rica as an investment prospect after Intel's decision. Given Intel's reputation for rigorous site-selection research, other companies can in a sense "free ride" on Intel's research and be much more confident about investing in the country.

Using as its main selling point Intel's "stamp of approval" for Costa Rica as an investment location, CINDE launched a strong campaign to attract other large electronic manufacturers as well as Intel's worldwide suppliers to invest in Costa Rica. On the day that Intel announced its investment, the Minister of Foreign Trade predicted that the country could attract around 40 Intel satellite companies. The objective was not only to increase overall FDI, but also to form the electronics cluster that was envisioned in the 1996 FIAS study and in the INCAE/HIID Competitiveness Agenda.

Unfortunately, the Asian crisis of 1997 together with an industry downturn at global level significantly reduced the flows of FDI in the electronics sector. For example, Seagate — a large-scale manufacturer of hard-disk units — and Lucent abandoned their Costa Rican plan. Also, many of Intel's suppliers refused to invest in the country due to the risk of selling to a sin-

gle buyer. A few Intel satellites did set up in the country, mostly small operations with very few employees, which contributed little to forming the desired electronics cluster.

Intel did generate a positive impact through backward linkages, forcing a significant improvement in the logistics area in less than three years. For example, FedEx and UPS initiated operations in the country, and now there are daily cargo flights to several destinations in the United States. AirExpress International, an international logistics and transportation company with a close business relation with Intel, invested through a joint venture with a local company.

Backward linkages also developed through domestic companies that supply Intel with specialized goods and services, as shown by two surveys (Larraín et al, 2001). One survey showed that a significant percentage of Intel suppliers received training from Intel and changed their organizational practices or their product variety due to Intel. The other survey indicated that Intel competitors believed that Intel generated changes in inputs markets from which they have also benefited, and had a positive effect on their own operations and the overall economy.

Perhaps the most important way Intel has benefited the economy is its collaboration with public universities to improve curricula and teacher training in technical fields, particularly with the Instituto Tecnológico de Costa Rica (ITCR). Generally, the presence of Intel

in the country has increased awareness about career opportunities in technical fields and engineering, leading to a very significant increase in enrollment in technical fields at public universities.

## LESSONS FOR OTHER COUNTRIES

Though Costa Rica's success comes from the convergence of different policies and events going back many years, rather than from a grand national vision, some general observations may still be of value to other countries:

- Costa Rica's long-term commitment to investing in education has been the most important factor behind the recent developments. The country's main competitive advantage lies in a labor force that is well educated relative to its cost. Countries should not only focus on increasing coverage of primary and secondary education, but should also put in place technical high schools and universities that guarantee a steady stream of technicians and professionals in areas where the country has a competitive advantage.
- Many of the now dominant recommendations for economic development are validated: political and economic stability; rule of law, transparency and low levels of corruption; economic liberalization regarding international flows of goods and capital; and a "pro-business" environment with a favorable attitude towards FDI.
- The Export Processing Zone system appears to have been important in attracting FDI to Costa Rica. However, other countries will have to do without this kind of incentive, owing to the Uruguay Round agreement to eliminate export subsidies by the year 2003 in all developing countries. One obvious alternative, but not without its costs, is to establish aggressively low corporate income tax rates.
- CINDE played an essential role in attracting FDI and in determining a strategy geared towards the electronics sector that would later prove successful for the country. CINDE has the required characteristics to play such a profound role — a nonprofit organization with strong ties to both private and public sectors, apolitical and with no special relation to any interest group, with strong financial support. By its nature, this organization was able to establish long-term goals, do the required detailed and careful research, get the appropriate expertise and human resources, be selective in its approach towards FDI, and make sure that its efforts matched the country's competitive strengths.
- Based on the Costa Rica case, countries should carefully identify the sectors where they have a

strong competitive advantage and thus high-growth potential, and make sure that economic policy is consistent with the needs of these sectors. This, for instance, is what lies behind Costa Rica's strengthening of technical schools in informatics, electronics and metal working and mold making. This is also the rationale for its supporting the development of local suppliers to high-tech transnationals.

- One factor suggesting that the Costa Rican strategy will be maintained at least in the medium term is that responsibility is spread among many different actors in society. It is not only the Government that is running programs to strengthen the technical capacity of the country, but several other organizations are also helping, among them public universities, industry chambers, technical schools, and CINDE.
- The case of Intel's decision to invest in Costa Rica shows clearly the importance of transportation logistics for high-tech companies, whose products exhibit high rates of innovation (and thus require fast shipment of goods from factory to consumers) and a high value relative to size and weight. High-quality airport systems and friendly and open policies towards air travel and cargo companies seem advisable.
- Finally, rather than give special concessions to lure particular companies to invest in the country, it is advisable to adopt policies and reforms that are generally applicable as well as particularly important for the companies whose investment is being promoted. ■

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