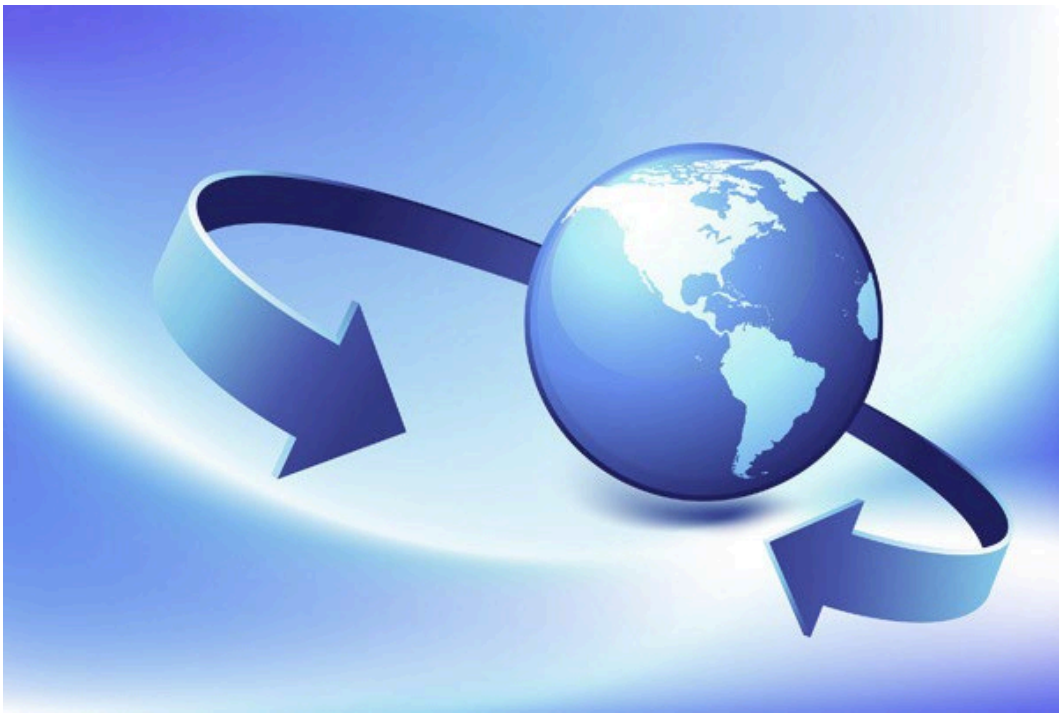
CHAPTER 1

Costa Rica in Global Value Chains

INTRODUCTION



Penny Bamber
Gary Gereffi
Stacey Frederick

August 2013

Duke | CENTER on GLOBALIZATION, GOVERNANCE & COMPETITIVENESS *at the* Social Science Research Institute

This research was prepared on behalf of the Costa Rica Foreign Trade Ministry (COMEX). The report is based on both primary and secondary information sources. In addition to interviews with firms operating in the sector and supporting institutions, the report draws on secondary research and information sources, including Costa Rica organizations the Costa Rican Investment Promotion Agency (CINDE) and the Ministerio de Comercio Exterior (COMEX).

Acknowledgements

Duke CGGC would like to thank all the interviewees, who gave generously of their time and expertise. Duke CGGC would also like to thank the personnel of COMEX, especially Francisco Monge, Andrea Rodríguez and Natalia Sanchez and the personnel of CINDE, especially Sandro Zolezzi, Francella Vargas, and Silvia Campos.

Duke University, Center on Globalization, Governance and Competitiveness (Duke CGGC)

The Duke University Center on Globalization, Governance & Competitiveness (Duke CGGC) is affiliated with the Social Science Research Institute at Duke University. Duke CGGC is a center of excellence in the United States that uses a global value chains methodology to study the effects of globalization in terms of economic, social, and environmental upgrading, international competitiveness and innovation in the knowledge economy. Duke CGGC works with a network of researchers and scholars around the world in order to link the global with the local and to understand the effects of globalization on countries, companies and the full range of development stakeholders.

Center on Globalization, Governance & Competitiveness, Duke University

Preface

The Duke University Center on Globalization, Governance & Competitiveness (Duke CGGC), embarked on this study to understand the participation of Costa Rica in four global value chains: medical devices, electronics, aerospace, and offshore services. The goal of this study is to provide a set of recommendations to the Costa Rican Government to enhance the participation and upgrading in the industries selected.

We have based our analysis on multiple sources of information: a review of the relevant secondary literature on each industry; trade and production statistics from international and domestic databases; company websites and online information about the firms operating in each value chain; and field research in Costa Rica, including interviews with firms and government stakeholders related to this project.

We appreciate the cooperation extended to us by the Costa Rican Ministry of Foreign Trade (COMEX), the Trade Promotion Agency of Costa Rica (PROCOMER), the Costa Rican Investment Development Agency (CINDE), and other agencies and individuals who facilitated our research. The comments and opinions expressed in this study do not necessarily reflect the position of the sponsors of this project, nor are they endorsed by the companies mentioned or the individuals interviewed. All opinions and errors of fact that appear in this report are the responsibility of the authors.

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Acronyms

CGGC	Center on Globalization, Governance and Competitiveness
CINDE	Costa Rican Investment Development Agency
COMEX	Ministerio de Comercio Exterior
EU	European Union
FDI	Foreign Direct Investment
FTA	Free Trade Agreement
FTZ	Free Trade Zone
GDP	Gross Domestic Product
GMA	Greater Metropolitan Area
GVC	Global Value Chain
IADB	Inter-American Development Bank
MNC	Multinational Corporation
PROCOMER	Promotora del Comercio Exterior de Costa Rica
OECD	Organization for Economic Cooperation and Development
US	United States
USAID	United States Agency for International Development
WDI	World Development Indicators

1. Introduction

Over the past three decades, Costa Rica has emerged as an economic and political leader in Latin America. The country has inserted itself into important high tech and knowledge sectors, which have contributed to economic development and job creation.

To further this development, the government has sought opportunities to continue upgrading in global value chains. They selected four industries of key importance for the country: medical devices, electronics, aerospace and offshore services. The main goal of this study is to provide a set of recommendations to the Costa Rican Ministry of Foreign Trade (COMEX), which commissioned this study, to provide guidance on moving up in the value chains selected. To that end, the global value chain (GVC) framework is used to understand the changing dynamics of these industries at a global level, to identify Costa Rica's position in these chains, and to highlight potential competitiveness opportunities.

This report analyzes each of the four key sectors identified above, and provides a detailed outline of the global value chain for each industry. The governance structures and upgrading trajectories within each chain are examined to identify potential barriers to entry that can limit the participation of local firms. In addition, key firms operating in the country are mapped onto the value chain, allowing policy makers to understand the value generated by different types of firms in the country and the human capital requirements for industry development. The study provides recommendations to support upgrading in the different industries, focusing on five different strategic areas: industry institutionalization, attracting FDI in higher value added activities, local firm development, cultivating human capital and improving business environment and regulations.

This introductory chapter is structured as follows: First, the global value chain analytical framework is explained; second, the methodology used in this study is outlined; third, Costa Rica's institutional context is examined as it relates to these four GVCs, focusing on specific areas: trade policy, free trade zones (FTZs), business environment, human capital and key stakeholders; and finally, the organization of the overall report is outlined.

2. Analytical Framework

This report uses the global value chain (GVC) framework to analyze the four industries selected for this study: medical devices, electronics, aerospace and offshore services. The GVC framework has been developed over the past two decades by a global network of researchers from diverse disciplines, to examine topics ranging from engineering to food and nutrition to the environmental sciences, in order to understand the phenomenon of globalization (Barrientos et al., 2011; Gereffi, 1999, 2005; Gereffi et al., 2005; Humphrey & Schmitz, 2002b; Kaplinsky, 2004, 2010). It allows one to understand how industries are organized by examining the structure and dynamics of the different actors involved. The value chain describes the full range of activities that firms, workers and supporting institutions around the world perform to bring a product from conception through production and end use. By examining the labor inputs, technologies, standards, regulations, products, processes and markets in specific industries and locations, it provides a holistic view of industries both from the top down and the bottom up (Gereffi & Fernandez-Stark, 2011).

Understanding how GVCs operate is essential for a country such as Costa Rica, which relies significantly on export-oriented foreign direct investment (FDI) for economic growth. The evolution of these GVCs has significant implications in terms of global trade, production and employment, and how developing countries are integrated in the global economy. By gaining access to developed country markets, participation in GVCs offers emerging economies an opportunity to add value to their local industries. Insertion and sustained participation in GVCs can be paramount for the economic growth, particularly in developing nations, due to accompanying job creation potential, inflow of foreign currency, contributions to poverty reduction, and more recently, access to the global knowledge economy. Understanding these chains is critical not only for attracting investment, but also supporting the competitive growth of local firms. These firms must compete with a growing number of foreign firms not only for the local market, but also for international clients and thus are forced to improve the efficiency and quality of their operations.

Identifying how value is distributed along the chain is a central element of GVC analysis. By adding value to production or moving into higher value activities, different actors can increase the benefits from participating in these global industries; this is referred to as "economic upgrading" in the GVC literature (Gereffi et al., 2005). Upgrading trajectories can be analyzed at both the firm and the country levels. In general, a country upgrades when a critical mass of firms located within its borders achieves upgrading. Upgrading depends considerably on how firm strategy leverages local competitive advantages such as qualified labor, presence of suppliers, geographic location and regulatory conditions. **How Costa Rica can "upgrade" in these four respective GVCs is the central question in this study.**

Economic upgrading includes six distinct changes in the firm's participation in a production model: *entry into the value chain*, when a new actor begins to participate in the value chain; *product upgrading*, which describes the shift into the production of a higher value product/service; *process upgrading* describes improvements in efficiency in the production

systems, such as the incorporation of more sophisticated technology; *functional upgrading* describes the movement to higher value stages in the chain that require additional skills; *chain upgrading*, which describes the entry into a new GVC by leveraging the knowledge and skills acquired in the current chain; and finally, *end market upgrading*, which describes the incursion into new market segments (Gereffi, 2005; Fernandez-Stark, et al., 2011; Humphrey & Schmitz, 2002). Countries often pursue functional upgrading as the most direct way of increasing the value of their participation in these chains. Yet, in developing countries, product and process upgrading are often more easily attainable, since they may require relatively minor adjustments in production and skills development with lower overall investment. Mapping out these upgrading trajectories in GVCs helps policymakers to define their ultimate upgrading goals by identifying the specific activities that their firms currently perform, as well as potential future opportunities for these firms (Gereffi & Fernandez-Stark, 2011).

Powerful **lead firms** determine how resources and knowledge are generated and distributed through the chain (Gereffi, 1994; Humphrey & Schmitz, 2002a). In the past, the large flow of information regarding production processes between these lead firms and suppliers helped to facilitate development of capabilities, and expertise of the latter were important drivers for upgrading in developing countries (Gereffi, 1999). This system is being transcended by the development and use of global standards by lead firms to shape their supplier behavior. These standards allow for the timely and efficient dissemination of large quantities of codified information regarding both the characteristics of the product and the manner in which it is produced to meet the quality requirements of developed-country markets. Through these measures, lead firms can ensure a consistent supply of products from diverse groups of global providers. As compliance is essential for sustained value chain participation, the widespread adoption of standards has required developing country industries to undergo both product and process upgrading. To meet these standards, producers must enhance their efficiency and systematically increase productivity (Altenburg & von Drachenfels, 2006). Adopting the necessary protocols often requires financial, informational and network resources that are beyond the scope of suppliers in emerging markets, and thus can serve as important barriers to GVC participation (Lee et al., 2010; Paus & Gallagher, 2008).

The GVC framework has been used to different degrees to understand the four industries studied. The electronics sector was one of the first industries to adopt global production model to leverage Asian supply chains and has a larger body of literature. Important GVC analysis in this area has been led by Sturgeon (Sturgeon, 2002; Sturgeon & Kawakami, 2011). In the aerospace sector seminal GVC works have been carried out by Niosi & Zhegu (2010; 2005). In the medical devices industry, there has been limited use of the GVC framework to understand the industry (Ciravegna & Giuliani, 2008; Fennelly & Cormican, 2006; ProduCen, 2007; Rana & Gregory, 2012). Offshore services value chain studies were pioneered by the Duke University Center on Globalization, Governance and Competitiveness (CGGC) in 2009 (Gereffi et al., 2009; Gereffi & Fernandez-Stark, 2010).

3. Methodology

This research draws on multiple sources of information: an extensive review of the academic and business literature available for the four industries; in-country interviews with representatives from the private sector, government and regulatory bodies and academic institutions; aggregated international and national trade data from Costa Rica; and two firm-specific data sets provided by PROCOMER as well as offshore services data by CINDE. The first of these data sets provided firm-specific export data from 2000–2011 and import data from 2009–2011, while the second data set draws on the annual reports filed for companies under the country's FTZ regime for relevant years from 2000–2011.

A total of 212 firms were identified as operating in the four sectors in Costa Rica. These firms were identified based on the analysis of the Costa Rican Investment Promotion Agency (CINDE) cluster and supplier lists for Life Sciences and Advanced Manufacturing, analysis of firms in each of the country's FTZ parks, review of press releases for new FDI in the country, lead firms identifying their local suppliers and competitors, and a review of firm databases gathered by earlier studies and information from Costa Rica Provee. In the case of offshore services, information on all firms participating in the sector was provided to CGGC by CINDE. Thirty-six firms were interviewed (the majority of the interviewees were in senior management positions), in addition to 19 institutional actors. Companies interviewed were identified by Duke CGGC and interviews were requested and coordinated by the Minister of Foreign Trade, COMEX and CINDE with a 100% positive response rate. Import-export data was received for 85 firms in the three manufacturing sectors. The data included the eight- and 10-digit trade code, export value, weight and destination/origin by company (export only). Based on our definitions for medical devices and electronics, this information accounted for 96% of export trade in 2011 for both industries. In addition, we received FTZ information for 70 firms. These data sets were used to explore the activities being performed by different firms in these three sectors, backward linkages with both local and foreign suppliers, employment and salary information, primary end markets and type of products exported. For the offshore services industry, export and employment data were provided for 82 firms operating within the FTZ regime, which represent approximately 80% of the total industry.

4. Costa Rica Economic Evolution from Agriculture to High-Tech & Knowledge Sectors

Over the past two decades, Costa Rica has transitioned from a dependence on primary products to high-tech manufacturing exports (OECD, 2012) and services exports. Structural reforms to improve macroeconomic stability at the end of the 1980s and early 1990s, the establishment of FTZs and the installation of Intel's plant and its subsequent impact on the increase in FDI facilitated this dramatic shift in Costa Rica's export composition (Ciarli & Giuliani, 2005). In 2011, FDI net inflows reached US$2.1 billion up from US$400 million in 2000 (The World Bank, 2012b). Costa Rica's FDI recruitment strategy is to promote the country as an export platform for efficiency seeking firms, supported by a stable political system and a skilled labor force (CINDE, 2012b). Table 1 highlights Costa Rica's leading product exports over the past seven years. While fresh fruits and coffee continue to play an important role in the country's exports, electronics and medical devices have been strong export sectors since 2005.

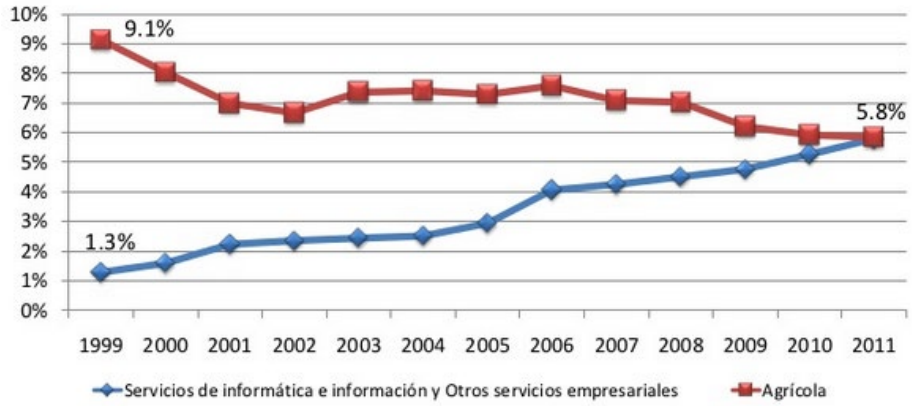
Table 1. Costa Rica's Top 10 Exports to the World by Year, HS Heading, & Value

HS Code	HS Heading Description	Export Value ($US '000,000)				Export Share (%)			
		'05	'07	'10	'11	'05	'07	'10	'11
Total		7,005	9,340	9,470	10,500				
8542	Electronic integrated circuits and micro-assemblies	803	1,440	984	1,893	11.5	15.4	10.0	18.0
9018	Instruments and appliances used in medical, surgical, dental or veterinary	502	665	804	877	7.2	7.1	8.5	8.4
0803	Bananas, including plantains, fresh or dried.	484	674	751	781	6.9	7.2	7.9	7.4
0804	Dates, figs, pineapples, avocados, guavas, mangoes	332	490	668	735	4.7	5.2	7.1	7.0
0901	Coffee, roasted or decaf, coffee husks and skins	233	257	261	378	3.3	2.7	2.8	3.6
2106	Food preparations nes or included elsewhere	147	185	290	315	2.1	2.0	3.1	3.0
9021	Articles orthopedic appliances	--	--	316	301	--	--	3.3	2.9
3004	Medicaments (excl. goods of heading 30.02, 30.05 or 30.	228	287	291	245	3.3	3.1	3.1	2.3
8544	Wire, cable (incl. coaxial cable) and other insulated p	--	156	--	220	--	1.7	--	2.1
8473	Parts and accessories (other than covers, carrying cases and the like) suitable for use with machines of headings 84.69 to 84.72.	679	1,015	877	--	9.7	10.9	9.3	--
6203	Suits, ensembles, jackets, trousers, overalls, not knitted	126	--	--	--	1.8	--	--	--
Top10		**3,533**	**5,168**	**5,208**	**5,745**	**50.4**	**55.3**	**55.0**	**54.7**

Source: Procomer, 2012.

Offshore service exports have grown rapidly; in 2005, there were 33 multinational corporations (MNCs) employing 10,802 people and exporting around US$387 million. Today, these figures have tripled; in 2011 there were close to 100 offshore services MNCs operating in the country, employing 33,170 workers and exporting US$1,390 million. According to PROCOMER, using data from the Costa Rican Central Bank, offshore services accounts for 5.8% of the gross domestic product (GDP), the same percentage as agriculture exports (see Figure 1).

Figure 1. Costa Rican Exports as a Percentage of GDP[1]



Source: PROCOMER and BCCR.

4.1. Engagement with the Global Economy: Trade Liberalization

As Costa Rica has shifted towards an export-platform model, there has been a strong drive to open the economy. Initiatives taken include increasing the number of preferential trade partners, establishing the FTZ regime and becoming an active participant of the World Trade Organization (WTO) (Villalobos & Monge-González, 2011). Costa Rica has bilateral free trade agreements (FTAs) with much of Central America and the Caribbean (CARICOM, 2002; Dominican Republic, 2002; El Salvador, Guatemala, Honduras and Nicaragua, 1993; Panama, 2009). In addition, it has FTAs with Canada, Mexico and the United States, facilitating trade relations with North America. The Central America-EU FTA finalized in 2012 further supports trade with Europe. In South America, Costa Rica established an FTA with Chile in 2002 and with Peru in 2011 and the government is currently in negotiations with Colombia (Villalobos & Monge-González, 2011). Costa Rica has also made efforts to facilitate South-to-South trade with Asia. The country entered into a FTA with Singapore in

[1] According to our study, the offshore services industry represents 4.6% of Costa Rica's GDP. However we have only available data from companies under the FTZ regime that represents approximately 80% of the total sector.

2010 and with China in 2011 and began negotiations with South Korea in 2012. Costa Rica is already China's second largest trading partner in Central America, while China is Costa Rica's second largest trade partner. Recent trade agreements (US-DR-CAFTA, Singapore, Mexico) have also incorporated the concept of digital products to avoid barriers to trade for these high tech goods.

FTZs in Costa Rica facilitate FDI, which is mostly dominated by US firms (OECD, 2012). In 2010, the FTZ regime accounted for 54% of FDI (PROCOMER, 2011). FTZs offer tax holidays for eight years, with a reinvestment option to extend the holiday for a further eight years. This tax holiday structure meant that by 2012, only 20% of manufacturing firms operating under the FTZ regime paid corporate income tax (PROCOMER, 2012). In 2010, the FTZ regulations were aligned with WTO requirements (see Table 2 for an overview of the benefits offered). Firms already operating in Costa Rica under the previous FTZ regime are required to transition to the new policies between 2009 and 2015; new firms entering the country today enter under the new free zone regulations.

Table 2. Incentives for Free Zone Companies

Incentive/Requirement	Time Frame	Old Law 7210	New Law (Law 8794)					
			Within GMA			Outside GMA		
			All	Cat. F	Mega	All	Cat. F[a]	Mega[b]
Incentives								
Corporate Income Tax Rate	Years 1-8	0%	0%	6%	0%	0%	0%	0%
	Years 9-12	15%	50%	15%	15%	0%	5%	0%
	Years 13-18					50%	15%	15%
Income Tax Credit [c]	No limit	n/a	n/a	10%	n/a	n/a	10%	n/a
Income Tax Deferral	10 years	n/a	n/a	Yes	n/a	n/a	Yes	n/a
Import Duties: Raw Materials, Components, Capital Goods	No limit	0%	0%	0%	0%	0%	0%	0%
Export and Excise Tax	No limit	0%	0%	0%	0%	0%	0%	0%
Remittances/ Repatriation Tax	No limit	0%	0%	0%	0%	0%	0%	0%
Sales Tax/ Consumption Tax	No limit		0%	0%	0%	0%	0%	0%
Requirements								
Minimum Exports		Yes (75%)	Yes			No		
Strategic Sector		No	Yes			No		
			Advanced manufacturing, electronics, R&D, medical devices, biotechnology, pharmaceuticals					
Investment in Fixed Assets (inside park/outside park)		$150,000/ $2,000,000	$150,000/ $2,000,000			$100,000/ $500,000		
			Megaprojects: $10 million; 100 employees					
Other Requirements			Meet minimum level of employment, present an environmental impact study, establish a national value added.					

Source: (CINDE, 2010; PROCOMER, 2012).

Note (a): Category F represents supplier companies that must sell 40% of output to other FZ companies. For those outside GMA, the time frame is 6 years and years 6-12.

Note (b): for megaprojects in strategic sectors outside GMA that employ 100 people, corporate income tax is 15% for years 13-25 (15 additional years).
Note (c): if profits are reinvested in fixed assets or for spending on education and training.

By 2010, there were 256 firms operating in the FTZs in Costa Rica, employing a total of 58,012 people (PROCOMER, 2011). Between 2006 and 2010, these firms accounted for 54% of the country's exports. Domestic and foreign firms alike are eligible to apply for FTZ status and both are afforded the same legal protection; nonetheless, MNCs account for the majority of firms in FTZs. Requirements differ according to the location of the firm—that is, whether it is located in an industrial park and in or beyond the Greater Metropolitan Area (GMA). In the past, FTZ policies were transversal; however, Costa Rica has been shifting gradually towards a more selective policy approach to FDI by targeting certain knowledge-intensive sectors (OECD, 2012). Once the new regulation comes into effect in 2015, certain benefits will limited to strategic sectors unless the firm is established outside of the GMA area (see Table 2). These new policies aim to focus resources on high potential sectors and to help decentralize FDI operations, which have become highly concentrated in the GMA region, placing pressure on the local infrastructure and labor force. Indeed, 64 of the 76 FDI projects initiated in the country between 2009 and 2011 were carried out in San Jose, Heredia, Alajuela and Cartago (OECD, 2012).

4.2. Business Environment

Despite the progress and growth described above, there remains room for improvement beyond the country's FTZ regime. In particular, streamlining government procedures for obtaining construction permits, registering property and enforcing contracts, improving transportation infrastructure and providing easier access to finance and credit are important steps that the country should take toward enhancing its business environment (WEF, 2012). Costa Rica's position in several global competitiveness rankings could be improved. The World Bank *Doing Business* Index ranks Costa Rica 110th of 185 countries (IFC & The World Bank, 2012), while in the Intellectual Property Rights Index, it ranks 52nd of 130 (Intellectual Property Rights Index, 2012). The World Economic Forum's Global Competitiveness Index ranks Costa Rica's infrastructure at 166th, procedures to start a business at 130th, and available financing for businesses at 122nd. The lack of access to finance indeed compounds a risk-averse culture generated by the 1980s international debt crisis, which made local firms reluctant to make the long term capital investments necessary to become qualified suppliers for MNCs (Ciarli & Giuliani, 2005). Furthermore, while Costa Rica prides itself on relying principally on renewable energy sources, which currently account for 78% of supply, its industrial electricity prices in 2010 were US$129.5 per MWh, 30% higher than in Mexico and double the cost of energy in the United States (see Table 8 for comparative information on global electricity prices) (The World Bank, 2012b).

Support from institutions such as CINDE, industrial park management and special agreements over energy pricing have helped foreign firms to navigate some of these challenges, allowing the country to continue to attract FDI (OECD, 2012). Local firms,

however, tend to operate beyond the reach of these support structures. This adds to these companies' capital constraints, further limiting their competitiveness vis-à-vis foreign firms in the FTZs. The government is making efforts to improve these conditions, although these are likely to take some time to make an impact. In 2008, the country adopted the Banking System for Development Law (No. 8634) to facilitate access to risk capital for entrepreneurs by allowing government funds to be used for the development of small- and medium-sized firms (SMEs) and the creation of seed and venture capital (Villalobos & Monge-González, 2011). In 2010, the current administration announced a US$2.7 billion infrastructure plan to improve and modernize the country's airports, highways and rail network. In 2011, the government also began to work on improving the business environment through a technical assistance agreement with the World Bank, which will include simplifying procedures for property transfer, starting a business, obtaining construction permits and paying taxes (The World Bank & International Finance Corporation, 2011).

4.3. Human Capital and Workforce Development

Costa Rica has a small population (4.62 million), and thus a small labor force to draw from at 2.15 million. Moreover, 66% of this labor force is concentrated in the GMA. The national unemployment rate in 2011 was 10.4%; yet analysis of the key regions where the high tech manufacturing and service sectors are located (Alajuela, Cartago, Heredia and San Jose) reveal much lower unemployment rates of 2.9–3.5%.

Table 3. 2011 Labor Force Indicators, National versus GMA

Indicator	National	GMA
Population	4.62 million	2.65 million
Labor force	2.15 million	1.42 million
Unemployment	10.4%	6.9% (Central Valley) 3.0% (Alajuela) 3.2% (Cartago) 2.9% (Heredia) 3.5% (San Jose)

Source: (Instituto Nacional de Estatistica y Censos (INEC), 2012; UNDP, 2012)

Without a military to finance, Costa Rica has been able to invest heavily in education over the past 50 years, and its education system is considered to be on par, if not better than, virtually all other Latin American countries (OECD, 2012). In 2009, government expenditure on education was 6.3% of GDP (The World Bank, 2012b).[2] Education is free until the 11th grade and mandatory to the 9th grade (Villalobos & Monge-González, 2011). While literacy rates are very high (97% in 2010, UNESCO), the country is nonetheless still transitioning from a reliance on a largely uneducated agricultural workforce to a more sophisticated one

[2] A constitutional reform passed in the 1990s requires a minimum of 6.0% of GDP be spent on education annually (Villalobos & Monge-González, 2011).

focused on higher tech industrialized activities. The share of the population with tertiary education is still relatively low (17%) compared to countries in aspirational development positions such as Singapore (26%), Ireland (35%), and Israel (45%)(The World Bank, 2012b) (see Table 4).

Table 4. Education Levels, Population 15 or Older Costa Rica, 2011

Education Level	Description	Number	Share of Pop. ≥ 15
Elementary School (Primary)	Six grades (through 6th grade); ages 6-13; Statistics include completed primary school and incomplete secondary school.	1,703,866	48%
INA	After completing 9th grade (three years of high school), students may enter an INA program that typically lasts 2-2.5 years (students do not earn a secondary degree).		
Academic High School (Secondary)	Five grades total (7-11th); decision made after 9th grade; graduate at 17; Statistics include completed secondary school, and incomplete technical high school.	516,631	15%
Technical High School (Secondary)	Six grades total (7-12th); decision made after 9th grade; graduate at 18 with technical degree; 96 institutions in Costa Rica	61,675	2%
College Education (Tertiary)	59 universities in Costa Rica; 5 public and 54 private	620,210	17%
Post-Graduate		61,408	2%
Unknown		6,375	0.2%
None	Includes people with no education and with incomplete primary education.	581,429	16%
Total		**3,551,594**	**100%**

Source: (CINDE, 2011a)(CINDE, 2011b); INEC National Household Survey (ENAHO), 2011 (Table 8: Población de 15 años o más Por nivel de instrucción Según región de planificación y sexo: Julio 2011)

Educational programs for high-tech sectors draw on three different institutions: Basic and secondary education schools provide a large proportion of line workers for manufacturing plants and entry-level agents in call centers; technical high schools and the Instituto Nacional de Aprendizaje (INA) provide technicians; and both public and private universities graduate the essential engineering staff. At the end of the 9th grade, students have the option to pursue an academic track, completing two additional years of schooling before applying to university or a technical track, that requires three years of technical training before entering the workforce, or further specialization at a university (Field Research, 2012). With 96 schools nationally, competition for places in these technical programs is considerable and supply of technicians for the high tech sector somewhat constrained. In 2011, roughly 2% of the workforce was a graduate of a technical high school program (Table 4). These vocational courses include electrical, electronic and electro-mechanical engineering, precision mechanics, industrial maintenance and executive secretary for services centers, IT network and IT support, among others. These students graduate as technicians in their respective fields. Table 5 provides graduate information for these technical schools since 2003 for selected courses.

Table 5. Technical High School Graduates, Selected Courses, 2003–2011

Programs	2003	2004	2005	2006	2007	2008	2009	2010	2011
Industrial Electronics	135	106	110	122	126	105	127	106	75
Electrical Engineering	134	106	114	124	123	92	121	89	140
Electro-mechanical	38	38	69	45	37	67	52	37	47
General Mechanic	35	72	53	58	41	47	56	30	32
Precision Mechanics	137	147	114	120	119	153	150	114	130
Industrial Maintenance	-	-	-	-	13	22	33	6	11
Offset Impressions	47	14	17	18	13	14	6	13	9
Textile Industry	141	160	145	203	162	97	116	83	66
IT Network	119	233	211	287	275	336	278	322	346
IT Support	-	-	-	42	88	132	222	141	285
Executive Secretary for Service Centers	-	-	-	47	1	315	273	307	372
Software Development	-	-	-	-	-	-	55	116	140
Total: All Programs	**4,071**	**4,178**	**4,993**	**5,199**	**5,172**	**5,695**	**5,848**	**5,257**	**5,712**

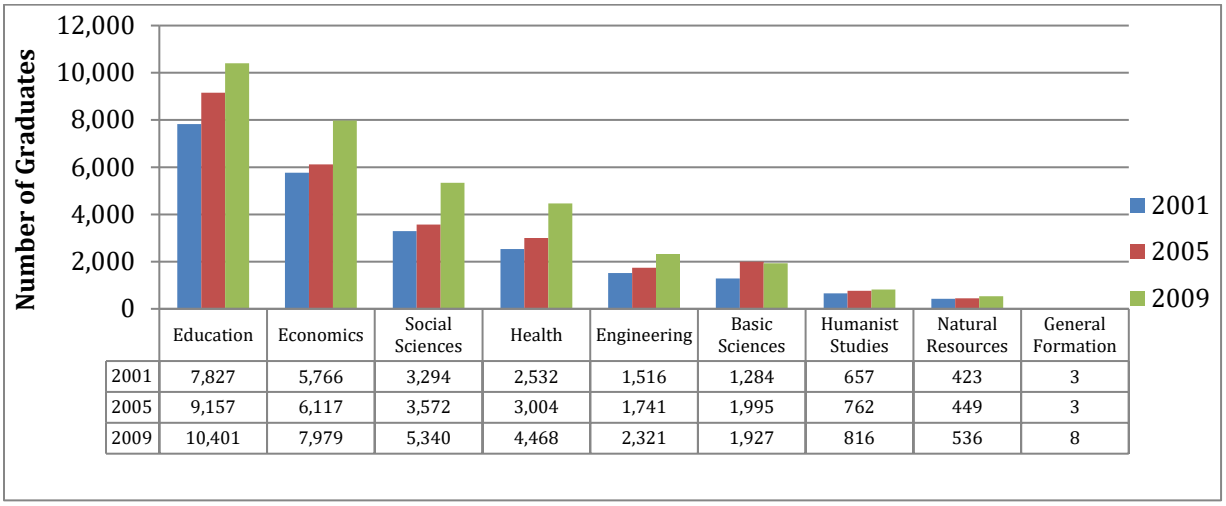
Source: CINDE based on data from Ministry of Public Education, 2012.

Students who do not follow the technical track can also opt to pursue vocational and technical education through INA after completing the 9th grade. INA is an autonomous public institution created in 1965 that offers its services free of charge and is financed primarily by resources coming from an earmarked 1.5% payroll tax, resources from the private sector and the government budget. INA offers a wide range of courses in all productive sectors. In 2010, INA trained over 37,000 people in Costa Rica. The institution has made efforts to align its training programs with the private sector in recent years, establishing several alliances and agreements with firms, including a number of firms in the FTZs. Courses include metal construction, body shop, industrial maintenance mechanics, precision mechanics, casting of metal alloys, electricity, electronics and microelectronics (CINDE, 2011b; Field Research, 2012).

Costa Rica's universities have played an important role in developing the engineering and management talent that has facilitated the growth of the high tech sectors in the country. However, the portion of Costa Rica's labor force with tertiary education is still low, at less than 20% (Table 4). There are five public universities, accounting for over 65,000 enrolled students, although it is the private university system that accounts for the largest number of graduates annually, awarding 68% of diplomas in 2009. With high levels of government investment (Ciarli & Giuliani, 2005), public universities typically outrank private universities considerably in terms of quality and performance (Cybermetrics Lab, 2012). The University of Costa Rica is ranked 11th in Latin America and is one of the top 500 universities around the world. As private universities have grown, quality has become increasingly disparate. This is potentially due to the voluntary nature of the country's university accreditation system (SINAES) (IT Association Costa Rica, Interview). Costa Rica has almost doubled the number of graduates in engineering, a key discipline for the high tech sector, since 2001, accounting for 6% of total university graduates in 2011. In order to continue to build on this past growth, the government has launched a US$200 million project with the support of the World Bank

to improve education in high demand sectors at four leading public universities (see Box 1). Figure 2 and Table 6 provides detailed figures for undergraduate university education from 2001 to 2011.

Figure 2. University Undergraduates in Costa Rica (2001, 2005, & 2009)



	Education	Economics	Social Sciences	Health	Engineering	Basic Sciences	Humanist Studies	Natural Resources	General Formation
2001	7,827	5,766	3,294	2,532	1,516	1,284	657	423	3
2005	9,157	6,117	3,572	3,004	1,741	1,995	762	449	3
2009	10,401	7,979	5,340	4,468	2,321	1,927	816	536	8

Source: CINDE based on data from CONARE and CONESUP, 2012.

Table 6. University Undegraduates in Specific Disciplines, 2001-2011 (Select Years)

Specific Field	2001	2003	2005	2007	2009	2011	Share of Discipline Total ('11)
Engineering Fields							
Industrial Engineering	409	407	615	642	687	794	31%
Architectural Engineering	222	197	169	195	366	395	15%
Electronic Engineering	176	198	256	237	330	388	15%
Civil Engineering	322	287	264	339	317	312	12%
Mechanical Engineering	101	174	121	169	186	190	7%
Other Fields in Engineering	35	49	71	123	127	169	7%
Electrical Engineering	69	89	64	88	167	146	6%
Topographic Engineering	118	84	121	59	56	67	3%
Chemical Engineering	23	27	34	37	57	33	1%
Agricultural Engineering	17	16	21	12	26	31	1%
Metallurgy	7	5	5	3	2	24	1%
Technical Drawing/Design	17	2	0	0	0	0	0%
Other Specific Fields							
Computer Science (Basic Science)	1,074	1,295	1,716	1,717	1,621	1,871	87%
Chemistry (Basic Sciences)	53	55	71	72	127	128	6%
Physics (Basic Sciences)	4	7	26	10	16	18	1%
Microbiology (Health)	85	88	92	78	76	65	1%

Source: CINDE based on data from CONARE and CONESUP, 2012.

There are three key stakeholders related in education and workforce development in Costa Rica.

CONARE: Consejo Nacional de Rectores (National Deans Council), which governs the public universities. CONARE have developed a strategic plan for 2011-2015 to improve public education at the university level. CONARE acknowledges the need to align its strategy with the private sector needs and focus on applied research for science and technology. However, it does not set out specific actionable items to strengthen this relationship.

CONESUP: Consejo Nacional de Enseñanza Superior Universitario (the National Council of Higher Education) authorizes the formation of universities, as well as new degree programs. It does not accredit quality systems of universities.

SINAES: Sistema Nacional de Acreditación de la Educación Superior. This is the official accreditation board in the country, established in 1999 and legally constituted in 2002. Programs are accredited after a minimum of four years and with a minimum number of graduates. Accreditation is optional and lasts four years. Organizationally, SINAES is under the umbrella of CONARE. In 2010, the legislature created a dependable source of funding for the organization and linked government hiring to graduation from a SINAES accredited program. By 2010, only one-third of universities in Costa Rica adhered to the SINAEs accreditation system, and by 2012 (September) only 68 programs had been accredited (SINAES, 2012)

Box 1. Improving Higher Education in Costa Rica: Investing in Science and Technology

In September 2012, the World Bank and the Government of Costa Rica announced a project to extend access to science and technology programs by increasing capacity at four of the country's public universities, Universidad de Costa Rica, Instituto Tecnológico de Costa Rica, Universidad Nacional and Universidad Estatal a Distancia. The project will be financed by a US$200 million long-term loan from the World Bank and will fund new infrastructure such as the construction of new buildings and the expansion of laboratories, laboratory equipment for research centers, post-graduate training and education for academic staff and other officials. The project will also focus on strengthening SINAES in order to consolidate the higher education quality improvement system and support increased information availability regarding labor demand (through the creation of a Labor Professions Observatory and an information system for CONARE).

University	Investment	Increase in Capacity	Increase in no. of accredited degrees
Universidad de Costa Rica	US$59.5 million (US$50 million from the loan and US$9.5 million in own resources)	21 % (engineering, biology, IT, food technology and health sciences	50%
Universidad Nacional	US$58.5 million (US$50 million from the loan and US$8.5 million in own resources.)	16 % (overall)	Increase total number
Instituto Tecnológico de CR	US$57.7 million institutional improvement plan (US$50 million from the loan and US$7.7 million in own resources)	14.5 % (overall)	12-17
Universidad Estatal a Distancia	US$55.8 million US$50 million from the loan and US$5.8 million in own resources.	12 % (overall)	Increase total number
Total for four public universities:	**$249.11 million (US$200 million loan + US$17.31 government Costa Rica, CONARE & SINAES)**	**16 % 10,364 to 12,055**	**47 to 85**

Sources: (The World Bank, 2012a; Wolfe, 2008)

4.4. Key Stakeholders in Driving Participation in Global Economy

Growth of the high technology and knowledge sectors has been facilitated by close cooperation and coordination between three organizations: COMEX, CINDE and PROCOMER. In 2010, this coordinating role was institutionalized with the establishment of the Presidential Council for Competitiveness and Innovation, which is now responsible for providing guidance on strategy and monitoring progress. Furthermore, in January 2011, a formal cooperation agreement between COMEX, CINDE and PROCOMER to attract FDI went into effect (CINDE, 2012a). These efforts at institutionalization are hugely important for the country's future progress. The stakeholders listed in Section 4.2 above also play an important role.

Table 7. Key Stakeholders in Driving Participation in the Global Economy

The Ministry of Foreign Trade (COMEX)	Created in 1986 through budgetary law, and formally instituted in 1996 as the government agency for trade and FDI policy. Responsible for defining the country's FDI policy, overseeing the FTZ regime and coordinating FDI-related strategies and plans. In 2005, COMEX introduced the Directorate for Investment and Cooperation, reformed in 2010 as the Directorate for Investment, responsible for advising on policy priorities and implementing investment promotion policy guidelines as defined by the Minister. The directorate is also responsible for coordinating with CINDE and other relevant institutions, as well as identifying necessary adjustments in the legal framework to improve the investment climate.
CINDE (The Costa Rican Promotion Investment Agency)	A private, not-for-profit, economic development promotional agency, established in 1985 with the help of the Irish Development Agency and USAID (supported its early years). CINDE's primary goal is to attract FDI to the country, and it has been quite successful. CINDE has attracted 42% of FDI to the country, and 89% of FDI to FTZs between 1997 and 2007 (Monge-González & Hewitt, 2010), and CINDE's own data show that for the period 2002–2011, they attracted 89% of FTZ FDI (CINDE, 2012a). In addition to actively recruiting new firms to invest in the country, CINDE provides a range of services for interested firms including site selection support, coordination of visits to established firms and introduction to business support services, as well as extensive post-establishment support. For example, the organization has been responsible for facilitating meetings between academic institutions and FTZ firms to develop solutions to potential human capital shortages in certain industries.
PROCOMER (Promotora del Comercio Exterior de Costa Rica)	A public organization responsible for promoting the exports of Costa Rican firms. It administers the FTZ regime and promotes linkages between MNCs and domestic companies. The latter is facilitated by Costa Rica Provee, an initiative begun in 2001 and partly funded by the IDB and the Government of Costa Rica (Vargas Madrigal et al., 2010). Limitations in the initiative's website, however, has inhibited use of the database and undermined the program's effectiveness (Vargas Madrigal et al., 2010). The organization's dual role is the result of its origin: it was founded by merging the Free Trade Zone Corporation which was responsible for administering the FTZ regime, with the export promotion agency (Field Research, 2012).
The Ministry of Science and Technology	The Ministry has also begun to play a more active role in promoting high-tech sectors in the country; specifically, it is tasked with increasing the supply of qualified human capital and developing the country's national innovation system (OECD, 2012). For example, 65% of Intel's in-house master's program is funded by this ministry.
The Presidential Council for Competitiveness and Innovation	Convened in 2011 by the Government of Costa Rica to improve the competitiveness and productivity of the country. It brings together several ministries as well as INA to facilitate inter-ministerial coordination to support the growth of strategic sectors (Field Research, 2012). The council's 2010–2014 agenda covers five key areas (1) Human capital and innovation; (2) foreign trade and FDI; (3) capital markets and financial reforms; (4) infrastructure (telecommunications, electricity, ports, transportation) and (5) regulatory reforms and red tape reduction (Villalobos & Monge-González, 2011).
Project Link Investments	Non-profit group whose mission is to promote economic development in Costa Rica by encouraging the growth of technology companies (Link Project). With the support of a number of companies and organizations, it is committed to the creation of an entrepreneurship-friendly environment in which technology start-up firms can succeed. The project has four components: (1) Incubation: sponsored by Parque Tec; (2) Investments: connecting start-up firms with investors, led by INCAE Business School and Mesoamerica, a consulting and investment group; (3) Financing: other funding and services for the start-ups comes through Link Financing, which is sponsored by Financiera Desyfin, company that provides banking services for small and medium companies; and (4) Exporting: open to start-ups and to small and medium sized technology companies (Yo Emprendedor, 2012).

5. Organization of the Overall Report

The remainder of the report includes one chapter per industry. Each of the four chapters begins with a global perspective of the corresponding GVC and ends with industry-specific upgrading trajectories. The global perspective provides a comprehensive overview of the entire industry, including: key sources of demand and supply; stages in which different countries operate; the governance structure of the chain; and the human capital required for each segment. This allows policy makers to understand the geographical distribution of the value chain, identify both potential competitors and buyers, and appreciate how power is exerted through the chain. These characteristics of the chain are important for both FDI recruitment strategies as well as agencies focused on promoting local firm participation in value chains. In particular, knowing the standards that govern entry into the chain is an essential step, and policy makers can support local firms by helping to ensure the presence of certifying firms within the country and providing grants or loans for these firms to achieve certification. Furthermore, functional upgrading through the chain is dependent on gaining new capabilities and generally requires a substantially different set of workers with different skill sets (Gereffi et al., 2011). Knowing the requirements at each stage can help policy makers to prepare the workforce for the needs of future upgrading strategies. As part of this analysis, throughout the reports comparisons are made to other competing countries or countries in similar positions to Costa Rica including Singapore, Ireland, and Uruguay among others (see Table 8 for key economic indicators).

Table 8. Costa Rica Comparisons, 2008

Country Name	Share of Labor Force by Education Levels (%)			GDP % Education	Labor Force	GDP Per Capita Constant $US	Industrial Electricity Prices $US/MWh
	Tertiary	Secondary	Primary				
USA	61	29	10	5.5	158,012,165	38,209	67.9
Brazil	9	31	41	5.4	98,227,293	4,479	175.1
Japan	41	--	59	3.4	66,707,220	40,433	154.4
Mexico	17	20	57	4.9	47,906,134	6,327	104.2
Philippines	28	39	31	2.7	36,722,588	1,314	n/a
Rep. Korea	35	42	23	4.8	24,550,819	15,350	57.8
Malaysia	21	56	18	4.1	11,548,873	5,078	n/a
Chile	26	49	24	4.0	7,451,903	6,240	151.5
DR	19	33	42	2.2	4,280,923	3,731	n/a
Israel	45	41	13	5.9	3,007,030	21,941	86.8
Singapore	26	50	24	2.6	2,624,581	30,132	n/a
Ireland	35	38	24	5.7	2,199,432	30,130	137.2
Costa Rica	**18**	**24**	**55**	**5.0**	**2,098,078**	**5,196**	**129.5**
Uruguay	19	27	54	n/a	1,670,604	8,212	117.2
Panama	25	30	43	3.8	1,581,716	5,644	174.0

Source: World Bank Development Indicators, 2008. (The World Bank, 2012b)
Note: 2008 is the most recent year with complete education statistics. Electricity prices are for 2010.
Source for Electricity Prices: OECD iLibrary: Energy prices in US dollars and Energy prices in Latin America from the International Energy Agency (IEA).

Finally, each chapter closes with a discussion of Costa Rica's position in the value chain, identifying upgrading trajectories that may be most suitable for the country to pursue based on its competitive advantages.

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