Central America in Manufacturing Global Value Chains (GVCs)

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1. Introduction

The recent protectionist discussions in the United States (US) have raised concerns amongst policymakers in Central America. Free trade with the US has been a central tenant of the region's economic development strategy over the past two decades. Today, the US is the region's leading trade partner, accounting for approximately 40% -45% of exports in 2015 and 2016 (UNComtrade, 2017c). An important share of these exports is manufactured products. Since the turn of the century, manufacturing in Central America has taken on an increasingly important role in the generation of foreign exchange, accounting for over 50% of merchandise exports in 2015 (World Bank, 2017).[1] This trade has been bolstered by the establishment of export processing zones (EPZ) and free trade agreements (FTA), such as CAFTA-DR with the US in 2006 and with the European Union (EU) in 2013.

This research uses the global value chain (GVC) framework to analyze Central America's participation in global manufacturing value chains, to understand the region's competitiveness drivers and to evaluate the risks posed to continued participation if US trade policies change. The GVC framework allows one to understand how geographically fragmented sectors are organized by examining the structure and dynamics of different actors– including both firms and countries, by tracing the shifting patterns of global production, linking dispersed activities and actors of a single industry, and determining the roles they play in developed and developing countries alike. The nature of the relationships between diverse actors in different countries within these chains plays a central role in determining how firms access markets and how they react to changing conditions.

Central America's entry into manufacturing GVCs has primarily been through the insertion in chains in three sectors: apparel, wire harnesses (automotive)[2] and medical devices. These sectors span low-, medium-, and high-tech manufacturing. They are important contributors to the region's export basket, and the US is central to their trade. They are among the leading manufacturing exports from CAFTA-DR countries, accounting for an annual average of 20% of all exports to the world since 2008 and 48% of exports to the US in 2015. The US is the leading export destination for these products; accounting for 70-80% of exports in these categories (UNComtrade, 2017c). Apparel is the region's leading export sector, accounting for approximately 15% of the region's exports annually since 2008, and between 20-30% of the region's exports to the US over the past 15 years (UNComtrade, 2017c; USITC, 2017a). Medical devices are the second highest export category to the US by value and arguably the region's most technologically sophisticated product exports, with a high growth rate of 134% between 2005 and 2015 for the US market alone. Medical devices have increased their share of all US-oriented exports from the region from just 3% in 2000 to 10% in 2016. Wire harnesses are the fastest growing manufacturing export to the US; direct exports to the US increased by almost 183% between 2005 and 2015 (USITC, 2017a).

To best understand how the region operates in these manufacturing sectors, this report focuses on analyzing the participation of select countries in each of the three value chains.

- Apparel: El Salvador, Guatemala, Honduras, and Nicaragua
- Wire Harnesses: Honduras and Nicaragua
- Medical Devices: Costa Rica and Dominican Republic

[1] Honduras is the exception to this rule, with manufacturing exports around 30% over the past decade.
[2] This is part of the automotive sector; however, due to the relative importance of the wire harness sector in the region versus all other automotive components, and the scope of the project, this was the only segment analyzed.

The report is structured as follows: First, we present the methodological approach employed. Next, the region's participation in the three manufacturing GVCs is mapped. This includes detailed analysis of the activities undertaken and products exported by each country, as well as understanding the profile of firms invested in GVC operations in each of these countries and their trade dynamics. Third, the relevance of trade policy and potential impacts of changes to trade policy are discussed, under four potential scenarios: (1) Status Quo, (2) US withdrawal from CAFTA-DR, (3) US withdrawal from NAFTA, and (4) an increase in non-tariff barriers (NTB). Following this discussion, the report closes with the analysis of the implications of these outcomes for policymakers in the region.

2. Methodology and Data

The Duke GVC Center team used a variety of quantitative and qualitative data sources to analyze the evolution of the position of the selected countries' in the GVCs and to forecast changes given potential US trade policy changes. Specifically, for each sector, the footprints of the selected countries were mapped on the GVC using a combination of trade, firm and employment data. The size, scope and regulatory nature of the three industries required a combination of data sources and mapping methodologies.

Trade data was primarily drawn from United Nations Statistics Division (UNSD), COMTRADE database to analyze imports and exports. Medical devices data was based on country export data, while for apparel and wire harnesses, given gaps in export data reported by Honduras and Nicaragua, mirror data was used to map exports and imports. This trade data was used to identify primary production networks in which each country participates and each country's dependence on the US as a trading partner. For apparel, COMTRADE was also used to identify sources of textile imports. This was supplemented with data from EPZs in Honduras and Nicaragua.

The United States International Trade Commission (USITC) database was used to identify share of trade undertaken between US and Central American countries making use of CAFTA-DR benefits (wire harnesses, medical devices) and data from the Office of Textiles and Apparel (OTEXA) was used for apparel. This data also provided insights into the evolution of products exported from the selected countries. In addition, in the medical devices sector, FDA registration data for each establishment and the products manufactured in that location offered additional information regarding the extent of product diversification and product lines being produced in each location.

Analysis of country investment promotion strategies, export profiles and trade legislation indicated that most firms in each sector were participants in the countries' export processing zones (EPZs) regime. Using this information, it was possible to identify the evolution of the number of firms operating in each sector as well as evolution of employment in the sector. National production data (i.e. number of firms or employment) for these sectors in the countries analyzed was not available. Specific firms, their origin and employment were identified through a combination of sources, including firm directories provided by the Central Bank (Costa Rica, Guatemala, Honduras), industry associations such as *Asociación de Maquilas Hondureñas* (Honduras) and CAMTEX (El Salvador), national EPZ committees, including *Consejo Nacional de Zonas Francas de Exportación (CNZFE)* (Dominican Republic) and *el Consejo Nacional de Zonas Francas (CNZF,* Nicaragua*)*.

Analysis of Import Genius imports (2013-2017) and exports (2006-2017) helped to identify which of these firms were engaged in direct trade with the US, and their primary buyers (Medical Devices, Costa Rica, Dominican Republic; Wire Harnesses – Honduras and Nicaragua). For apparel, data from Import Genius on trade between each country and the United States was used to identify buyer-supplier relationships, and the transportation (i.e., ports) network used in each country.

To complement the firm and trade data, interviews with key stakeholders (firms, industry associations, EPZ agencies, policymakers) were undertaken. A mix of over 60 in-person (either in-country or with US headquarters) and phone interviews were carried out between December 2017 and February 2018 to understand firm strategies and priorities with respect to location selection (i.e. capabilities of the workforce, free trade agreements, proximity to market, access to raw materials, etc.). In addition, relevant information was drawn from 10 firm interviews undertaken in-person by the authors in San Jose, Costa Rica between June and August 2012 on the medical devices sector.

3. Central America in Manufacturing GVCs

The analysis presented in this section discusses the dynamic roles these countries play in the GVCs, covering the types of activities undertaken, and products exported, investing firms that have driven exports and the evolution of key market destinations. For each of the countries analyzed, these industries represent significant export earnings, over US$1B (with the exception of Honduras in wire harnesses) and are key export industries accounting for between 7-43% of total country exports. These sectors also offer approximately 420,000 jobs across the region; apparel remains the most significant employer, with approximately 350,000 jobs; wire harnesses and medical devices offer fewer, but more technical and professional jobs. Overall, while there are exceptions, the region participates in the production stages of global manufacturing chains, leveraging its relatively low-cost labor, favorable trade policy and proximity to the United States.

Table 1. Central America, Key Sector Exports (2015) and Employment (2016)

	Apparel (A) & Textiles (T)				Wire Harnesses		Medical Devices	
	El Salvador	Guatemala	Honduras	Nicaragua	Honduras	Nicaragua	Costa Rica	Dominican Rep.
Exports (US$, billions, 2015)	$2.2	$1.6	$3.4	$1.6	$0.6	$1.1	$2.5	$1.1
Employment (2016)	80,953	77,000	97,880	95,281	13,450	15,600	15,700	21,674*

Source: UN Comtrade, 2017

Note: Employment data based on national EPZ reports in each country. *Dominican Republic data includes employment in the pharmaceutical and medical supplies sectors.

3.1. Global Characteristics of the Apparel, Wire Harness and Medical Device GVCs

Despite often being aggregated into a single industry category by economists, manufacturing GVCs differ significantly in the way in which they operate due to variations amongst lead firms, dominant technologies, regulations and markets. These differences have implications for how developing countries and their domestic firms can gainfully participate in these global industries. This section discusses the global characteristics of each of these industries, highlighting key differences in Table 2.

The **apparel industry** is an example of a ***buyer-driven*** chain common in labor-intensive, consumer goods industries which are marked by power asymmetries and a separation between the company that manufacturers the final product and the buyer or brand owner responsible for distribution to the final consumer or retail outlet (Frederick et al., 2015; Frederick et al., 2014). Lead firms control the service-related activities that add the most value to apparel products (e.g., branding, design), and outsource all or most of the manufacturing to a global network of independent suppliers. Approximately 90% of apparel sold is under this model; the remaining share is produced under an 'OBM' model (Own Brand Manufacturing) in which the brand owner is also the manufacturer. The CAFTA-DR region is unique in the apparel industry in that a significant share of exports from the region are based on this OBM model (i.e., Hanesbrands, Gildan, Fruit of the Loom, VF Jeanswear/workwear).

While barriers to entry into apparel manufacturing are low in terms of skills, capital investment and technological sophistication, it is very difficult to gain access to global buyers to become part of their production networks. Furthermore, once a firm becomes a supplier, it is also uncommon to move beyond manufacturing and into the more intangible, service-related activities in the chain related to creative design, brand development, research and even sourcing because buyers often specify the textile suppliers they want apparel manufacturers to use to ensure consistency in production across global locations and to negotiate lower material prices. As such, a middle or high school education is sufficient and training if often performed on the job over the course of a few weeks with newcomers typically starting with the most basic sewing operations.

Given the demand for apparel globally and the variety of reasons consumers need different types (weather, size, cultural and personal preferences, occupation, leisure activities, etc.) combined with the relatively low unit price of a garment, the industry is among the least concentrated (the world's largest apparel company accounts for less than three percent of the market). While many apparel manufacturers have quality management/ISO 9000 standard certifications, the importance of product and process standards is comparatively low as apparel does not pose a significant health and safety risk to users. Tariffs, trade agreements and government intervention in the textile and apparel supply chain has historically been very important in the industry and played a significant role in shaping the geography of production networks and buyer-supplier relationships still in place. Related, import tariffs on apparel products are among the highest of all imported goods in key consuming countries such as the United States and Europe. For example, in the United States, T&A trade accounts for approximately 42% of all U.S. duty revenue and involves 20% of all U.S. importers (U.S. CBP, 2016). Apparel has high duty rates, averaging above 10%, compared to all other imports, which have an average duty rate of 2%.

Wire harness production is part of the automotive GVC, which is a ***producer-driven*** chain. In this sub-sector, producers control the technologies platforms and work closely with the principal lead firms (car manufacturers) in the industry in the design of new products and manufacturing in-house (Carillo & Miker, 2014; Sturgeon et al., 2016). In some cases, these OEM firms are spin-offs from the car manufacturers themselves; such as Delphi (General Motors). Today, the wire harness sub-sector is highly concentrated, and most firms are global in scope, headquartered in either the US or Japan. Technologically, the sector has become more sophisticated due to the addition of more electronics into vehicles, and the advent of electric cars. The economies of scale required to support global car brands are very high – in

2014, the three leading firms (Toyota, Volkswagen and GM) produced some 30 million cars - requiring significant capital investments. In addition, while competition is high for each model design, once a supplier is selected, contracts extend to approximately five to seven years. Barriers to entry are thus substantial for new firms.

Barriers to new countries to enter the industry are also relatively significant; requirements for entry include a low cost, but technically capable labor force in proximity to a regional automotive assembly hub. Labor-intensity is high during assembly stages, automation of these processes is not yet cost-effective, and this has led to global relocation of wire harness operations to countries with low cost labor. Nevertheless, despite the emphasis on low cost, technical capabilities of the labor force in assembly are important in the sector due to the safety and quality requirements of automotive components. Training thus plays a more important role in this sector than in apparel; it is basic, but it can take a relatively long time to bring workers up to full productivity[3] and ensure safety and quality protocols are managed to ISO and lead firm standards.[4] Finally, due to the bulk volume of these products, wire harness assembly tends to be established in relative proximity to automotive assembly sites. Firms producing in Honduras and Nicaragua are closely tied into regional production networks in Mexico and the US. Together, these characteristics reduce operation mobility as operations tend to be set up in the lower cost peripheral countries around an assembler base.

Like the automotive sector, the **medical device GVC** is a **producer-driven** chain, however, in this sector, there is much less outsourcing, with lead firms operating as OBM firms (Bamber & Gereffi, 2013). This is due to the high levels of investment required in designing and developing new products, together with a very strict regulatory environment. As increased awareness for product safety and quality concerns have grown globally, these factors have contributed to high levels of concentration in the industry, with few firms able to sustain the high investment costs while simultaneously maintaining strong global production and marketing. As a result, lead firms are - almost without exception - from leading developed country markets, such as Philipp's (Germany), BD (US), Baxter (US), Boston Scientific (US) and Medtronic (US/Ireland).

The industry has been slow to offshore operations to take advantage of lower cost locations, and offshoring has been concentrated in a limited number of countries where firms can ensure quality, regulatory compliance and intellectual property protection. These include Costa Rica, Dominican Republic, Ireland, Mexico, and Puerto Rico. The first products to offshore have been relatively simple single-use products such as intravenous tubing (disposables, Class I), which are labor-intensive, with more sophisticated products such as surgical instruments (Class II) and therapeutic devices such as heart valves (Class III) being relocated as new locations gain capabilities and achieve certifications. These products vary in terms of their capital and labor intensity. Training is essential; it can take up to six months for product line operators to reach full productivity for some complex products. Product transfers, shifting production between sites, can take up to 18 months due to the importance of supply continuity in the life-sustaining sector. Due to these factors, there has been very little industry relocation. These have consisted primarily in movements between developed country production bases and new offshore locations. Once investments are made, they tend to be stable over time.

[3] It takes as long as three months to train a new employee and allow them to perform tasks alone.
[4] Standands include ISO TS 16949 and International Automotive Task Fore (IATF).

Table 2. Key Global Characteristics: Apparel, Wire Harness & Medical Device GVCs

Characteristic/ Variable	Apparel	Automotive - Wire Harnesses	Medical Devices
Governance Structure of GVC	Buyer-driven	Producer-driven	Producer-driven
Outsourcing	High; OEM	High; OEM	Low; OBM
Industry Concentration (Firms)	Low	High	High
Technological Sophistication	Low	Medium	Low-High
Capital Intensity: High capital intensity favors US production	Low	Medium	Medium-High/High
Labor Intensity: High labor intensity favors lower-cost countries	High	High - 300-500 minutes to complete a combined automobile harness	Low – Medium – High (Disposables, High)
Location Selection Requirements: Lower requirements increase number of potential competitors in the sector	Labor-Cost Cost/access to raw materials Cost Sensitive	Labor-Capability/Cost Energy costs Cost Sensitive; Geographical location, shipping weight drives need for proximity	Labor-Capabilities Location reputation; IP protection Knowledge sensitive
Backward Linkages: Importance of co-located input supply in location decisions	Medium (Textiles)	Medium-Low (no need to have plastics/copper wire)	Low
Importance of Human Capital & Training: Availability of talent & subsequent investments in the workforce development increase probability of staying	Low 1-3 months to full productivity	Low-Medium 1-3 months training; 3+ months to full productivity	Medium-High 1-2 months training; Up to 7 months before full productivity (depending on product line)
Relevance of Standards Compliance: Importance of standards compliance for GVC participation	Low	Medium (Technical Specs) ISO 9001 & ISO 16949	High (FDA registration and ISO 13845 certification); validation of first SKU-2 months, subsequent SKUs-3 weeks
Importance of Tariffs and Trade Preferences	High	Medium	Low
Industry Mobility to Date: How much relocation (i.e., country to country shifts) has taken place in the sector since GVCs began to shape trade	High – From developed countries to East Asia, to regional networks, China, South/SE Asia and Africa	Medium-Low – Peripheral low-cost countries around automotive assembly hubs	Low – Primarily developed to developing countries, first move

Source: Authors

Note: OEM – Own Equipment Manufacturing, OBM – Own Brand Manufacturing.

3.2. Key Activities Undertaken in GVCs

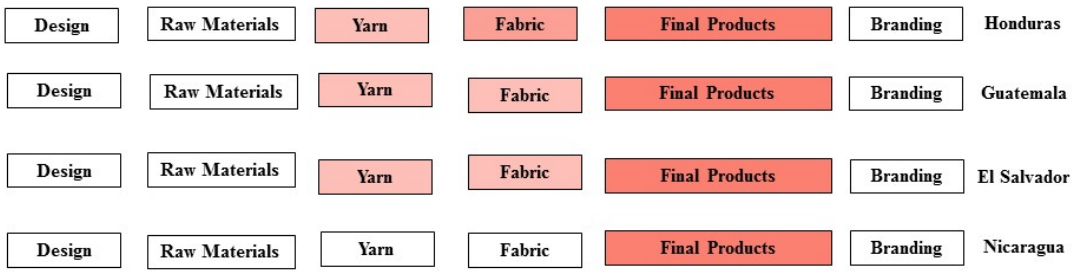
Central American countries primarily participate in lower-value production stages of these industries with a focus on labor-intensive assembly operations. This is true for all three GVCs. Additional activities within these chains depend on the maturity of the operations, proactivity of the government in supporting sector expansions, the level of development of each country,[5] and the type of investing firms.

[5] As measured by GDP/capita.

Regional apparel exports date back to the 1970s, with a jump in the early 1980s due to early US preference programs for production sharing in the Caribbean Basin to enable manufacturers to conduct the most labor-intensive operation (sewing) in lower-cost countries without having to pay import duties. Honduras and Guatemala were among the earliest to have apparel factories, followed by the Dominican Republic (DR) and El Salvador and lastly Nicaragua. Many of the manufacturers in the region have been in business for over 30 years and have gradually expanded their geographic and supply chain footprint over the years (from basic sewing, to include cutting, dyeing/washing, trim, finishing, fabric production, and yarn). Manufacturing capabilities for components (fabric and yarn) vary by country, with Honduras producing the highest volume of knit fabric (cotton or cotton/polyester blends), El Salvador producing synthetic yarn, elastic and fabric, Guatemala producing the widest variety, but in smaller mills and the only sizeable lightweight woven manufacturer, while Nicaragua primarily imports textiles. Raw materials (i.e., cotton/synthetic fiber) are not generally produced in the region, and if yarn is produced in-country, these are still imported.[6]

From an activities viewpoint, firms are primarily in assembly of final products (cut/sew), with minimal activities outside of manufacturing (design, branding, sourcing/logistics coordination and sales/customer acquisition). While a company might be responsible for coordinating and providing the final buyer or headquarters location a full-package product, the actual sourcing activities often take place at the manufacturers' headquarters or sales office in Asia or the US. This is not unique to the CAFTA-DR region, but is the typical operating model of the apparel GVC (Gereffi & Frederick, 2010).

Figure 1. Select Central American Countries in the Textiles & Apparel GVC

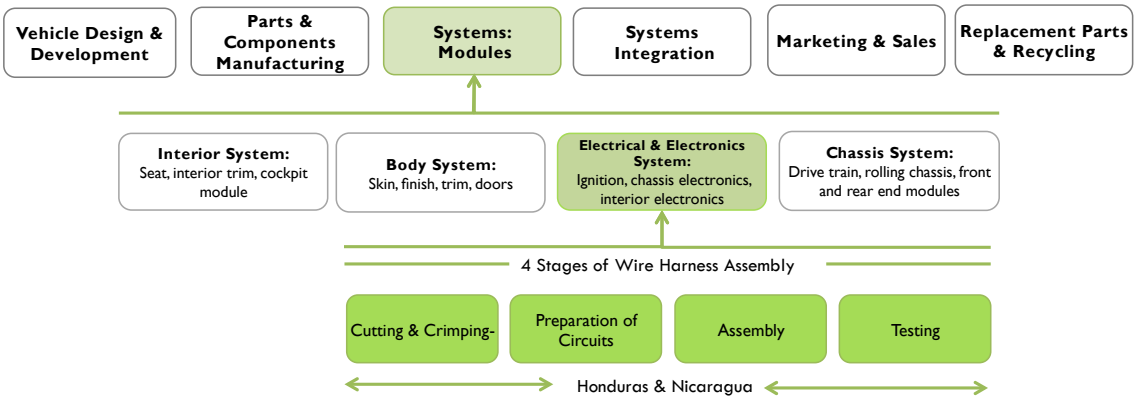


Source: Authors.

In the **wire harness sector**, with over 15 years of experience, both Honduras and Nicaragua, which began assembling harnesses in the late 1990s and early 2000s respectively, have both gone on to undertake all activities related to their fabrication, including cutting, crimping, circuit preparation and testing in addition to assembly operations. Some firms in Honduras are beginning to manufacture some specialized components to add onto the harnesses.[7]

Figure 2. Honduras and Nicaragua in Wire Harness Assembly Operations

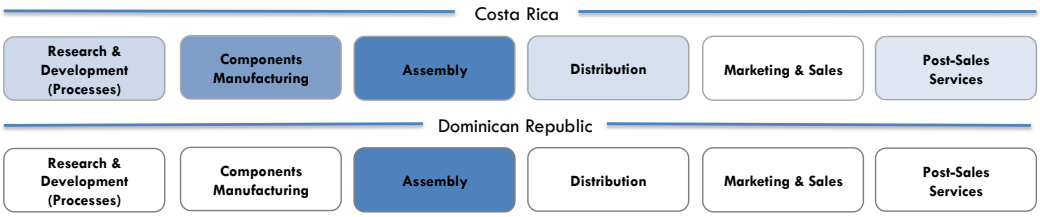
[6] However, new synthetic facilities are in the pipeline in all four countries for expansion in yarn.
[7] The production of terminals for these harnesses generally depends on economies of scale and automation and continues to be based in developed country automotive producers, Germany, Japan and the US. Germany, for example, exported US$4 billion in terminals in 2016 (UNComtrade, 2017b). Only niche, customized or specialized components are manufactured in Honduras.



Source: Authors

Having entered **the medical devices sector** in the late 1990s primarily in assembly operations, by 2017, Costa Rica was undertaking several production and services activities within the chain, including vertically integrated production with component manufacturing and sterilization. Numerous firms now also undertake sustaining engineering to increase efficiency in plant operations, with a smaller subset also undertaking process development and launching new products to market directly from the Costa Rican manufacturing operations. Recent efforts also include upgrading into pre- and post-production services including global procurement, distribution, and complaints management; the latter is an essential element for FDA regulation in the US. By comparison, the Dominican Republic has a smaller footprint in the medical devices GVC, despite having entered the industry at the same time as Costa Rica. Activities primarily focus on labor-intensive assembly and packaging, with the more established firms carrying out sustaining engineering to support productivity improvements. Neither country undertakes new product development, which is consistent with the global industry operations. These activities are typically undertaken closer to market and in developed countries. Figure 3 illustrates these activities.[8]

Figure 3. Costa Rica and Dominican Republic Footprint in Medical Devices GVC



Source: Authors

Note: Shading indicates participation in value chain segment. Color intensity denotes relative share of firms in each country participating in different activities, not number of firms.

3.3. Products

Product sophistication and evolution differs by sector; apparel has been the most static sector, while medical devices have by far been the most dynamic – although only in Costa Rica. This

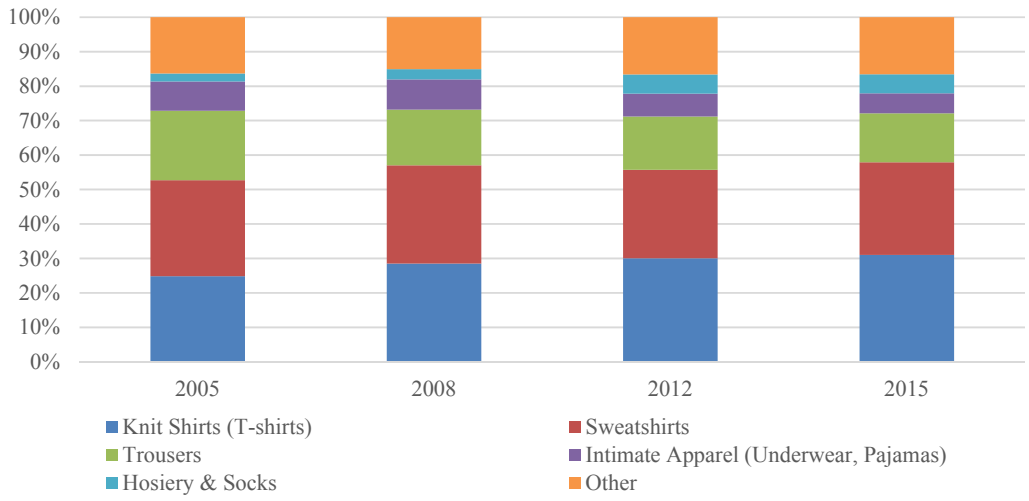
[8] A more comprehensive GVC mapping of the activities of each country can be seen in the Appendix.

is partly an outcome of the roles that the region fills in each of these global industries; in the apparel sector, Central America is a very small player in the global industry filling a specific niche; in the wire harness industry, Nicaragua and Honduras have played secondary roles to Mexico's production base undertaking the lower cost items, while Costa Rica (together with Mexico) has become a central element in the global offshoring strategies of the medical devices industry.

In apparel, there has been minimal product upgrading. The main product categories exported from the four countries have remained largely the same over the last 20 years; knit shirts, sweatshirts, trousers, and underwear/socks. The top three subsectors have accounted for approximately 73% of exports since at least 2005. The top HS code, cotton t-shirts, has remained the same (2010-15), and accounted for 20% of exports by value in 2015. The four countries are primarily exporters of knit apparel (rather than woven), and the share of knit exports has increased (72% in 2005 to 80% in 2015). The four countries also primarily export cotton products, but dependence on cotton has decreased over the last decade in line with the overall decline at the global level. In 2015, 56% was cotton compared to 73% in 2005.

These products, which are primarily basic, cotton knits, are products that were, and still are, produced by the few existing vertically-integrated North American OBM apparel firms. These are also the products that are cost competitive to produce in the region, due to a combination of the lead firm's long history producing them (leading to efficient production systems), market share, and historical protection policies for US textiles and cotton.

Figure 4. Apparel Exports of Four Countries, By Subsectors, 2005-2015



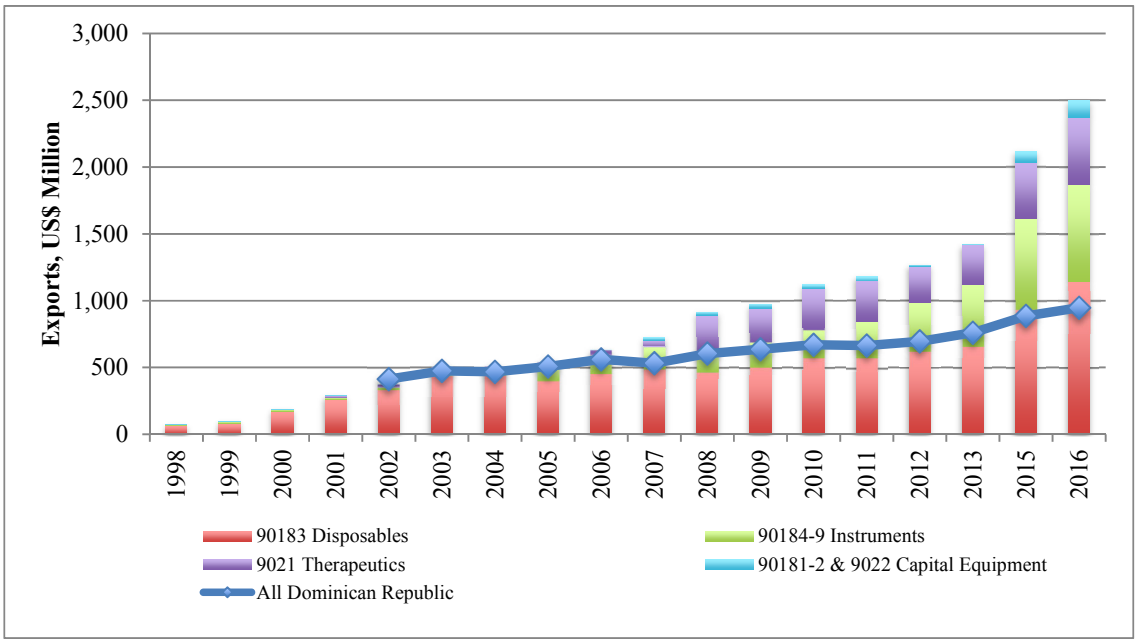
Source: Authors based on UN Comtrade, 2017

On the other hand, product analysis reveals variations of product types and complexity in the wire harness and medical device sectors both across countries in the region and overtime. In wire harness production, Honduran production covers almost the full range of product complexity from doors and battery to chassis and instrument and engine sub-systems. These are destined primarily to standard market segment. In Nicaragua, production is oriented towards both the standard and luxury automotive markets, although in the latter, production –

which is based directly on customized orders - has only been on a few types of harnesses, such as door and seat harnesses for models such as the BMW X-series.[9]

In the medical devices sector, there are notable differences between the product output of the two countries. The Dominican Republic exports primarily high volume, lower value disposable products, including sutures, ostomy bags and intravenous sets.[10] Costa Rican exports are more diversified, with firms producing a higher value-lower volume mix (see Figure 5). While low value products such as IV sets continue to generate important revenues (US$1.1B in 2016) for the country, export growth (2005-2015) has been faster in surgical instruments (586%), therapeutics (993%) and capital equipment exports (6,600%).[11] Similarly, where DR's product mix primarily consists of FDA Class I and Class II products, Costa Rica has been producing several products in Class III category since the mid-2000s. Class III products by definition are high risk products, which serve a life-sustaining or supporting function, and thus their production requires an ecosystem of high regulatory compliance. Developing local capabilities to meet these requirements takes time and commitment, particularly towards the development of specialized human capital.

Figure 5. Costa Rica & DR Medical Devices Exports, by Product Group 1998-2016



Source: UNComtrade (2017d)

[9] Trade data limitations prevent the use of unit value analysis as a proxy for technical complexity/value.
[10] Classification of exports by HS tariff line is less specific in the Dominican Republic with most exports being reported as 9018; this makes it impossible to use trade statistics to analyze the product mix of exports.
[11] *Disposables* include products such as bandages, plastic syringes, catheters and needles. These are "low tech," generally single-use products that are cost driven. *Surgical instruments* include products such as forceps, medical scissors and dental drills, as well as specialized surgical instruments used in cosmetic and endoscopic surgery. These are generally multi-use products that are sterilized between uses with different patients. *Therapeutic devices* include both implantable and non-implantable devices to help people manage physical illness or disability. Due to their prolonged use inside the body, the production of implantable devices requires considerable expertise, particularly with respect to bio-compatibility, and obtaining regulatory approval for is a costly process. *Capital equipment* includes single-purchase equipment that can be used repeatedly over several years. These products require ongoing account management for accessories, services and parts.

3.4. Firm Investments in GVCs

Overall, GVC participation in these industries has been driven by large-scale investments by foreign firms into EPZs. Domestic firm participation is weak except for a few textile and apparel firms in Honduras, El Salvador and Guatemala. Benefits granted to exporting firms are similar across the CAFTA-DR countries and include exemption from corporate income tax for 8-20 years with additional exemptions of other taxes for an indefinite time frame (municipal, export, sales, imports). All countries provide 100% national treatment for foreign investors and full repatriation of profits. The main difference is that some countries require the investments to be in strategic sectors, while others extend these benefits more broadly.[12]

The scale of operations and concentration of foreign firms has typically been significant; in all three industries, the top five firms in each country dominate the bulk of export value. These firms tend to have other branch plants across the region, although in many cases, each plant is dedicated to the production of specific products. Firms from the US are amongst the oldest and largest investors, although investment from Germany, Korea and Japan is also relevant in certain sectors. These firms are mostly global leaders in their respective value chain stage.

In the **apparel sector**, Honduras and El Salvador have the most local investors. In both countries, local entrepreneurs were a driving force in setting up and investing in the first EPZs and establishing early textile and apparel capacity and are still active in the industry today. Textile mills, however, were initially built and operated by US and Korean foreign investors in the 2000s, while earlier mills were established by domestic firms. Today, several of these are now owned and operated by regional investors. Fabric and yarn mills that are part of the supply chain of vertically-integrated OBM firms are captive to the brand (Fruit, Hanes, Gildan), while other mills in the region sell to multiple buyers.

In the **wire harness sector**, investment is highly concentrated, with 5-7 companies in Honduras[13] and two in Nicaragua. These firms are primarily foreign, and local investment is insignificant. Two of the major global investors in the region are Lear Corporation (US, Honduras) and Yazaki (Japan, Nicaragua). In Honduras, Lear investments (including KyungshunLear, its joint venture (JV) with Hyundai (Korea)), accounted for approximately 70-80% of employees (~9,500) in the sector; while Arnecom de Nicaragua, Yazaki's JV with Xignux of Mexico, accounted for approximately 85% (14,000). These firms are global leaders in the automotive parts market, ranked 16th and 14th respectively. Mexico is the primary investment destination for these firms, and each have numerous plants in the country; their Central American plants generally operate under the umbrella of the Mexican regional headquarters. Indeed, Arnecom's supply chain is very closely linked with Mexico, as investing partner, Xignux is a major supplier of the cables used in the manufacturer of automotive electrical and electronics systems.

Other smaller but important investors include Draexlmaier, a German supplier (ranked 50th globally) of primarily German luxury cars (e.g. BMW). Draexlmaier set up operations in Nicaragua in 2010 at the same time German automakers began investing in assembly plants in North America (US & Mexico). By 2017, the company had 1,500 employees in Nicaragua,

[12] See Table 13 in the Appendix.

[13] Approximately 5-12 firms have invested in wire harness production in Honduras over the past decade, although the number has fluctuated, particularly around the time of the global financial crisis which had a major impact on trade in the automotive sector.

with ample room for growth in its facilities in anticipation of new contracts (Olivares, 2013{ProNicaragua, 2016 #2). In Honduras, Empire Electronics, a US firm, supplies a wide range of OEMs with approximately twice as many employees, although they have been in the country considerably longer, having invested in 1997. Of these two, Honduras is the only regional production site for Empire, while Draexlmaier has four plants in Mexico.

In the **medical devices sector**, Costa Rica has a larger base of companies than the Dominican Republic with 65 firms manufacturing and exporting devices, compared to 27. Nonetheless, both countries host major investments from the top twenty global medical devices firms. These include Baxter (both), BD (DR), B.Braun (DR), Boston Scientific (CR), Edward Lifesciences (both), Fenwall (both), Medtronic (both), Philip's (CR) and St. Jude Medical (CR). The most established plants in each county were set up in the 1990s. These firms are mostly US-based[14] and tend to have multiple global operations, including plants in Ireland, Mexico, and Puerto Rico. Generally, the MNC operations in Dominican Republic are oriented towards more disposable products (Class I and Class II), whereas in Costa Rica, firms have evolved to produce more complex products (Class II and Class III). In both countries, these plants are large, generally employing over 1,500 people in each operation.

While both countries have also been able to attract smaller, more specialized investors, with limited global production operations outside of their home country (e.g. Apollo Endosurgery, Vention Medical, Volcano Corporation[15]), the profile of these firms investing in Costa Rica is typically for higher value, and complex products (e.g. endoscopic guide wires, implants) than those in Dominican Republic (e.g. orthopaedic braces, wound dressings, sutures).

3.5. Trade Flows in GVCs

The US is the predominant market for these GVCs either through direct or indirect exports; market diversification is weak despite slight diversification in origin of firms discussed above. This reflects the market-seeking nature of firm investments into the region and highlights geographic proximity and market access as central to the region's value proposition in manufacturing chains. Imports vary by sector, nonetheless a large share of these are sourced regionally, from the US, Mexico or other Central American countries. This is particularly notable in the apparel sector due to specific 'yarn-forward' requirements for US market access. Below we discuss how this varies slightly by country and industry sector.

First, we analyze export diversification. Table 3 provides analysis of the Herfindahl-Hirschman Market Diversification Index, measuring concentration of exports by market share and market number. On the two extremes of the scale, green (closer to 0) reflects highly diversified, and red (closer to 1) represents least diversified. With the exception of Dominican Republic medical devices exports, all countries in each of the three industries improved, albeit only very slightly in some cases, the share of exports per market and the number of export destinations between 2005-2015.

[14] Exceptions include B.Braun, which is Germany by origin and Medtronic, which is now headquartered in Ireland. Nonetheless, the operations in the region are driven by the US divisions of these firms.
[15] Volcano Corporation invested in Costa Rica in 2011 as an independent firm. They were acquired by Philips, a top five global medical devices firm, in 2015.

- **Biggest Diversifiers**: Costa Rica's medical devices sector has experienced the greatest diversification, both in terms of market share and the number of markets between 2005-2015. The diversification of exports of wire harnesses from Nicaragua is the result of increased exports to Mexico. There, harnesses either undergo additional processing, and/or are installed into cars before being exported on to the US or other locations.

- **Most Concentrated**: Apparel is the most concentrated of the three industries, although slight progress has been made in reducing dependence on the US market, with the four countries analyzed opening trade to an average of 17 new countries over the period. Exports to those markets, however, remain very small compared to those to the US.

Table 3. Market Upgrading, Herfindahl-Hirschman Market Diversification Index

		HH Market Concentration						Number of Markets (Exports>US$10K)					
		2005	2007	2011	2013	2015	2007-2015	2005	2007	2011	2013	2015	2007-2015
Economy Wide	Costa Rica	0.20	0.15	0.16	0.16	0.18	0.027	139	145	145	159	150	5
	Dominican Rep.		0.27	0.32	0.29	0.31	0.046		143	136	146	147	4
	El Salvador	0.38	0.30	0.24	0.28	0.31	0.009	110	113	127	118	116	3
	Guatemala	0.31	0.23	0.21	0.21	0.20	-0.030	117	122	130	137	134	12
	Honduras	0.56	0.46	0.32	0.31	0.35	-0.111	115	126	135	142	134	8
	Nicaragua	0.41	0.42	0.29	0.29	0.42	0.002	100	110	127	135	131	21
	Honduras	0.56	0.46	0.32	0.31	0.35	-0.111	115	126	135	142	134	8
	Industry Specific												
Medical Devices	Costa Rica	0.87	0.79	0.61	0.60	0.52	0.269	36	48	71	63	74	26
	Dominican Rep		0.59	0.75	0.76	0.77	-0.18		59	56	47	57	-2
Wire Harnesses	Honduras	0.83	0.84	0.87	0.75	0.73	0.104	13	22	34	36	45	23
	Nicaragua	0.42	0.87	0.72	0.45	0.48	0.400	7	11	22	26	46	35
Apparel	El Salvador	0.93	0.86	0.88	0.87	0.85	0.01	81	85	93	97	98	13
	Guatemala	0.93	0.92	0.84	0.80	0.80	0.119	78	84	95	100	92	8
	Honduras	0.89	0.84	0.75	0.69	0.70	0.132	84	96	103	111	117	21
	Nicaragua	0.95	0.95	0.93	0.89	0.87	0.075	56	72	85	95	97	25

Source: (WITS, 2018a)

Notes: HS02: Medical Devices (9018-9022), Wire Harnesses (854430), Apparel (61, 62). Downloaded November 9, 2017 mirror import data was used for Apparel and Wire Harness and direct export data was used for medical devices. This indicator is a measure of the dispersion of trade value across an exporter's partners. A county with a preponderance of trade value concentrated in a very few markets will have an index value close to 1. Thus, it is an indicator of the exporter's dependency on its trading partners and the danger it could face should its partners increase trade barriers. Measured over time, a fall in the index may be an indication of diversification in the exporter's trading partnerships.

In apparel, the US accounted for 89% of apparel exported from the four countries (ranging from 84% for Honduras to 94% for El Salvador). Honduras is the 7th most important country for US apparel imports, followed by El Salvador, Nicaragua and Guatemala ranking 10-12th respectively in 2016. Overall the four countries account for 9% of US apparel imports (unchanged 2005-2016) and approximately 2% of world imports. Beyond the US, apparel is exported to Mexico, Canada and the EU-15.

Textile imports and backward linkages: one area that has expanded in the CAFTA-DR region is knit fabric, and to a lesser extent, yarn production. In line with apparel exports, most production is for cotton or cotton/polyester knit fabrics and spun yarn.

El Salvador and Guatemala each imported approximately US$900 million in textiles in 2016. El Salvador fabric imports have steadily declined since 2005 and yarn imports have

increased, as have fiber imports indicating growing capacity in fabric production. El Salvador fabric imports are increasingly from Guatemala (10 to 20% between 2012 and 2016) while the share from China is increasing (woven and knit), and US and Korea are decreasing.

In Guatemala, fabric accounted for 62% of textile imports in 2016. Guatemala is substituting knit fabric in country or from China at the expense of Korean imports. Woven fabrics are increasingly produced in country or are imported from China while US imports have declined (and Mexico has increased). Guatemala's yarn imports by value have remained steady, with an increasing share coming from the region (El Salvador and Costa Rica), however the US is still the largest supplier. Guatemala is producing more yarn and fabric in the country and sourcing in the region to account for the increasing share of qualifying imports (however, the share for Guatemala has historically been lower than the other countries).

Honduras imports more yarn than fabric. Fabric imports have decreased over the last decade. Imports are from the United States (80%), with an increasing share from El Salvador. Fibers in Honduras are primarily from the US, followed by China, India and El Salvador.

Nicaragua only imports fabric. China is the top source (39%), followed by the US (27%), Korea and Mexico then Guatemala. Fabric imports for knits are increasing. Knit fabric imports are from China whereas woven fabric was from the US and China, plus Hong Kong, Taiwan and Pakistan (all of which have fallen off) as Mexico has replaced these sources. This is due to the expiration of the TPL preference in Nicaragua at the end of 2014 and shift to taking advantage of the cumulation agreement with Mexico under CAFTA-DR.

While textile production has significantly expanded to meet the demands of current manufacturers, this does not necessarily mean that existing producers are capable of producing the types of fabrics needed for new buyers or have production set-ups conductive to producing them at needed volumes and competitive prices.

Table 4. Apparel Textile Imports: 2008 vs. 2016

Country	Yarn or Fabric & Share		Main Source & Share		Import Value (US$, M)		Material & Share	
	2008	2016	2008	2016	2008	2016	2008	2016
Honduras	Yarn: 57%	Yarn: 71%	US: 8%	US: 86%	$1,538	$1,537	Cotton: 61%	Cotton: 53%
El Salvador	Fabric: 70%	Fabric: 53%	US: 65%	US: 57% (2015)	$714	$427	Cotton: 68%	MMF: 62%
Guatemala	Fabric: 66%	Fabric: 62%	US: 35%	China: 35%	$750	$814	Cotton: 58%	MMF: 46%
Nicaragua	Fabric: 95%	Fabric: 98%	China: 29%	China: 39%	$365	$480	Cotton: 65%	Cotton: 57%

Source: UNComtrade (2017a)

In **wire harnesses**, North America is the most important market for Central America and Mexico. Over 95% of the wire harnesses produced in Honduras, Nicaragua and Mexico are destined for direct or indirect export to the US and Canada. Nicaragua and Honduras are the 3rd and 4th largest exporters to the US after Mexico (1st) and China (2nd).[16] Over the past decade, they have gained 5% US market share each, mostly at Mexico's expense which has seen its market share decrease by 15% during the same period. Although during this same time, Mexico's automotive output of finished cars has grown significantly, doubling output since 2005 and more than doubling the 2008 low point (1.5 million). In 2017, 3.8 million cars

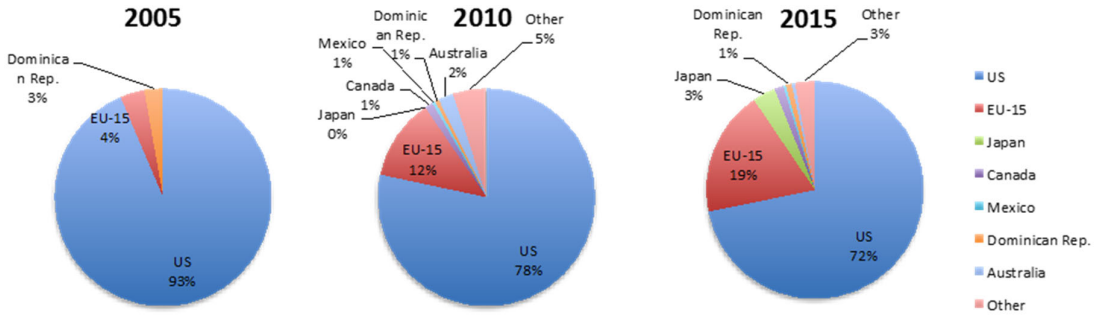
[16] By comparison, they are the 8th and 9th largest global exporters.

were assembled in Mexico (Reuters, 2018), some of which were models previously assembled in the US. Investment accelerated between 2012 and 2014, with automotive investment reaching record highs in 2014 at US$4.1 billion (Ruiz Durán, 2016). This created localized demand for wire harnesses.

In turn, the US is highly dependent on imports from the region; 77% of wire harness imports were sourced in Mexico, Nicaragua and Honduras. While this has remained constant over the past five years, it should be noted that Vietnam has rapidly grown in this same period to gain 4% US market share. This represents a threat for the region, as Vietnam has done so without preferential trade terms and from considerable distance. Analysis of the imports indicates the strong regional nature of the wire harness production network in the scope of the automotive value chain. On average, since 2012, 83% of annual insulated cable imports to Nicaragua came from Mexico.[17]

As noted above, regional **medical devices exports** are slightly more diversified in terms of end markets than the other two industries, although more so for Costa Rica than the Dominican Republic. Costa Rican exports to the EU-15 and Japan, in particular, grew steadily over the past decade from just 4% in 2005 to 22% in 2015 (see Figure 6). By comparison, the US accounts for approximately 90% of DR exports, followed by the EU-15 (5%) and Japan (4%) that year. This diversification in the DR, however, is based on the production models of less than five firms.

Figure 6. Costa Rica Medical Devices, Export Share by Destination, 2005-2015



Source: UNComtrade (2017d)

An important consideration in the export destination of medical devices is the presence of sterilization facilities at the production location. In Costa Rica, prior to 2012, only a few large manufacturers had internal sterilization capacity. This necessitated the shipping of products to sterilization plants in the US before sending them on to their final destinations. The subsequent establishment of operations by two third-party suppliers (Sterigenics and Synergy One) has facilitated direct shipping to other global distribution centers. This provides plants in the country with a competitive advantage over other locations in attracting new product lines. Dominican Republic currently does not have third-party sterilization operations, and a large share of firm exports are thus destined directly to contract sterilizers in the US, such as Sterigenics in Charlotte, North Carolina.

[17] While it's not possible to assume all these inflows were for the wire harnesses sector – since many of them have multiple uses, the key input categories correspond to those used by major manufacturers of wire harnesses are HS854449 (cable), HS853690 and HS854720 (connectors).

3.6. Institutional Support

Countries in the region have varied in their approach to developing GVC-oriented industrial policies. Below is an assessment of institutional activity towards industry development divided into four categories: (1) *Early proactive* – indicating that initiatives were taken/policy approach was developed as the industry was beginning to globalize and offshore production; (2) *Late proactive* indicates that policymakers have developed a strategy toward sectoral development but that they were not amongst the first movers in the GVC; (3) *Reactive policies* are those whereby firms were investing without an established industrial development policy, and local public/private stakeholders began to provide local support for key issues and overcoming constraints, and finally, (4) *Neutral* means that local stakeholders have taken no specific approach towards supporting GVC participation.

As highlighted in Table 5, Costa Rica has provided the earliest and most sustained policy support; the country's institutions have shifted the focus of their GVC-oriented policy from industry to industry as the country's competitive position has evolved. On the other end of the spectrum, El Salvador has been more reactive, and institutions have yet to put strategies in place to significantly support the country's position in respective manufacturing GVCs.

Table 5. Key Institutional Support for GVC Participation

Country	Key Institutions	Strategies	Proactive/Reactive Approach to GVC Policy*
Costa Rica	CINDE, PROCOMER	Drive investment in strategic, higher value sectors; cluster initiatives 5-6 years old	Early proactive, sustained
Dominican Republic	CNZFE; ADOZONA	Drive investment in high employment related sectors; recent cluster initiatives	Reactive; trade preference for apparel
El Salvador	CAMTEX; PROESA	Synthetic/sportswear and textiles focus	Reactive/Follower
Guatemala	VESTEX	Trim/accessories, full package, Korean investment	Early proactive, stagnant
Honduras	AHM, Honduras 2020	Honduras 2020 strategy, building synthetic yarn plant; focus on logistics/ports for speed to market and sportswear. Wire harnesses also a key sector.	Late proactive
Nicaragua	CNZF, ProNicaragua	Backward linkages to woven textiles	Neutral/late proactive; trade preference for apparel

Source: Authors.

Notes (*): see descriptions of the scale of institutional proactivity towards industry development is divided into four categories in the paragraph above.

For **apparel**, institutional support comes from the apparel industry association in Guatemala (VESTEX) and the industry association and export promotion office in El Salvador (CAMTEX and PROESA). In Honduras, the Association of Honduran Maquiladoras (AHM) is the primary supporter in the industry and in implementing the Honduras 2020 strategy while the Central Bank is the primary source of data/statistics, and in Nicaragua the free zone organization (CNZF), provides the most information and support to the industry. Among the countries, Guatemala had the earliest and most proactive efforts in terms of marketing the

country to foreign investors (particularly in relationship building with Korean firms) and building a network of supporting industries in-country. This included service providers, buyers' offices, and trim suppliers. The organization also convenes the region's only annual trade show. Recently, Honduras has been the most proactive in terms of strategy development through the 2020 initiative which focuses on increasing employment and exports, investing in infrastructure, and expanding backward linkages to textiles and expanding product focus to sportswear. Efforts in El Salvador to promote a strategy geared towards athletic/outdoor apparel and synthetics are less formalized than the other countries, however the private sector has been successful in mobilizing this strategy.

All four countries have plans for growth. Guatemala is keen to focus on providing a wider variety of products in smaller, more flexible runs. El Salvador's focus is to position itself as a 'full package vertically oriented destination with big factories', whilst Honduras is looking to expand its offer into new markets and implement its National Economic Development Project 20/20. In Nicaragua, efforts to increase textile capacity are a key focus area.

Investments in the wire harness sector in Nicaragua and Honduras have recently been targeted by local investment promotion agencies, reflecting more generalized initiatives to boost investment. Both countries passed laws allowing "light manufacturing" sectors to invest under their EPZ legislation, ProNicaragua includes the wire harness sector as part of their promotional materials and Honduras included wire harnesses specifically as part of the Honduras 20202 strategy.

Costa Rica's efforts in the **medical devices sector** have been proactively driven by very strong institutional support, primarily from CINDE and PROCOMER and the establishment of a formal cluster in 2012/13, which meets regularly to discuss common challenges and share best practices on issues such as human capital development and increasing energy efficiency. Efforts in the Dominican Republic to specifically support sector growth by comparison are relatively incipient, with the launch of a cluster initiative in late 2016. Prior to that, the country's proximity to Puerto Rico and the island's change in tax status, combined with its strong EPZ reputation and availability of high school educated population allowed the medical devices sector to grow organically in the country. While both countries participation in promotional activities such as the large industry trade fairs in the US and Germany each year, CINDE has developed a more strategic plan for targeting investors that fulfill the country's upgrading ambitious in the sector. To date, the DR has not yet begun to do so. Reflective of the foreign nature of investors in this sector, there is no medical devices association in either country, with firms being represented through either a generalized association for EPZ firms (such as ADOZONA-DR) or, more often the case, firms engage directly with CINDE/CNZFE when they require external support. In general, agencies in both countries (CINDE-CR and CNZFE/ADOZONA-DR) provide ongoing support for investors.

4. Trade Policy and Manufacturing GVCs in Central America

Free Trade Agreements (FTA) and the CAFTA-DR agreement, in particular, are considered to have been major drivers in Central America's insertion into GVCs. Much emphasis is thus placed on their preservation and promotion. The countries of the region have signed multiple agreements, including with the European Union (2013), Mexico (2012) and the US (2006). These agreements set out conditions not only regarding preferential access to key markets and reducing non-tariff barriers to trade/improve trade facilitation, but also establish terms

and, in some cases, technical capacity development, for investment protection and improving business conditions in a partner country. Increased trade openness in turn leads to increased trade flows and contributes to an expansion of logistics operations and shipping channels. Combined, these trade and investment provisions are considered important factors in driving firm investments into the region. Table 6 highlights key FTAs for Central America's participation in the apparel, automotive and medical devices GVCs. The significant number of FTAs suggests that market dependence on the US is not due to a lack of market access and openness, and that from an institutional standpoint the region is well-positioned to expand exports to other markets.

Table 6. Relevant Free Trade Agreements

Country	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua
CAFTA-DR - US	Jan 2009	Dec 2004	Mar 2005	Apr 2006	Oct 2005
Canada -	Nov 2002			Oct 2014	
CARICOM	Nov 2005				
China	Aug 2011				
European Free Trade Association	Aug 2014		July 2015 (S)		
European Union	Oct 2013	Oct 2013	Dec 2013	Aug 2013	
Mexico – Central America	Jul 2013	Sept 2012	Sept 2013	Jan 2013	
Pacific Alliance	Negotiations				
Republic of Korea	Nov 2016 (S)	Nov 2016 (S)	Nov 2016 (S)	Nov 2016 (S)	Nov 2016 (S)

Source: OAS (2017)

The relative importance of FTAs and CAFTA-DR for the three industries, however, varies due to uneven tariff measures. CAFTA-DR is most important for apparel and least important for medical devices. Table 7 compares average tariffs paid by CAFTA-DR countries with Most Favored Nation (MFN) tariffs.[18]

Apparel: The CAFTA-DR agreement has been instrumental in supporting ongoing apparel exports from numerous countries in the region. As an industry that is highly sensitive to cost changes, the tariff reduction for apparel products has helped the region remain as a competitive base in the face of increased competition from cheaper locations in Asia. Most apparel products enter the US market under CAFTA-DR provisions. CAFTA-DR and earlier trade preferences for Central American and Caribbean countries since the mid-1980s[19] have been the primary driver of exports and investment in the region. In 2016, 77% of US apparel imports from all CAFTA-DR countries qualified for duty-free entry and met the rules of origin (ROO).[20]

[18] MFN tariffs would apply in the event that CAFTA-DR is abandoned. These are the highest tariffs that apply to members of the World Trade Organization; all signatories of CAFTA-DR are members (WITS, 2018b).
[19] The U.S.-Caribbean Basin Economic Recovery Act (CBERA) was the initial program in the Caribbean Basin Initiative (CBI), which came into effect on January 1, 1984, and granted benefits to 20 countries/territories in the Caribbean Basin (807 program). CBI was expanded through the U.S.-Caribbean Basin Trade Partnership Act (CBTPA)(807A+), which entered into force on October 1, 2000 and continues until September 30, 2020.
[20] ROO under CAFTA-DR for apparel are complex, however the most basic requirement is the yarn-forward rule of origin indicating that yarn and subsequent manufacturing stages must be performed in a constituent country. There are also special requirements for elastic fabric, linings, sewing thread and pocketing. The main exception is a cumulation agreement with Mexico for woven fabrics. For details, see the OTEXA website.

Table 7. Applicable US Import Tariffs, by Sector, 2017

	CAFTA-DR Imports		MFN Imports	
	Tariff	Share of Exports	Tariff	Share of Exports
Apparel	0%	77%	10.1-12.8%	23%
Wire Harnesses	0%	98%	5%	2%
Medical Devices	0%	0%	0%	100%

Source: USITC, 2017 USITC (2017b); OTEXA, 2017.

Automotive production networks in North and Central America have been shaped by the tariffs benefits and rules of origin requirements of NAFTA and CAFTA-DR.[21] This is true for wire harness production as well; 77% of wire harnesses enter the US duty free under these agreements. CAFTA-DR provisions allow duty free entry of wire harnesses assembled in the region into the US, provided the products have undergone a change in HS tariff line. Almost all regional exports to the US make use of that provision (98%) (USITC, 2017b).[22] Furthermore, although some firms had invested in both Honduras and Nicaragua prior to the implementation of CAFTA-DR,[23] significant sectoral growth has only taken place since the signing of that agreement; Nicaragua's exports to the US doubled between 2006-2016, while Honduras grew by 50%. In addition, although CAFTA-NAFTA could be considered the most important FTAs with respect to wire harnesses, the Mexico-Central America (2012) and EU-Central America (2013) agreements, which allow for diagonal accumulation and free movement of intermediate goods between these countries, have further facilitated the development of regional production networks, with primary inputs coming from Mexico (cables) and Germany (terminals).

The **medical devices** sector, on the other hand, does not directly rely on FTAs to provide tariff free entry into key markets; MFN tariffs for these products are 0% in the US and the EU and, in general, no devices enter the US market under FTAs. Nonetheless, firms value the investment and business environment fostered as a result of having these agreements in place; particularly smaller companies with a limited global production portfolio. In the Dominican Republic medical devices sector, for instance, while most exports are driven by large MNCs which have been in the country for over 15 years, there was a notable increase in smaller operations investing around the time of the signing of the FTAs with the US (2004-2008) and Europe (2011-2014). These firms have a lower ability to manage the risk associated with foreign investments, and thus tend to favor locations with additional institutional protection.

4.1. Potential Changes to US Trade Policy and Impact on GVC Participation

In this section, to predict how the region's GVC participation in manufacturing sectors could be affected by changing US trade policy, four potential scenarios are identified. These include 1) maintenance of the status quo; 2) US withdrawal from CAFTA-DR; 3) US withdrawal from NAFTA, and; 4) an increase in non-tariff barriers. Given that NAFTA

[21] Approximately 90% of US wire harness imports come from countries with preferential access (UNComtrade, 2017e; USITC, 2017b). The leading exporters include Mexico, Honduras, Nicaragua, Philippines, Thailand and Morocco.

[22] The balance enters the US under the general trade regime. These wire harnesses include the wire harnesses which are exported as such to the countries for additional processing.

[23] This was partly supported by the Caribbean Basin Trade Partnership Act (2000) and the Caribbean Basin Initiative (1983) which allowed for duty free imports of foreign assembly using US inputs http://documents.worldbank.org/curated/en/746311468256479916/pdf/WPS4789.pdf

negotiations are ongoing and results unpredictable, no scenario has been included for a modernized NAFTA outcome.

While estimating the probability of these different alternatives playing out is beyond the scope of this study, the perception of firms and policymakers in the region is that the most likely scenarios include maintenance of the status quo and US withdrawal from NAFTA, with CAFTA-DR withdrawal being the least likely scenario. Interviewees attributed the unlikelihood for the US withdrawing from CAFTA-DR principally to the following two factors: First, the US has maintained a trade surplus with the region since the agreement was put into place, in 2015 and 2016, this reached approximately US$5 billion (US Department of State, 2018); and, second, while NAFTA negotiations have begun, with a March 2018 deadline for wrapping up negotiations, CAFTA-DR has not yet been identified by US policymakers for review.

Table 8 details estimated outcomes of these scenarios on the participation of the region in the three manufacturing sectors analyzed in this study. This analysis is based on the examination of firm production strategies, global geographical distribution of the three industries, and regional and global country capabilities discussed in earlier sections.

Table 8. Estimated Impact on GVCs due to Trade Policy Changes

Industry	Status Quo/No Change	CAFTA-DR Ends	NAFTA Ends	New Non-Tariff Barriers Added
Apparel	Growing at half the (20% - four countries, 0% - CAFTA-DR) global rate (2005-2015) 42%	23% non-CAFTA-DR trade stays the same; All: Reduced future investment. N.A. investors –RPN; corporate divestment from T&A, shift production to Southeast Asia for firms already there, shift to other nearby countries with preferences (Haiti); Asian investors (Guatemala, Nicaragua) (reduce production in non-price competitive products; exports decrease by 25-30%.	Increase in exports, relocation from Mexico. Woven fabric cumulation with Mexico may end, so perhaps a decline in trouser exports unless woven fabric manufacturers moved from Mexico to CAFTA-DR.	NR/Unlikely
Wire Harnesses (Direct)	Continued growth (230%), double world growth rate (105%, 2005-2015)	Slower growth 98% enter under CAFTA-DR (N.A. investors – RPN); 5% MFN. Improved productivity efficiencies still possible.	Increase in exports, potential relocation from Mexico to leverage cheaper labor, infrastructure dependent.	US content requirements increase
Wire Harnesses (Indirect)		NR		
Medical Devices	Continued growth (193%, 2005-2015), +double world growth rate (86%), +six times world growth rate 2011-2015 (66% compared to 10%)	Direct impact: 0% import duties. Not relevant	Not relevant: 0% import duties Not relevant	Relevant – FDA registration & inspection required

Source: Authors. Notes: NR = Not Relevant. N.A. = North American

Apparel production in Central America, Mexico and the Caribbean have long (~33 years) heavily relied on US trade preferences, and any change in legislation will lead to at least a partial reduction in exports and a decline in future investments. However, there are several caveats to the situation. If CAFTA-DR preferences were to end, it is likely that (1) the fourth of US apparel imports that do not enter under CAFTA-DR preferences would remain, (2) existing firms will decrease future investment plans in the region, (3) US investors that have only produced using regional supply chains may start to divest from the industry altogether, (4) Asian investors will shift products that are not price competitive without the duty exemption (products other than cotton, knit basics) to Asian countries with lower labor costs or other countries in the region that still qualify for preferences (i.e., Haiti). If NAFTA were to end, while CAFTA-DR remains the same, the CAFTA-DR countries will likely see production from Mexico shift to CAFTA-DR. However, it is still likely that this could halt future investment plans as it shows general instability in trade legislation. It would also create confusion and issues surrounding existing cumulation agreements and disrupt woven supply chains in which the fabric is from Mexico.

With continued preferences, apparel exports from the four countries will continue to grow in line with overall apparel consumption in the United States. With continued investments in the region to expand textile capacity and capabilities, the four countries should maintain their share of the US market. Threats to continued growth include uncertainty of the future of the FTA and the potential of the US signing trade agreements with other countries and unpredictable wage increases. Accelerated growth with CAFTA-DR benefits will depend on firms' ability to reach new buyers (i.e., brand and retailers) who currently do not source from the region or only source a small share. This will require new marketing efforts and firms (or networks/vendors) capable of providing a wider range of products in shorter production runs.

For certain products, the region is price competitive without tariff preferences. Unit value analysis indicates that the CAFTA-DR countries are cost-competitive, and these supply chains would likely remain in the region. In categories that are above world averages in the United States, production is more likely to shift to other countries. These are also the products that have a lower degree of backward linkages (i.e., fabric and yarn) within the region. The ability to produce other products, such as synthetics, at globally competitive prices is difficult to access because the supply base for synthetics is far more limited in the region.

Wire harness production in Central America is deeply embedded in the regional production networks established by leading firms in the US and Mexico and which depend on FTAs. Estimated outcomes thus vary according to the different scenarios. Under the *status quo*, strong growth in the industry is expected to continue. The industry has experienced tremendous growth, as wire harnesses become lighter and their production more globalized. Trade in wire harnesses increased from US$18 billion in 2005 to US$36 billion in 2015 (UNComtrade, 2017e). Honduras and Nicaragua together have grown at twice that rate, with the expansion of established investors as well as attracting new investors. *Severance of CAFTA-DR* would result in a 5% MFN tariff imposition on wire harnesses; however, given the wage differential (e.g. Nicaragua per hourly rate of US$1.20 versus the US$14 in the US), the region is likely to continue to be competitive. Employment data is revealing: the entire automobile industry employs just 14,500 people in wire harness related roles (BLS, 2018). This is the approximately the same number as the Arnecom de Nicaragua operations. Key concerns, however, include the time and cost related to shipping from the region to the US.

This takes approximately twice as long as shipments from Mexico to the US and requires significantly more inventory holding on both inputs and outputs.

The region's countries would also be expected to benefit from an *abandonment of NAFTA* as firms could shift products destined for US assemblers from Mexican plants to those in Nicaragua and Honduras. The Mexico-Central America trade agreement allows for tariff free movement of products between the countries, and as well as removing bureaucratic non-tariff barriers. Overall growth would be tempered by Mexican automotive assembler decisions regarding whether to relocate their plants, or pay the 2.5% MFN average tariff.[24] On average, it is estimated that is currently US$1,200 cheaper to place a Mexican produced car in the US than an American-assembled one, driven to a large degree by cheaper labor (Congressional Research Services, 2017). With average new car prices in the US at approximately US$34,500,[25] Mexican assembled cars have around 3.5% cost advantage. In addition, since 2012, a host of design centers and components manufacturers have established operations in Mexico, deepening the industry's ties to the country (Ruiz Durán, 2016). Furthermore, logistics and time-in-transit would remain a constraint for moving Mexican wire harness factories into Central America. The temporal effects would also be dampened by the typical business model for harness manufacturing which provides contracts per model for 7 years with up to 15 additional years, and for which supplier firms establish specific plant capacity (Olivares, 2013).

Holding global demand growth constant, based on the steady past growth of **the medical devices sector** in Costa Rica and the Dominican Republic, increased efforts in both countries to improve their competitiveness through a variety of sector initiatives and no direct use of trade agreement benefits by firms, it is estimated that *under all scenarios* the region's participation in the industry will continue to grow. Of these scenarios, increased non-tariff barriers pose the greatest risk, due to the highly regulated nature of the industry. One such barrier includes the medical device tax, a 2.3% tax levied on the sale of all medical devices in the country (both domestically produced and imported), included into the Affordable Healthcare Act in 2015. While this does not shift the playing field amongst producers, according to the medical devices industry, led by Advanced Medical Technology Association – members of which are amongst the largest investors in the region the tax will dampen demand.

5. Implications for Policy Development

The analysis presented in this paper has highlighted that the region's participation is largely reliant on MNC investments in low-cost, labor-intensive operations in manufacturing GVCs. This is the most footloose form of investment in GVCs, which increases the vulnerability of the region to changing cost conditions that can result from trade policy and the entry and growth of other low-cost locations around the world. To remain competitive and maintain GVC participation in these industries in the face of change, countries in the region must

[24] Most automobiles produced in Mexico for sale in the US fall under HS tariff codes with an average 2-2.5% tariff rate. However, for heavy-duty transport vehicles, MFN tariffs reach 25%. This could impact 30% of Mexico's automotive exports (in 2016, 29% of exports to the US were under HS 8704). Currently, however, the wire harness manufacturers in Central America are not producing harnesses for this product category.

[25] Estimates vary but respected online sites such as Cars.com, Kelley Blue Book and J.D. Power indicate that the average price for a new car in the US in 2017 was between US$30,000 and US$35,000 (J.D. Power, 2017; Kelley Blue Book, 2017; Mays, 2017).

upgrade within their current sectors or move towards higher tech sectors that are more insulated from competition.

- **Upgrading Opportunities in the Apparel GVC:** Foreign-owned manufacturing in Central America in any of these GVCs is unlikely to lead to the development of Central American brand manufacturers capable of exporting to developed countries such as the US (i.e., functional upgrading). However, if local capabilities and entrepreneurs exist, there is potential for them to purchase the assets of foreign companies that choose to divest from the industry or focus on other core competencies (see textile companies for an example). Then there are opportunities to set firm strategy and determine new markets. Continued expansion of regional textile and trim suppliers provides a potential supply base for regional apparel suppliers.

- **Upgrading in Wire Harness Production**: Key opportunities for upgrading in this chain lie in process and product upgrading. Plants in the sector have steadily increased their presence in the production stage of the chain into all four stages of the fabrication of wire harnesses. While some plants are known for their high levels of efficiency and lean manufacturing, across the sector there are continued opportunities to improve competitiveness through process upgrades. In addition, product upgrading channels are also available. Honduras and Nicaragua have both demonstrated strong capabilities in the production of higher quality and more sophisticated harnesses through the smaller firms operating in the sector (i.e. Empire and Draexlmaier). There may be opportunities to upgrade into other automotive products as well. Functional upgrading into wire harness component manufacturing would only be possible with respect to cable production and highly customized components; globally, terminals are currently produced by a handful of automated plants based in Germany, Japan and the US, despite large scale production of harnesses in developing country hubs. Furthermore, due to weaker economies of scale compared to Asian counterparts in electronics components, upgrading into more components for installation into wire harnesses, while possible, would need to be in very low volume, high mix products.

- **Upgrading in Medical Devices Production:** There continues to be scope for product upgrading in both Costa Rica and the Dominican Republic out of non-classified and Class I products into more Class III products; while still labor-intensive, these are higher value products. These product groups face significantly lower risk of being shipped to cheaper locations due to the regulatory processes and costs involved in setting up production lines. The Dominican Republic has functional upgrading opportunities through the establishment of a local third-party sterilization operation, which would facilitate a shift towards direct distribution from the country. Nonetheless, leveraging the benefit from these investments is a timely process, due to the long lead times in the industry's operations. Costa Rica has the opportunity to continue to develop into more post-sales services, leveraging the country's strong reputation as both a global services operator and a medical devices production hub.

- **End Market Upgrading across Industries:** end market diversification is an opportunity for all countries and industries analyzed in the report. Institutionally the countries are well-positioned for end market diversification (Table 6), however for the three GVCs analyzed, exports are still concentrated to the United States. Market access exists and is not the bottleneck. As such, more focus should be placed on increasing awareness of regional capabilities by expanding investment, export

promotion efforts and improving trade facilitation and logistics. In the apparel sector, end market diversification in the Latin American region combined with functional upgrading of domestic firms offers the most potential. The potential of increasing exports to Europe are likely limited as Europe has its own regional supply base for fast fashion. However, European brands and retailers are growing in the US and Latin American market and are reaching a critical mass where developing a regional supply base would be beneficial.

- **Intersectoral Upgrading:** The vulnerability of these industries to changes varies, with apparel on one extreme and medical devices on the other. Wire harness production falls closer to apparel, given the role of trade policy in the broader automotive industry. While participation in the medical devices sector in the region is primarily within labor-intensive production operations, it is highly regulated and relatively more knowledge intensive than the other two sectors analyzed here. The high sunk costs and high-oversight requirements related to these characteristics decrease sensitivity to smaller changes in costs such as wage increases. To maximize country upgrading from a holistic industrial development perspective, a long-term plan should be in place to reduce dependence on apparel exports and to shift focus, skill development and incentives towards industries that offer more domestic spillover potential. Given the low profit margins and division of labor between retail and manufacturing in the global apparel value chain, there are limited opportunities to advance in the industry even under ideal upgrading conditions (see Table 9 on Realistic Expectations). Sectors that are more cost sensitive, with low sunk costs and low requirements in terms of institutional set up are more sensitive to changes in trade policy than those that are more knowledge/technology intensive and require a more strongly aligned institutional framework and have high sunk costs. Therefore, in the face of uncertainty, intersectoral upgrading into more tech/knowledge sophisticated sectors is better for countries in the region, even if they are in the lowest value-added stages of those industries. The pathway to intersectoral upgrading can also be pursued by identifying synergies across GVCs in the region. For example, industrial automotive fabrics and medical textiles are both opportunities to build synergies with the apparel and textile industry.

Achieving these upgrading strategies requires adjustments to the existing policies pursued by countries in the region. First, an industry-specific strategy to export-oriented participation in manufacturing GVCs needs to be determined at the national level to align all public and private stakeholders around these goals. This should be followed with improvements in human capital development, a more regional approach, and investment policies.

1. **Developing a strategy for export-oriented manufacturing GVC participation** Countries in the region have varied in their approach to developing a coherent strategy to improve GVC participation in these dynamic manufacturing sectors. Costa Rica has been the most proactive; CINDE, together with COMEX, as well as private sector stakeholders and educational institutions have developed strong plans for industry development in the medical devices sector, focused on pursuing clear upgrading strategies. Others in the region have been less active on this front; Guatemala initially pursued a strong strategy for apparel in the 1990s but have not been particularly proactive in the last decade. Nicaragua has focused on transversal goals, but with no industry-specific plans. Collective, collaborative action which brings together multiple stakeholders in each country is required; furthermore, due to

poor economies of scale, increased coordination or, at a minimum, awareness, across the region is also necessary to provide a competitive base versus other emerging large low-cost players globally.

2. **Develop the skills required for upgrading and private sector development:** Economic upgrading in GVCs is highly dependent on skills development; these skills requirements are necessary in all sectors to increase productivity, but they are even more important in higher tech and highly regulated industries, such as medical devices. Formal training for apparel workers may take just a few days, a month in automotive, and up to two months in medical devices; subsequent on the job training takes even longer (see Table 2). A skilled workforce is essential for developing new capabilities, adopting new protocols, and ensuring quality standards, such as zero defects, are met (Gereffi et al., 2011). Countries in the region are beginning to understand the importance of targeted workforce development for GVC participation. For instance, Costa Rica and the Dominican Republic have both launched operator programs in technical schools and courses at the post-graduate level. A systematic approach, nonetheless, could yield even better results: this requires mapping of current skills needs, gap analysis of existing supply base, identification of skills needed for upgrading, and identification of appropriate policies and programs to implement to support that upgrading.

   In the textile and apparel sectors, skills have primarily been acquired through early FDI from US firms investing in the region since the 1990s. As such, the number of foreign workers in the industry is low in all countries as locals have been trained to take over these positions. However, there is not a source for firms or workers to learn new skills that are not the core competencies of these foreign investors-design, flexible production/shorter runs, merchandising, sourcing, etc. The country has a strong pool of engineers, but skills are limited in other areas. A regional textile and apparel training center, degree programs in targeted areas at existing universities, or providing access to international training courses and trainers via online courses or foreign studies would benefit all four countries. More research into the specific needs should be further explored.

3. **Regional supply chain development:** the importance of backward and forward linkages for the success of these industries varies. Trade policy requirements in the textile and apparel industry make regional linkages between textile production and apparel manufacturing essential to Central America's participation, while proximity to suppliers enables speed to market, which is particularly important for fashion-oriented items. From a global perspective, the individual CAFTA-DR countries are insignificant (ranking in the 20s of top global exporters). However, as a region, CAFTA-DR is among the top 10 exporting countries. Given the size of the output of the region, the need for multiple large-scale textile facilities is limited. Rather, expanding the range of fabric inputs provided within the region will enable future product upgrading to products that require a more diverse base of inputs beyond basic knits. A regional marketing effort, particularly to reach new buyers that are accustomed to working with Asian-based suppliers and intermediaries, would benefit all four countries as each one provides a unique offering.

   The situation in the automotive GVC is like apparel; due to the need for high volume production, the potential of an individual Central American country to account for a

sizeable share of the global market is limited. As such, to attract the attention of new lead firms and to expand to new end markets will benefit from a regional approach.

In the medical devices sector, outsourcing is more limited, however, crucial services such as testing laboratories, calibration services and sterilization can help to deepen firm ties. The need for a regional strategy in medical devices is more limited given the lower production volumes needed and concentration of lead firms.

A regional development perspective also extends to transportation infrastructure and logistics. Facilitating and easing access across borders may alleviate the need for investment in large projects in each country (i.e., inter-country road systems over ports and airports).

4. **Develop targeted investment policies at the sectoral level and support existing investors:** While overall investment policy, such as that covered by the region's EPZ policies and numerous trade agreements is a key factor in promoting an adequate business environment, however, targeting specific types of firms in each industry is equally as important as facilitating both intra- and intersectoral upgrading. MNCs differ in their strategies towards global locations with implications for upgrading potential. Furthermore, as highlighted, specific industries contribute to development in different ways; targeting investment in specific-sectors through adjusting eligibility of EPZ laws over time, such as Costa Rica has done is necessary to maintain a dynamic focus on upgrading. Extending EPZ benefits to all sectors makes it difficult to incentivize and reward companies that make significant positive investments in the country such as reducing the number of expats, investing in training, or upgrading equipment. Equal if not more emphasis should be placed on encouraging reinvestment by committed firms as on recruiting new companies. Investment promotion agencies, such as CINDE (CR), CNZFE (DR) and PROESA (El Salvador) play a key role in attracting the right investment and ensuring it stays in the country by providing constant support for investors.

6. Appendix

Table 9. Realistic Expectations from Different GVCs

Industry	What it can provide	Unlikely to lead to	Suggested strategy
Apparel	Formal employment, Female employment Knowledge of production systems, productivity, and other lean manufacturing/industrial engineering (IE) concepts Supervisor and middle management experience (if expat laws enforced) Workforce with knowledge of assembly-line manufacturing Opportunities for domestic firms to engage in subcontracting or non-critical input providers	Functional upgrading Domestic firms selling to foreign markets White collar/salaried jobs Increased demand for university education Experience using advanced machinery or computers Interpersonal/soft business skills Formal apparel retail Knowledge of standard-driven GVCs	Identify a niche market/product category that is less cost competitive Build a small number of domestic brands and firms for domestic/regional market Target investment for key textile inputs Proactively target other export markets/buyers for niche products Provide access to educational opportunities for service-related positions Gradually de-prioritize apparel for investment incentives/increase for more capital-intensive, environmentally friendly investments and companies investing in workforce capabilities
Wire harnesses	Formal employment, Female employment Knowledge of production systems, productivity, and other lean manufacturing/industrial engineering (IE) concepts Knowledge of safety best practice Some experience using automated technologies (e.g. cutting) Workforce with knowledge of assembly-line manufacturing	Functional upgrading, even into procurement due to importance and role of Mexican plants. Domestic firms selling to foreign markets White collar/salaried jobs Increased demand for university-level education	Identify other lead firms with Mexican networks to expand number of firms in country Strengthen regional supply chain links with Mexico for inputs Proactively target other export markets/buyers for niche products Support training programs through financial incentives for technicians
Medical devices	Formal employment Supervisor and middle management experience Technical and professional employment Some experience using automated technologies (e.g. packing) Workforce with knowledge of assembly-line manufacturing	Functional upgrading into the development of new clinical or medical solutions	Identify and target potential investors suited to upgrading goals Support training programs through coordination between private sector and education institutions, scholarships abroad Enhance linkages through development of support services such as laboratory and calibration Identify potential manufacturing-related services to support through global services operations

Table 10. Central America in Manufacturing GVCs: Summary Table

Category	Variable	Apparel (A) & Textiles (T)				Automotive - Wire Harnesses		Medical Devices	
		El Salvador	Guatemala	Honduras	Nicaragua	Honduras	Nicaragua	Costa Rica	Dominican Republic
Entry into GVC	First major exports/investments	1990s (Apparel); 2000s (Textiles)			2000s	1994	2001	1988 (Baxter)	Late 1990s
CAFTA-DR Insertion in GVC	Principal GVC activities	Assembly (Final Product)	Assembly (Final Product)	Fabric & Apparel (Final Product)	Assembly (Final Product)	Assembly of Component/Sub-assembly (Intermediate)	Assembly of Component/Sub-assembly (Intermediate)	Assembly (Final Product)	Assembly (Final Product)
Exports (2015)	Sector Total	US$2.2B (A)	US$1.6B (A)	US$3.4B (A)	US$1.6B (A)	US$0.6B (2016)	US$1.1B (2016)	US$2.5 B (2016)	US$1.1B (2016)
	Growth rate (2005-2015)	26%	-15%	16%	113%	316% 42% (2007-2016)	150% 519% (2007-2016)	292% 160% (2008-16)	87% 75% (2008-2016)
	Share of Country Exports	43%	16%	39%	31%	7% (2016)	11% (2016)	20%	14%
	Dependence on US market; share enter under CAFTA-DR	92%; 77% average	90%; 77% average	84%; 77% average	93%; 77% average	53% (2016); 98%	85% (2016); 98%	72%; 0%	90%; 0%
Firm characteristics	CAFTA-DR Firm Role	OBM branch plant	OEM branch plant	OBM branch plant	OEM & OBM branch plants	OEM branch plant	OEM branch plant	OBM branch plant	OBM branch plant
	Ownership	Foreign (North America)	Foreign (Korea)	Foreign (North America)	Foreign (North America/ Korea)	Foreign (US); Lead Firms	Foreign (100%) (Japan/Mex; Germany); Lead Firms	Foreign (US -61%); Lead Firms	Large, foreign (US - 41%); Lead Firms
	Size	Approx. 2/3 of firms >1,000 employees	Approx. 2/3 of firms >1,000 employees	Approx. 2/3 of firms >1,000 employees	Approx. 2/3 of firms >1,000 employees	Large (>2,000 emp.)	Large (>2,000 emp.)	Large – top 5 > +1,000; top 10 >500 (93% exports, 84% emp.)	Large + Medium (Simple average 700)
	Average number of years in country	+20 years	+20 years	+20 years	+10 years	+10 years	+10 years	+5 years	+5 years
	Other regional branch plant locations/sister plants	Honduras, Dominican Republic	Nicaragua	Dominican Republic, El Salvador, Nicaragua	Guatemala, Honduras	Mexico (Multiple plants); Generally, 1 plant/model, but broad capabilities	Mexico (Multiple plants) Generally 1 plant/model, but broad capabilities	DR, PR, Mexico/sister plants limited, up to max of 20%	CR, PR, Mexico
Import origin and backward linkages	Imports vs local procurement, supplier co-location	Medium – sufficient for existing demand for knit fabrics, but yarn primarily from the US. Nascent woven fabric, but region primarily in knits now.				Low – mostly imported		Low – all imported (Mexico, high; 9% local)	Low – all imported
Product upgrading and diversification	Number of product lines/models	Knit Apparel T-shirts (#1) Long-sleeved shirts (#2) Trousers (#3) No diversification 2005-2015				Slight – Italian luxury models; increased unit value	Slight – European luxury models; increased unit value (Use interviews to complete)	847 products registered (FDA - 2017)	627 products registered (FDA – 2017)
Employment	Total	80,953 (T&A)	77,000 (T&A)	97,880 (T&A)	70,331 (T&A)	13,450	15,600	15,700	21,674*
	Number of expats							very low; 1-2 per firm max	< 2%
Non-manufacturing activities	Degree of functional upgrading in the country	No functional upgrading- Assembly only				Functional upgrading into sourcing and design limited to one company	No functional upgrading, component manufacturing and assembly only	Materials procurement; Process improvement; Sustaining engineering; Packaging, Labeling, Sterilization, Distribution	Materials procurement, Process improvement; Sustaining Engineering, Labeling, Packaging

Table 11. Significant Manufacturers and Buyers by Country and GVC

Country	Apparel Manufacturers (Foreign)	Apparel Manufacturers (Domestic)	Apparel Buyers	Wire Harness Manufacturers	Wire Harness Buyers	Medical Devices
Honduras	Hanesbrands, Fruit of the Loom, Gildan	Elcatex, Grupo Karim, Kattan	Hanesbrands, Fruit of the Loom, Gildan	Lear Corporation KyungshunLear Empire Electronics Delphi	Ford, Chrysler, General Motors, Hyundai, Kia	--
El Salvador	Hanesbrands, Fruit	Intradeco, ICAT, Industries Merlet	Hanesbrands, Fruit, REI, Nike, Adidas, Lululemon, Gap, Under Armour, Walmart, North Face, Lacoste	--	--	--
Guatemala	Sae-A, Samsol, IndyKnit, Hansoll, Hansae, Shinwon, Denimatrix	Liztex, Textisur	Gap, Walmart, Target, JCP, VF, Abercrombie, PVH, Macy's	--	--	--
Nicaragua	Gildan, Sae-A, Hansoll, Hansae, Shinsung, Gatornica, Rocedes, China United, Kentex, New Holland, VF	--	Walmart, Target, Gap, JCP	Arnecom de Nicaragua (Yazaki) Draexlmaier	Ford, General Motors, Chrysler BMW, VW, Tesla	--
Costa Rica	--	--	--	--	--	Baxter Boston Scientific Hospira St. Jude Medical
Dominican Republic	--	--	--	--	--	B.Braun Baxter, BD Convatec Edward Lifesciences Fenwal Medtronic

Source: Authors

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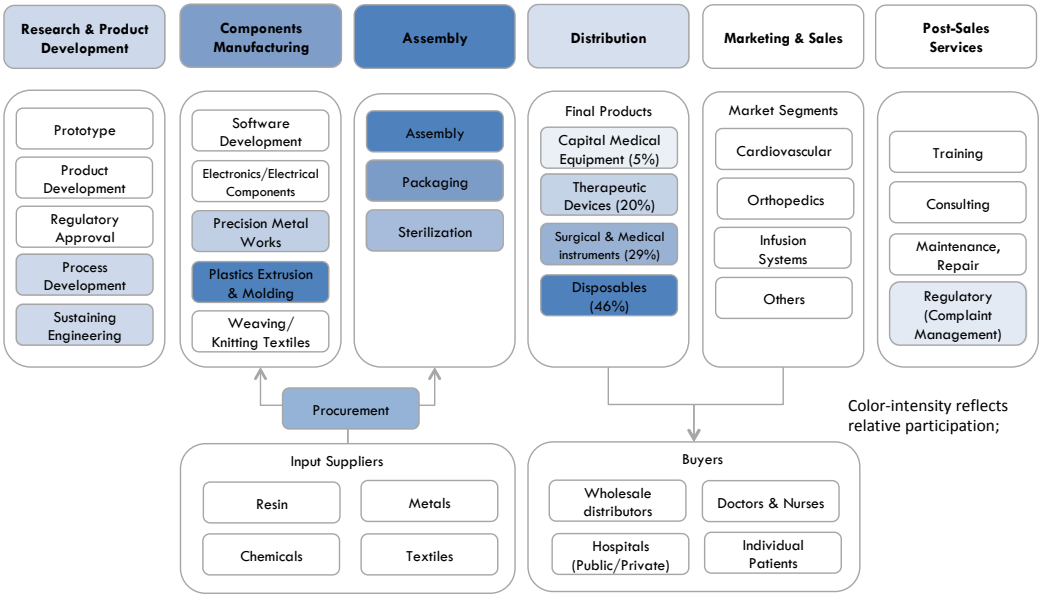
Table 12. General Economic Indicators 2015, CAFTA-DR and Mexico

	Costa Rica	Dominican Republic	El Salvador	Guatemala	Honduras	Nicaragua	Mexico
GDP per Capita (Current US$)	11,825	6,722	4,224	4,147	2,361	2,151	8,201
Population (million)	4.86	10.65	6.34	16.58	9.11	6.15	127.54
Labor Force (million)	2.34	4.89	2.88	6.58	4.06	2.79	57.88
Exports (Current US$ Billion)	18.16	18.02	6.66	13.43	9.19	5.16	399.13
Exports (% of GDP)	32	25	24	20	43	39	38
Development Level (Developing Country)	Middle-income	Middle-income	Middle-income	Middle-income	Middle-income	Low-income	High income

Source: World Bank (2017)

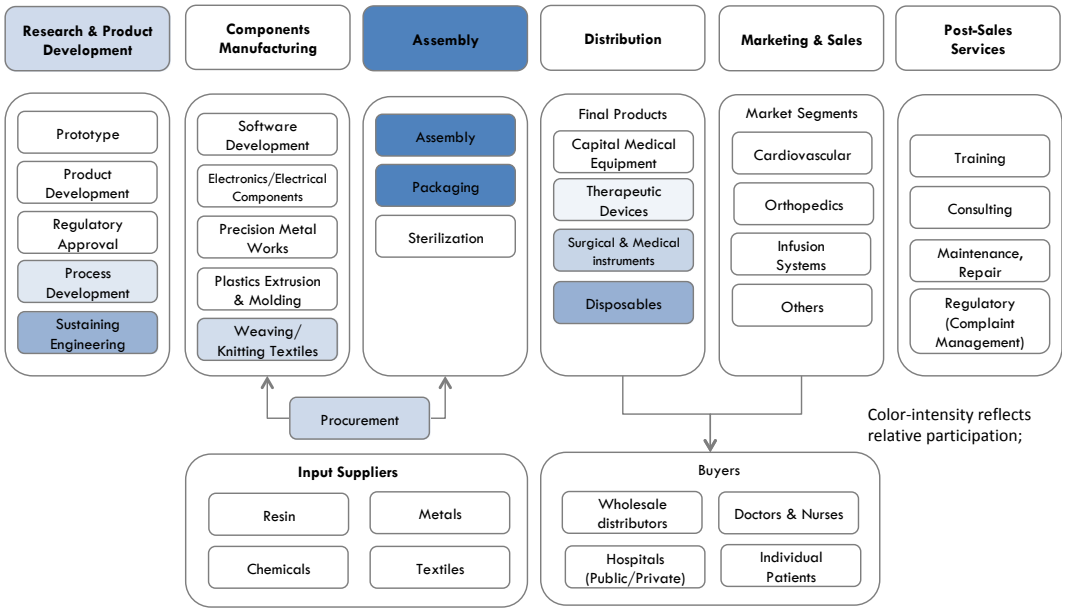
Figure 7. Costa Rica in the Medical Devices GVC



Source: Authors

Notes: Color-intensity reflects the relative participation of firms in the sector in different stages of the chain.

Figure 8. Dominican Republic in the Medical Devices GVC



Source: Authors

Notes: Color-intensity reflects the relative participation of firms in the sector in different stages of the chain.

Table 13. Benefits of Investing in Export Processing Zones in Central America - DR

Benefit	Costa Rica [a]	Dominican Republic [b]	El Salvador [c]	Guatemala [d]	Honduras [e]	Nicaragua [f]
Corporate Tax Rate; Time	0% for 8 years; 8-year extension for significant investment; next 4 years - 50% of income taxed at 6-15% (based on firm size)	0% for 15-20 year; 20 years for Haitian border region	0% for 15 years: if in San Salvador metropolitan area; 20 years in all other areas. Partial exemptions	0%; 10 years (also on Solidarity Tax, Guatemala's alternative minimum tax)	Exempt	0% for 10 years, 1 extension
Municipal, Local & Property Tax	Exempt	Exempt	Exempt (municipal taxes on assets and property)			Exempt
Export Tax	Exempt	Exempt		Exempt	Exempt	Exempt
Import Tax on machinery, raw material and inputs	Exempt	Exempt	Exempt	Exempt (up to 2 years for inputs)	Exempt	Exempt
Repatriation of Profit	100%	100%	100%	100%	100%	100%
Foreign Ownership	100%; National Treatment	100%; National Treatment	100%; National Treatment	100%; National Treatment	100%: National Treatment	100%; National Treatment
Sales Tax	Exempt	Exempt		Exempt	Exempt	Exempt
Strategic Sectors	Life Sciences, Advanced Manufacturing, Global Services	Apparel and Textile, Medical Devices, Tobacco, Global Services	Qualifying firms located in the foreign trade zones and bonded areas	Apparel and Textile, Global Services (Call Centers, BPO)	Apparel, Light Industry, Global Services (Call Centers)	Apparel, Light Industry, Call Centers, Medical Devices

Source: Authors based on [a] www.cinde.org; [b] CNZFE; [c] USCS El Salvador Guide 2016; [d] USCS Guatemala Guide 2016 ; [e] www.investinhonduras.hn; [f] www.pronicaragua.com