



CABEI

Central American
Bank for
Economic
Integration

**DEVELOPING THE
POTENTIAL OF VALUE
CHAINS IN CENTRAL
AMERICA
SUMMARY REPORT**

DEVELOPING THE POTENTIAL OF VALUE CHAINS IN CENTRAL AMERICA SUMMARY REPORT

Central American Bank for Economic Integration
Office of the Chief Economist
TEGUCIGALPA, HONDURAS
WWW.BCIE.ORG

The study "**Developing the potential of value chains in Central America**" identifies and analyzes the value chains with the greatest potential to generate investment, greater added value and formal employment. In addition, it analyzes the main conditions that would lead to a greater linkage of the companies of each country to the Global Value Chains, that is, the conditions that each country should guarantee to facilitate this process, as well as the coordinated actions at the regional level for the integration of the chains.

This Report has been prepared under the leadership of **Dr. Florencia Castro-Leal**, Chief Economist of CABEI, the research and writing was in charge of **Dr. Hugo Maúl**, consultant, in coordination with **Rodrigo Méndez Maddaleno**, Economist.

The content of this publication is the responsibility of its authors and does not reflect the official position of the Central American Bank for Economic Integration.

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1. INTRODUCTION

1. CABEI's mission for the balanced and equitable development of Central American societies recognizes that the integration of these economies into global trade is an essential requirement to promote development.

The Central American region¹ faces a broad work agenda to achieve significant increases in its productivity levels, capacity to generate formal employment, promote higher levels of innovation and research and development. Important challenges that seriously limit the possibilities of economic growth and improvement in living standards in the countries of the region. CABEI plays a crucial role in this matter by supporting regional production integration and transformation; Given the importance of exports for the countries of the region, it is necessary to identify new ways to enhance the existing competitive advantages and advance in the sophistication of the exportable offer. In this context, the successful insertion of the region's productive sectors in the Global Value Chains represents an important opportunity to promote sustainable and inclusive economic growth in the region.

2. This report analyzes the main conditioning factors that would promote a greater linkage of the companies of each country to the Global Value Chains, that is, the conditions that each country should guarantee to facilitate this process, as well as the coordinated actions at the regional level for the integration of the chains.

The specific cases that are analyzed correspond to products and / or productive sectors that have already been linked to important Global Value Chains but that, due to the weaknesses in the national enabling conditions and in the regional articulating axes, do not yet develop their maximum potential. In terms of job creation, investment attraction, innovation and regional linkage. Although this report does not focus on a prospective analysis, it is recognized that a pending challenge is the discovery of new products and / or productive sectors that could be successfully inserted in Global Value Chains that do not yet have a presence in the region.

3. This report systematizes a broad consultation process with direct and indirect actors within the value chains.

In this process, a wide variety of secondary sources were consulted on the main Global Value Chains in the region; productive sectors that participate directly and indirectly in the economic activities of these chains; public policies related to the promotion of exports, employment, investment and innovation within the chains; restrictions and opportunities for growth in the countries of the region; commitments, requirements and international agreements that govern the operation of the chains; and characterization of productive activities and support services within the chains. Likewise, primary sources of statistical information related to exports of goods and services were also consulted; imports of productive inputs from the main chains; production, investment and employment; and economic complexity of the economies of the region. The information obtained from documentary sources was complemented with

the appraisals of a wide range of experts in the region in matters of trade promotion and investment; national and regional union activities; public officials; export entrepreneurs in key sectors; and consultants specializing in logistics, infrastructure and economic development issues. The development of selected chains in other regions of the globe was also analyzed to better understand the opportunities and constraints that they could face in the region.

4. Central American economies are characterized for being small, open and dependent economies.

Central American economies are characterized by their small size in world trade and by their degree of openness to international trade, constituting classic cases of what the literature calls small dependent economies, price takers in international markets. At the regional level, the degree of total openness, measured by the ratio of total trade (imports plus exports) to GDP, is 69%; intraregional trade represents nearly 25% of the region's GDP. On the other hand, the region's consolidated exports in 2018 do not even reach 0.5% of the world trade volume.

5. Exports are concentrated in the U.S. market.

Another common element in the region is the importance of the U.S. market, which, on average, accounts for about 40% of all regional exports; an additional 23% are intended for the Central American region itself (BCIE, 2020). At the aggregate level, as shown in the Graph, Central American exports continue to be predominantly of agricultural origin (29% of the total) and services (31% of the total); the sectors that contribute the remaining 40% are characterized by being of a manufacturing nature and/or belonging to Global Value Chains (GVCs).

6. Incipient diversification of the agricultural export basket.

The region continues to depend on traditional export products such as coffee, bananas, sugar and its by-products, palm oil, beef and dairy products. However, exports of "non-traditional" agricultural products, which include other fruits (pineapple, melon, papaya and avocados, for example), legumes, vegetables and other vegetable products are already showing an incipient degree of importance in the region: in Costa Rica this type of exports represents 7.5% of its total exports (especially in the case of pineapple, for which this country has become the main supplier of the U.S. market); in Guatemala they represent 6.6% of total exports (especially exports of vegetables, vegetables and fruits); in Honduras 3.4% (highlighting the export of fruits); in Nicaragua and El Salvador the contributions are minimal (0.48% and 0.22% respectively).

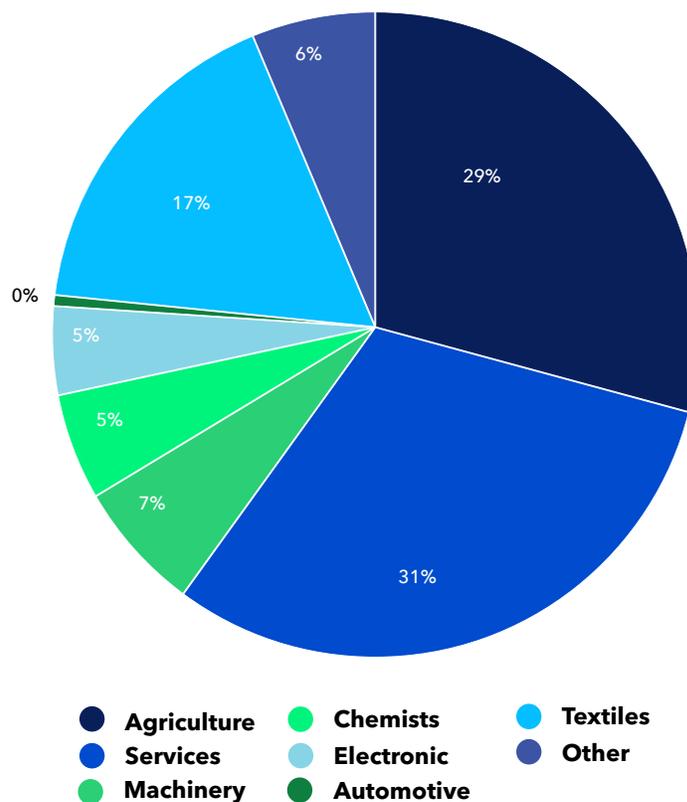
¹Central America or the región refers to CABEI's regional founding member: Guatemala, El Salvador, Honduras, Nicaragua and Costa Rica.

7. Unequal progress in exports economic complexity among countries. Although, in average, the economic complexity of region's exports show certain progress, there are important differences among the countries as, shown in the next **graph 2.2** In relation to the rest of the world, except for Costa Rica, the rest of the countries show a decline or stagnation in the world ranking of economic complexity of exports; between 1998 and 2018, Guatemala fell 19 places; Nicaragua (with respect to 2004) 17; Honduras 14; El Salvador 9; and Costa Rica improved 4 places.

8. Manufacturing exports are concentrated in goods of low or medium economic complexity. The main category of low complexity goods in the region is apparel and textile exports, with Honduras and El Salvador accounting for nearly two thirds of total exports, and Guatemala and Nicaragua for the remaining third. In terms of medium or highly complex manufactured goods, Costa Rica stands out in the export of machinery and electrical products and appliances; of the total exported by the region, Costa Rica contributes 83% of the machinery category (primarily exports of medical devices) and the rest of the countries with 17% (with a wide variety of other types of devices); and 48% of exports of electrical products and appliances.

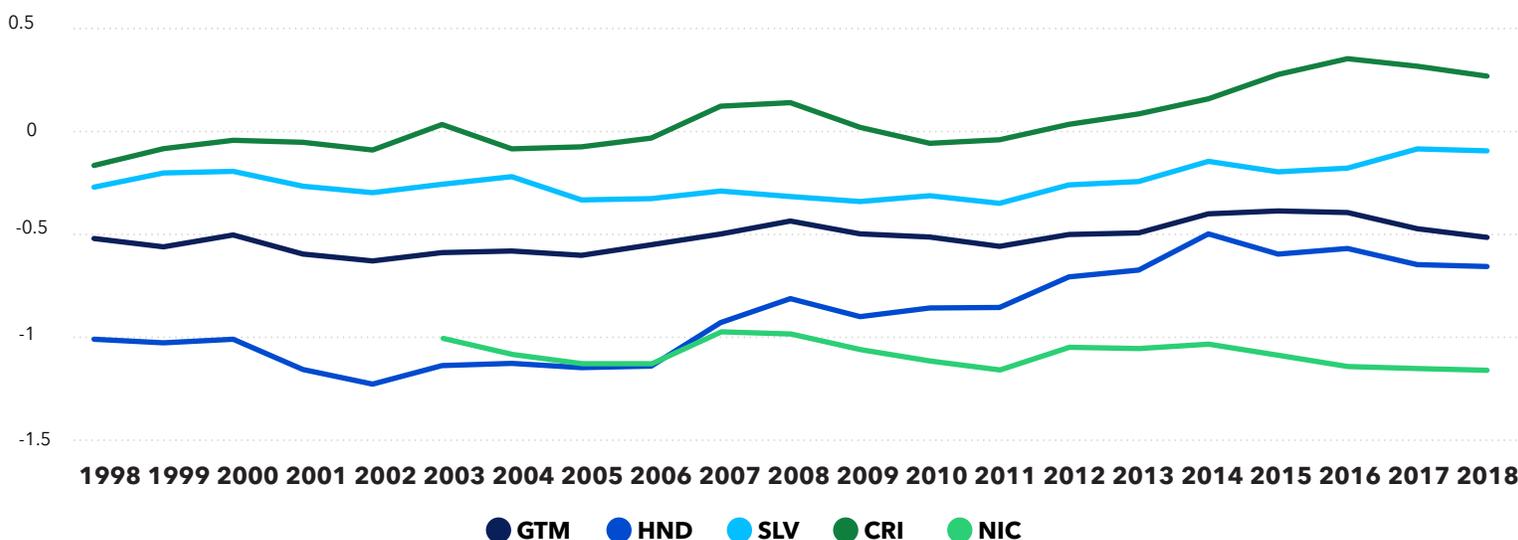
9. Global value chains play an important role in the region. Trade liberalization in the region, coupled with the globalization of the world economy, led several leading companies to take advantage of the proximity to the U.S. market, existing tariff preferences and market quotas, and the relatively low cost of labor to relocate part of their operations to the region. Proof of this is the role apparel and textiles, medical devices, electrical products and appliances, play today among other chains, in the region's exports.³

Graph 1 Structure of Central American Exports 2018



Source: Own elaboration based on AEC information.

Graph 2 Economic Complexity Index -ECI- of Exports



Source: Prepared with information from the AEC.

²Economic complexity is a measure of the productive know-how within a country, reflected in terms of the diversity of its exports and the number of countries capable of producing the same type of goods. The more diverse, interconnected and unique this productive knowledge is, the more diverse, sophisticated and complex a country's productive matrix will be.

³Global Value Chain is the entire range of activities necessary to take a product or service from its initial conceptualization to its final state, as well as the way in which these activities are distributed and organized geographically across the borders of many countries.

2. ASSESSMENT OF THE POTENTIAL OF THE CHAINS ACCORDING TO THEIR DEVELOPMENT CONTRIBUTION IN THE REGION

10. Global value chains have a high potential to generate employment, promote investment, and foster higher levels of research, development and innovation. Following the methodology suggested by the World Bank (Hallwald-Driemeier, 2018), nine mayor export product categories were assessed in terms of their capacity to absorb low-skilled workers; contribution to total employment in the country; average worker productivity; share in the regional exports; and scope for innovation and technology diffusion.⁴

11. Distinguishing the development potential of each product category shows significant diversity. Table 1 shows the result of this assessment process, distinguishing the development potential of each product category according to the above-mentioned criteria. In addition, to evaluate the intraregional or extra-regional nature of exports of these product categories, the proportion of exports (X) and imports (M) destined for or originating in the Central American region was analyzed. The potential of each of the World Bank categories was evaluated according to three criteria: High, Medium and Low (denoting them by the colors green, yellow and red, respectively); as for the regional nature of exports, red is used to denote an intra-regional vocation and green for an extra-regional vocation.⁵

Table 2 Five successful value chains in Central America

Chain	Product Category	Country	Chain Length Index ⁶
Agricultural products	Live animals; products animal (e.g. beef); vegetables products (vegetables and fruits, e.g. pineapple); fats and oils (animal or vegetable); processed foods	Guatemala (fruit and vegetables), Costa Rica (pineapple) Honduras and Nicaragua (beef)	1.9
Textiles and footwear	Textiles (e.g. synthetic); products made with textiles (e.g. sports clothing); footwear	El Salvador	2.6
Machinery and electronic products	Machinery and mechanical products; electrical equipment; audio equipment; tvs	Costa Rica	2.5
Medical devices	Optical devices, photographic, measuring, precision, medical and surgical devices; clocks; audio equipment and accessories	Costa Rica	2.5
Call centers	Service exports	Guatemala	1.5

Source: Own elaboration and (OECD, 2021)

Table 1 Pro-Development Potential of Selected Product Categories

Product category	Intraregional trade 2018		Absorption workers low training	% Of total employment	Product average labor	Participation regional exports	Potential innovation and technology diffusion
	X	M					
Live animals, animal products and vegetable products, animal or vegetable fats and oils, prepared foods	5	27	HIGH	HIGH	LOW	HIGH	MEDIUM
Chemicals and related industries Products	63	21	MEDIUM	LOW	HIGH	MEDIUM	HIGH
Paper or cardboard and products of wood pulp or cellulose	61	30	MEDIUM	LOW	MEDIUM	MEDIUM	LOW
Textiles and articles made from textiles and footwear	18	16	HIGH	HIGH	LOW	HIGH	MEDIUM
Plastic or rubber products	50	21	HIGH	LOW	MEDIUM	MEDIUM	MEDIUM
Articles made of stone, cement and similar materials; ceramic products; glass and glass products	59	24	HIGH	LOW	MEDIUM	HIGH	MEDIUM
Base metals and base metal products	40	17	LOW	LOW	MEDIUM	HIGH	HIGH
Machinery and mechanical products; electric equipment; stereos; TV's	7	7	MEDIUM	LOW	HIGH	HIGH	HIGH
Optical, photographic, measuring, precision, medical and surgical devices; watches, musical equipment, and accessories.	10	9	MEDIUM	LOW	HIGH	HIGH	HIGH

Source: Prepared based on Hallwald (Hallwald-Driemeier, 2018) and ECLAC (CEPAL, 2021, pág. 91)

⁴By the design of the investigation it was decided to exclude from the analysis traditional export products (of agricultural origin, metallic mining and oil).

⁵ECLAC (2021) defines intraregional vocation when the weight of intraregional exports of the product is greater than the weight of intraregional exports, in the case of Central America higher than 23.8% of total exports. Extra-regional vocation is when intra-regional exports of a product are less than 23.8% in the Central American case.

⁶This value refers to the number of productive links (stages) in a chain; the higher the value, the longer the chain under consideration.

12. The contribution of the chains to the development of the economy differs according to the nature of their products.

Agricultural exports (natural resource-intensive) and clothing and textile exports (labor-intensive) have a high potential in terms of the employability of people with low levels of education and training, and the exploitation of the region's natural advantages. The contribution of exports of medical devices and electrical products and appliances (global innovative sectors) lies in their potential to promote product development and innovation.

13. There are five successful value chains that display significant development potential for the region's development.

It is important to recognize that the chains considered produce a very wide diversity of products that share similar characteristics in terms of production processes, constraints, incentives and support services. Within this wide range of products, as shown in **table 2**, certain families of products that already occupy an important position in the value chains operating in the region were chosen.

14. The greatest potential for employment generation is found in chains intensive in the use of low-skilled labor.

As expected, the most important export sectors for the region, which are labor-intensive production activities (lower levels of capital per worker), have the greatest potential to generate employment, as shown in **table 3**. According to these estimates, during 2018 these chains would have generated 803,645 direct jobs: The Fruits and Vegetables chain would have contributed 79% of the total, Apparel and Textiles with 16%, Medical Devices with 4% and Machinery and Electrical Products with 1%.

15. Investment per worker is directly related to the level of product sophistication.

The level of investment required will depend on the relative importance of each chain in total exports. The following table shows the levels of additional investment, estimated based on imputed employment for each category and the factor intensity coefficients (capital/labor ratio), according to different scenarios of employment generation (**see table 4**).⁷

16. Export of products from agricultural origin requires more sophisticated production methods to increase productivity.

One of the main challenges in this area is to increase the levels of capitalization in the fruit and vegetable export chains, so that this type of production processes become increasingly sophisticated (precision agriculture type). In order to reach much higher productivity levels than the current ones, thus benefiting all the factors involved in the production process.

3. OPPORTUNITIES AND CONSTRAINTS OF SUCCESSFUL CHAINS IN THE REGION

17. Constraints observed and opportunities identified for the selected chains are indicative of effective lines of action

Table 3 Factor use intensity, imputed employment, and exports 2018

Product family	Exports (in Million USD)						Jobs per USD Billion Exports	Total imputed employment (persons)
	GTM	SLV	HND	NIC	CRI	Region		
Vegetables and fruits	2.20	0.02	0.64	0.19	3.24	6.30	101,402	637,121
Apparel and textiles	1.90	2.90	3.70	1.80	0.19	10.5	11,978	125,279
Medical devices	0.01	0.06	0.00	0.01	1.80	1.90	18,346	34,443
Electrical products and appliances	0.01	0.43	0.64	0.55	1.00	2.70	2,556	6,803

Source: Own preparation according to methodologic guidelines of Dolabella, 2019 and WTO, 2019, págs. 45-82.

Table 4 Additional investment needed to increase regional employment 2018

Cadena	Ratio Capital/Worker (USD x Employment)	Regional employment	Additional Investment (millions of USD) necessary to increase regional employment	
			By 33%	By 66%
Vegetables and Fruits	10,364	637,121	2,201	4,398
Apparel *	12,894	125,279	668	1,336
Textiles	29,780			
Medical devices	18,488	34,443	212	424
Electrical machinery and products	19,400	6,803	44	88

Note: It was calculated using a capital x worker ratio weighted by the proportion of employees in apparel (81.5%) and textiles (19.5%) in Guatemala in 2018.

Source: Own preparation.

and of greater impact to leverage their development.

Despite there being substantial differences between the chains characterized in this Report, they all share common characteristics, regardless of the product family and country in question. The main characteristics of the Global Value Chains to which the identified product families belong are summarized in **Table 5**.

3.1. Value chain characterization by their comparative advantages

18. Main activities carried out by the chains are of a productive nature.

The main processes carried out by the chains in the region are product assembly, preparation and processing. Very little is done in the region in terms of production of primary industrial inputs for local production and in terms of product design, development and innovation, as well as direct marketing of products.

⁷It should be noted that the additional investment levels in this table only refer to investments in physical capital directly used in the production process; other types of investments necessary to start up a business, not directly related to the primary production process, are not considered in these calculations. In the case of vegetables and fruits a capital/labor coefficient is used, which reflects the need of increasing the current capitalization in the production of these crops.

Table 5 Opportunities and constraints of successful value chains

Chain	Description	Restrictions	Opportunities
Vegetables and Fruits (Guatemala)	Export of "non-traditional" vegetables with a low level of processing (packaged and frozen)	Agricultural practices that are not very productive	Promote precision agriculture to increase productivity
		Low-quality road infrastructure and insufficient coverage	More investments in road infrastructure
		Limited information on market conditions	Improve market information systems
Pineapple (Costa Rica)	Export of fresh or minimally processed (frozen) pineapple.	Customs systems and sanitary regulations	Increase financial support to improve cultivation methods
Synthetic fiber clothing (El Salvador)	Manufacture of accessories and sportswear.	Insufficient storage and processing infrastructure	Modernization of customs and logistical systems
		High and unstable electricity prices	Increase availability and improve electricity prices
		Delays and inefficiency in customs services	Speed of response to market and regional integration
Electrical products and appliances (Costa Rica)	Assembly and production of electrical products and appliances	LACK of cooperation among members of the chain Strengthen relations among chain actors	Strengthen relations among chain actors to promote R&D
		Insufficient investment in R&D	More investment in R&D
		Weakness in linkage channels between academia and industry	Improve the functioning of the R&D&I ecosystem to move into more sophisticated products
Medical devices (Costa Rica)	Manufacture of Class I medical devices (of lower value and sophistication) and, to a lesser extent, manufacture of more sophisticated devices	Insufficient investment in R&D	Financial support for R&D&I
		Intellectual property protection system limits opportunities	Strengthening of the legal framework for intellectual property protection
		Workforce poorly trained in English language	Expand functional English language instruction for this sector
Call Centers (Guatemala)	Inbound call centers, focused on technical support, sales, and quality control activities.		

Source: Own elaboration

19. Most products are produced under the Original Product Manufacturing model. The great challenge for the region in industrial chains is to evolve from the OEM (Original Equipment Manufacturing) model. Where products are manufactured following technical guidelines from the leading companies in the chain, to the ODM (Original Design Manufacturing) model, where design and research, development and innovation would be carried out within the region.

20. Most production processes are labor-intensive. In general, the region specializes in labor- and natural resource-intensive activities, whose competitive potential depends on low production costs (especially low-skilled labor).

21. There is some progress in product sophistication. In the case of Medical Devices, Electrical Products and Appliances, and Apparel and Textiles, there is a gradual evolution towards more sophisticated goods and domestic value added. Although most of the research, development and innovation necessary for this evolution is carried out outside the region.

22. The proximity to the U.S. market is not exploited to its full potential. It is important to recognize that geographic proximity does not in itself represent a competitive advantage if it does not translate into speed to market. The process of "nearshoring" of global production, which, in principle, should favor the region,

cannot be capitalized to its full potential if this type of response cannot be guaranteed.

23. Logistics of finished product distribution and input supply are key value chain development. The region's competitiveness ultimately depends on being able to guarantee the safety, reliability and speed of transportation in and outside the region, as well as the speed, predictability and efficiency of customs and port procedures and related processes.

3.2. Governance Mechanisms

24. Most chains are led by large trading companies. The most common governance scheme in the region is "buyer driven", where the buyer is the company that establishes the technical, quality and price parameters governing manufacturing processes in the region. These companies specialize in everything related to the marketing and sale of the products produced in the region, as well as controlling the stages of product design, development and innovation. In the case of medical devices, the leading role is played by large global manufacturers.

3.3. Stakeholders involve

25. The most important government actors are those involved in trade facilitation. Government main actors involved in the operation of the chains are: (i) the agencies in charge of promoting competitiveness; (ii) attracting investment; (iii) ministries in charge of negotiating and administering trade agreements; (iv) tax administration; (v) ministries in charge of labor; (vi) ministries in charge of economic development; (vii) ministries in charge of sanitary, phytosanitary, and environmental issues; (viii) research, development, and innovation systems; and, (ix) training centers.

26. Private institutional actors are important for regional coordination. Regarding the institutional actors of the private sector, the following stand out: (i) business associations at the sector level; (ii) export associations; and (iii) regional federations of business associations; and, (iv) other regional bodies that carry out important tasks of coordination and defense of the interests of the sectors. Also, promote the adoption of better production practices, coordinate the representation of the sectors before international cooperation actors, and promote the exchange of information between countries.

3.4. Restrictions for the value chains

27. The restrictions on the operation of these chains vary in type and severity, as shown in Table 5 and explained below.

28. Limited financing opportunities under preferential conditions prevail, as well as lack of knowledge about production challenges on behalf of financial institutions. All chains need to modernize their plant and equipment; acquire and adapt new technologies; and invest more in research and development. The limited availability of financing mechanisms on preferential terms limits the chains possibilities and the capacity for growth, consolidation and sophistication. Financial institutions lack of knowledge about the particularities of production, product cycles and other challenges faced by each of these chains makes the situation even more difficult.

29. Prevalence of low education levels and poor training of workers. One aspect of specific concern to respond to the challenge of product and process sophistication faced by all the chains is to raise the level of education and training of their workforces. The use of increasingly sophisticated technologies, more demanding levels of compliance with different standards by leading companies and the need to raise productivity levels will require more and more adequately trained and educated workers.

30. Limited research, development and innovation capabilities. Although there are significant divergences between each chain, in their own way, each of them suffers from weaknesses in the channels of linkage between academia and industry in terms of basic research. And the misalignment between the objectives of science and technology and innovation systems and the specific needs of the chains.

31. The need to ensure world-class certification processes. A constant of all the chains is the existing supply of laboratories and certifying agencies specializing in quality control, environmental, sanitary, phytosanitary, food safety, and other requirements. There is also a need to professionalize this type of support services to the maximum so that they can effectively comply with and certify the requirements and standards demanded in the destination markets.

32. Inadequate and insufficient productive infrastructure. All chains are affected, in one way or another, by poor conditions and insufficient land, port, airport and customs transportation infrastructure; likewise, there is also a lack of infrastructure designed with regional integration in mind, so that preference is given to means of transportation that allow greater volumes to be moved in less time (railroads) or that allow productive clusters to be integrated more effectively and efficiently.

33. Difficulties in the regional integration of the chains. The dispersion of regulations, requirements and procedures for the same family of products throughout the region unnecessarily raises the costs of intra-regional trade and limits the possibilities of reliable and effective integration of chain operations in the region.

34. Incomplete and outdated information hinders chain operations. The lack of timely and up-to-date sources of information on production, regulatory, infrastructure and market issues not only limit the proper planning of chain development at the regional level, but also complicates the cross-border operations of companies in the region.

3.5. Improvement opportunities

35. Opportunities for improvement range from very general issues, such as planning the development of chains at the regional level, to very specific problems like the sophistication of products produced in the region.

36. Raise exports economic complexity. The sophistication of exports in these chains requires actions directed upstream (increasing the sophistication of production processes, supply of inputs and support activities of the chains) and downstream (increasing the sophistication of the products) and moving towards commercialization in destination markets.

37. Expand the chains' own product design capabilities. Migrating from the OEM model to the MDG model requires acquiring and developing the skills that are currently being supplied by the leading companies in the chains in terms of product research, development and innovation. This requires coordinated action between companies, academia and specialized public-sector agencies in these areas to develop locally the technical and professional capabilities needed to design new products that will be accepted by the leading firms in the chains.

38. Venture into the marketing of products in the target markets. In order to move downstream in the chains, it is necessary to move in the direction of direct participation in the marketing of

products and develop their own brands. For this purpose, the region needs to improve its distribution logistics and have the real capacity to respond quickly and reliably to market needs. This implies improving its capacity to comply in a timely and strict manner with international performance and quality standards demanded by the destination markets, as well as the capacity to manage distribution logistics to serve those markets effectively.

39. The need to harmonize regulations at the regional level.

The need to guarantee the response times response to markets, reliability and regional integration in the supply chain and strict compliance with international standards requires the governments of the region to develop homogeneous regulations and standards to facilitate the movement of factors, intermediate inputs and finished products in the region, and to improve the effectiveness and assertiveness of the government agencies involved in all the processes involved in the operation of these chains.

40. Improve the coordination and effectiveness of regional trade associations.

The similarities and complementarities that exist at the regional level should be used to support the transfer of knowledge and technologies, set common goals, promote chains, harmonize incentives, plan infrastructure works and any other element that ensures regional integration of the chains. This requires strengthening the functioning of regional trade associations in order to take advantage of common opportunities for all and improve their capacity to react to common threats.

4. LINES OF ACTION FOR STRENGTHENING THE CHAINS

41. Strengthening existing chains in Central America requires actions both at the country level, known as enabling conditions, as well as at the regional level known as articulating axes.

To achieve existing value chains success in the medium term, the countries of the region need to increase and make more flexible their capacity to adapt to changes in consumption and production patterns. Therefore, it is key to prioritize actions that increase and make the chains' capacities more flexible to contribute to development, at the country and regional levels.

42. Enabling conditions are all those actions in the normative and regulatory field as well as key investments necessary to promote the development of the chains within each country.

It is necessary to modify normative and regulatory frameworks, make strategic investments in infrastructure, guarantee adequate response speeds of the chains to market needs, ensure the reliable and predictable supply of inputs, facilitate investment in research, development and innovation, as well as improve human resource training.

43. Articulating axes are all those actions, direct and indirect, public and private, that promote a greater and more effective regional integration of the chains.

Planning the value chains development at the regional level is essential to take advantage of regional integration opportunities in research and

development matters, improve production processes, integrate supply chains, and develop common regional infrastructure. Although it is indicative in nature, the prioritization of lines of action at the regional level makes it possible to identify the roles to be played by the different institutional actors involved in the operation of the chains; future needs for transport, port, airport and customs infrastructure; financing needs; as well as designing regional development policies.

4.1 Enabling Conditions at the country level

44. Improve human resource education and training. Without exception, in all the cases studied, a more educated and better trained labor force is required for the chains to operate properly. Given the growing demands in terms of compliance with different types of international standards, the need to adopt more advanced technologies and improve product sophistication, all the chains increasingly need better-trained workers. To this end, academia and industry should work together to design educational and training programs specific to the needs of the chains.

45. Predictability in the evolution of labor costs. It is critical that the constant pressures to comply with labor regulations respect, in salary matters, a minimum wage congruence between minimum wage levels and labor productivity.

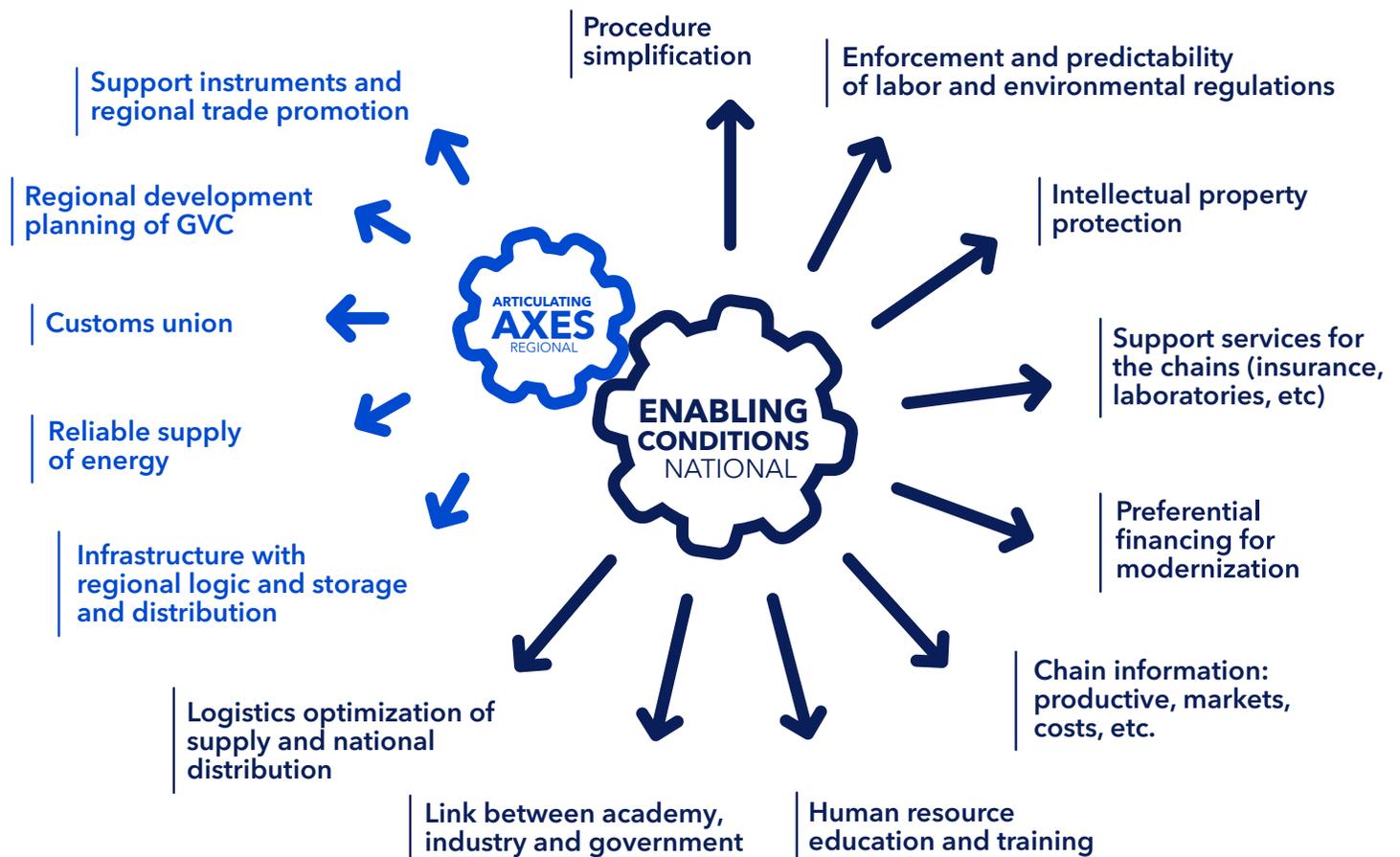
46. Access to financing on preferential terms to modernize the chains. Three major needs were identified: renewal of machinery and equipment, acquisition of new technologies (process automation in the apparel and textile chain, and precision agriculture in the fruit and vegetable chain, for example), and research and development of new products and production processes.

47. Progress in streamlining and digitalizing the procedures. All procedures related to the operation of companies within these chains and to the transportation and dispatch of their products should be carried out at "one-stop-windows" through electronic platforms. Projects such as the Central American Digital Trade Platform, an effort led by the IDB, the European Union and SIECA, is an important step in this direction. It is also important to advance in the standardization of norms and regulations at the regional level.

48. Improvement in the protection of intellectual property. In the absence of adequate legislation in this area, it is very difficult for companies in the region to venture into the design and development of new products and/or production processes; the impossibility of adequately protecting their inventions or innovations is a need that grows as products and production processes become more sophisticated and with greater value added.

49. Land transportation infrastructure that facilitates the connection between producing regions and shipping points for finished products. Investment in this type of infrastructure should favor the movement of goods to ports of shipment (disembarking) of finished products (intermediate inputs),

Figure 1 Articulating axes and enabling conditions



Source: Own elaboration

as well as the connection between the areas producing raw materials (products) and the places where they are transformed (packaged) for export. Priority should be given to the movement of goods to ports of shipment (disembarkation) of finished products (intermediate inputs), as well as the connection between the areas producing raw materials (products) and the places where they are transformed (packaged) for export. In the case of the vegetable products (vegetables, vegetables and fruits) it is important to improve the conditions of many of the roads that connect the producing regions in the rural area with the collection centers, packing plants, freezers and transformation plants.

50. National optimization of distribution and supply logistics for perishable products. At the national level, the main need is to improve and/or expand the existing infrastructure for product storage, when the production is in the hands of small independent producers scattered throughout the country (a particularly important problem for agricultural products that are exported fresh, frozen or with some type of processing, where quality control is of the utmost importance). Increased product storage capacity would entail the need to expand and/or build the capacity of existing processing plants (packing plants) and their refrigeration/freezing capacities. In addition, there is a need

to invest in modernizing existing transportation fleets to ensure that they meet the minimum requirements for safe transport without compromising the quality and safety of the products.

51. Promoting precision agriculture. The transition from traditional farming methods to precision agriculture is one of the main challenges for agricultural commodity chains. This transition would enable export agriculture of selected products to obtain higher yields per hectare, higher income for producers, greater variety of products, higher value products and better control of the different standards and requirements demanded by the products' destination markets.

52. Public-private partnerships to promote the dissemination and adoption of better production methods. To make sure that the best and most modern technologies reach most producers, public-private efforts are required, in which the government provides financing for this type of investment and an effective advisory system, and the leading companies constantly monitor the adoption of the best production methods among their suppliers.

53. Predictability of environmental incentives and restrictions.

As important and urgent as the environmental sustainability of production processes in value chains is, it is necessary to seek an appropriate balance between environmental protection and the development of these chains. Above all, the possibility of arbitrary management must be reduced to a minimum.

54. Improve the link between academia and industry. In addition to the need for human resource training and basic and applied research, academia needs to work on specific lines of research focused on specific needs of the value chains. This requires the financial support and collaboration of the companies themselves and the public sector, given the public good characteristics of this type of activity.

55. Availability of laboratories and certification agencies. The governance of the chains and access to destination markets depends on effective and timely compliance with strict standards and requirements in terms of production processes, quality, safety, food safety, environmental sustainability, sanitary and phytosanitary standards, etc. Therefore, the regionalization of this type of services would bring significant gains in terms of scale of operations, which would facilitate the costs involved in adopting the technology and methodologies demanded by the respective international agencies, so that the opinions and evaluations carried out in the region would be valid in the destination markets.

56. Risk reduction through insurance. Given the importance of logistics services to optimize the supply chain, it is necessary to have a wide range of coverage for specific risks related to the transportation of goods, warehousing, inventory management, product valuation, order preparation, loss, theft or damage to goods, environmental liability, etc. In this case, as in the case of laboratories, there should be a minimum harmonization of the regulatory framework at the regional level, opening the market to international competition, if necessary. In the case of agricultural export products, agricultural insurance under preferential conditions would be very useful to protect the capital and investments of small producers in this chain, especially to respond to catastrophic events, which are so frequent in a region that is vulnerable and exposed to natural disasters.

57. More and better economic information facilitates coordination within the chain. The lack of timely, up-to-date and detailed information on market conditions, production, costs, prices and inputs in the selected chains makes it difficult to map them adequately. The limited availability of detailed and recent studies on the economic structure of the export sector, talent gaps, installed productive capacity, and related and complementary companies in the region prevents adequate regional coordination of public and private institutional actors. Given the public good nature of this type of information, it is necessary to harmonize definitions, concepts and measurement methodologies, as well as to define a minimum inventory of indicators that should be kept up to date.

4.2. Articulating Axis at the regional level

58. Reliable supply of electricity at competitive prices. A reliable, enough, and clean supply at competitive prices is a necessary condition for the development of the chains in the region. Important challenges persist in each country. The SIEPAC is an important step in this direction, however, important challenges remain in terms of regional alignment of objectives, strengthening of the institutional framework in charge of the Regional Electricity Market, development of a common legal and regulatory framework for the sector in the region, and improving regional coordination in terms of investment planning in transmission and generation capacity⁸.

59. Land transportation infrastructure that responds to a regional productive logic. This type of investment includes the construction of overland communication routes (highways or railroads) that connect the production and supply of inputs with the main ports in the region (which should also obey the logic of regional integration, regional cargo consolidation and minimum efficient scale to be competitive at the international level) and with the T-MEC region and the Panama Canal. Therefore, it would be necessary to explore in more detail the most necessary routes and types of investments to facilitate the fast and safe movement of finished products and raw materials in the region (such as the Road Integration Corridors of the Puebla-Panama Plan).⁹

60. Warehousing and distribution infrastructure that facilitates response times to the market. Speed and reliability in the delivery of finished products and in the provisioning of supplies become critical when considering the shortening of product life cycles, shorter lead times, ordering of products in small quantities highly differentiated from one another and minimization of inventories (on-demand replenishment). Changes that will demand more and more efficient product collection centers, storage of goods, infrastructure for transshipment of cargo between different modes of transport, free trade zones, industrial parks, etc.

61. Optimization of distribution logistics at the regional level. As e-commerce continues to advance, there will be an increasing need to deliver directly to consumers the products that global chains produce in the region; instead of exporting these products to distribution centers in the destination markets, as is currently the case, orders could be consolidated and shipped directly from the region to consumers at their destinations. This would require significant investments to develop fulfillment centers connected to large e-commerce platforms (such as Amazon or Mercado Libre). This change of model would require major investments in storage and distribution centers (for raw materials and finished products) -Hubs- at the regional level to optimize the operation of the chain, taking advantage of the capacities of the productive spokes that each chain has in the countries of the region.

⁸ Echeverría, 2017

⁹ Delgadillo, 2008

- 62. Continue moving towards a regional customs union.** Although the ideal situation would be for the region to function as a totally integrated market, so that goods and factors can move freely within the region, it is a fact that in the short- and medium-term land customs will continue to exist. Therefore, together with the streamlining of procedures and the standardization of permits and requirements, customs infrastructure must be modernized throughout the region to ensure the safe and expeditious movement of goods, while guaranteeing the food safety conditions and quality of the products transported.
- 63. Planning the development of regional chains.** Governments and the private sector in the region should plan the regional development of the chains in the medium term; it is necessary to lay a minimum foundation to take advantage of the benefits that arise from an integrated economic region. Although the suggestion is not, in principle, a detailed planning of all the enabling conditions that the chains would need to develop, at the very least, an indicative type of planning should be developed to outline the general features of the development path that these chains should follow.
- 64. Harmonization of promotion instruments.** The lack of coordination in national efforts to promote exports and attract investment opens up the actual possibility of a race to the bottom in terms of the incentives offered by each country. Rather than turning efforts into non-cooperative games in which the winner is the one who moves first or offers the greatest advantages, the challenge is to transform such efforts into a cooperative game in which cooperation among countries makes it possible to achieve larger prizes.
- 65. Coordinated trade promotion.** While each country does its own thing to promote its respective advantages, it cannot be overlooked that we all share certain basic competitive advantages, as well as a common geography, culture and history. It is practically impossible to think of each country not doing this type of activity, but at the very least, the respective agencies should develop a portfolio of the opportunities offered by the region and include it in their routine promotional activities.
- 66. Promoting compliance with labor and environmental regulations.** The growing interest of the consumers and governments in developed countries in promoting environmental sustainability, combating climate change and promoting compliance with human rights is making it increasingly important for the region's supply chains to comply with international standards, especially in labor and environmental matters.
- 67. Development of regional capabilities in research and development.** Given the nature of these issues and the characteristics of the GVCs in each of the countries, it must be recognized that this is a regional problem rather than a problem of each country or chain. In order to take advantage of economies of scale and reach a larger number of beneficiaries, it would be important to explore the possibility of developing regional research and development capabilities. In order to take advantage of economies of scale and reach a larger number of

beneficiaries, it would be important to explore the possibility of developing regional research and development capabilities.

- 68. Promotion of regional platforms for dialogue, consultation and problem solving.** Trade unions and regional exporters associations constitute a powerful and effective mechanism to maintain a constant dialogue at the regional level about the current state of the chains, their potential future development, and the problems they face. Likewise, these associations could play a more active role in: the organized representation of the chains in front of external actors such as leading companies of the chains, foreign regulatory agencies, cooperators and international financial organizations; promoting the adoption of best practices by chain members; and, active participation in promoting the region as an investment destination.

4.3. Leveraging existing value chains

- 69. Promote greater integration of the apparel and textile chain in the region.** Based on El Salvador's "synthetic cluster" and Guatemala's "Complete Package", a strategy could be devised to seek a greater degree of vertical integration in the chain and ensure a broader and more reliable supply of goods within the region.
- 70. Leverage the regional development of the medical device chain based on Costa Rica's experience.** The level of development that Costa Rican companies have reached in these products, as well as the support services that have emerged around this industry, would allow this cluster to take the lead in the development of this chain in the region; Costa Rica could offshore the production of the most basic medical and electronic devices to the rest of the countries in the region, offering the services of the cluster to the rest of the countries, and take advantage of this to focus on more sophisticated products.

5. AREAS FOR FURTHER ANALYSIS

- 71. Potential for regional vertical integration.** The growing need to make the supply chain within the chains more predictable makes it necessary to know in greater detail the factors that can ensure that the chains are supplied with inputs produced within the region (backward linkages).
- 72. Potential for increasing the value added of products.** The potential for sophistication and upgrading of products and processes in the chain (industrial upgrading) depends on complex processes of "learning by doing", innovation, research and development that need to be investigated in greater depth.
- 73. Growth potential.** Considering that all the chains studied have a low share of the global market supply, research should be conducted on how to significantly expand their participation in new markets and/or discover the products with the greatest growth potential.

74. Potential to take advantage of economies of agglomeration and economies of scope. Taking better advantage of economies of scope within existing chains would make it easier to expand the variety of products offered by existing chains. Existing clusters in the region (economies of agglomeration) would allow for greater levels of specialization and greater use of existing knowledge and skills in the region. Research is needed on how to take greater advantage of the existing potential in this area.

75. Potential to replicate best productive and organizational practices. Identifying best practices in the region's chains would enable the best knowledge, technologies, skills, production methods and organizational models to be disseminated to a larger number of companies in the region.

5.1.Chains Selected for Further Analysis

76. The following table evaluates the potential of three of the existing chains in terms of the criteria described above and their potential to generate employment, investment and promote research, development and innovation.

Table 6 Chains identified to be further analyzed

Potential	Vegetables, legumes and fruits	Apparel and Textiles	Medical devices and products and electrical appliances	Call centres
Regional vertical integration	MEDIUM	HIGH	MEDIUM	HIGH
Increase the added value	MEDIUM	HIGH	HIGH	MEDIUM
Growth	HIGH	HIGH	HIGH	HIGH
Potential to take advantage of economies of agglomeration and economies of scope.	MEDIUM	HIGH	HIGH	HIGH
Potential to replicate best productive and organizational practices.	HIGH	MEDIUM	HIGH	HIGH
Generate Employment	HIGH	HIGH	MEDIUM	HIGH
Generate Investment	HIGH	MEDIUM	HIGH	MEDIUM

Source: Own elaboration

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