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## Technology and Economic Integration: Growth and Development for Caribbean Island Economies

*Geneive Brown Metzger and Stephen Metzger*

THE island nations of the Caribbean are faced with a similar set of circumstances; that is, they are small in terms of territory and population, and individually lack a diversity of natural resources. This is true of small, island economies worldwide, which are highly dependent on the world market as a source of income (exports) and a source of supply (imports). Yet, some island economies have done extremely well, such as Singapore, Hong Kong, Taiwan, and Malta, while others have faltered.

The successful island economies seem to possess a comprehensive vision, strong leadership, and perseverance in pursuit of better economic performance. Their political class has been in tune with the need for universal material progress and has consistently pursued effective economic and trade diplomacy, resulting in beneficial bilateral and multilateral trade relationships and advantageous economic

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*Geneive Brown Metzger is a U.S./Caribbean business consultant who promotes Caribbean trade and investment. She served as Consul General for Jamaica to New York from 2008 to 2012 and was a member of the USAID/Migration Policy Institute Think Tank on Diaspora under Former Secretary of State Hillary Clinton. She earned degrees from City University of New York and Columbia University and received an Honorary Doctor of Laws Degree from the University of Technology, Jamaica.*

*Stephen Metzger is Principal of International Competitive Assessments, a management consulting and market research firm in the United States. He teaches courses related to development economics at York College and Fordham University in New York and is a visiting professor at the University of Technology, Jamaica. He earned degrees from Yale University and Rice University, where he received a PhD in Economics.*

relations in general. Moreover, these countries have recognized the importance of science and technology in their development. Such countries can possibly be the source (as examples) of policy guidance for individual economies in the Caribbean region with respect to broad economic policy and the role of technology in achieving a higher standard of living.

While government policy and diplomacy with regard to trade relations have a recognized role in development, the further question arises with respect to the importance of integration of individual economies through trade blocs or groups. The small, island economies of the Caribbean are also collectively organized under the Caribbean Community and Common Market (CARICOM). While the individual Caribbean islands lack diverse economic resources, the group as a whole has greater diversity with, for example, Jamaica mining bauxite, Grenada growing spices, and Trinidad refining oil. Regional integration can further support the development goals for CARICOM members, with science and technology—activated by entrepreneurial activity and government policies—playing a key role.

### **Economic Issues Unique to Small Island Nations and Options for Development**

The small, island economies of CARICOM, and in fact small, island economies worldwide, typically lack a diversity of resources found in larger economies, as well as large populations that attract the development of significant consumer markets. The dearth of resources and the limited internal development of what resources may be available—which would otherwise foster domestic industrial growth and manufacture of products for export—translate, other things equal, into lower incomes and a small consumer market.<sup>1</sup> Economies with large populations and diverse natural resources have available a much broader range of development options. Policies can be implemented that exploit the country's natural resource base, where the primary development factor may be increased capital investment with an essentially duplicative technology. Alternatively, capital "deepening" with known technologies may be undertaken, substituting capital for labor in key industries—the larger economy ensuring the absorption of the labor force. Significant infrastructure investments can be made, providing employment and serving to complement industrial development.

None of these opportunities or options are present to the same degree in a small, island economy. Such an economy, if it is successful in terms of achieving a certain level of GDP and a certain rate of GDP growth, may, in the miniature, resemble a larger economy, but it will have achieved this position by a different route than, and without the advantages of, a larger economy. Thus, the reality is that policy makers in small, island economies operate within a narrow range of discretion concerning economic development—as dictated by the needs for external finance and resource development, as well as the consideration of whether to focus on internal or external markets.<sup>2</sup>

Yet, a number of small, island nations have addressed these problems and overcome them. A hallmark of successful economic growth in small, island economies has been export-led manufacturing sectors, combined with a business-friendly economic environment. This is by no means a revelation, but moving from individual example to a general policy dictum for virtually all island economies and for CARICOM is a step that has not yet been taken.

To buttress the general policy argument and characterize successful island-nation economic development, we look at six key variables linked to commonly implemented economic development policy. These were then correlated with GDP and GDP growth across a cross-section of island economies. These variables are

- technology intensive exports as a percent of total export trade;
- total trade sector as a percent of GDP;
- export trade as a percent of GDP;
- ranking with respect to “ease of doing business”;
- ranking with respect to “perception of corruption” (lack of transparency); and
- ranking with respect to the penetration rate of broadband internet connections.

The first three variables should help to confirm that a policy of export-led growth is, and has been, a critical component of successful small island economies. The next two go to the performance of government in implementing and facilitating economic development. And the final variable is a measurement of countries’ communication infrastructure, as the means by which they are enabled to participate in the global network of internet-based transactions.

### *Technology-Intensive Exports*

Values for the three export variables for the country sample of small, island economies are in Table 1. CARICOM is roughly in the middle tier of the range of individual countries in the three categories, but significantly below economies such as Ireland, Singapore, Hong Kong, and Taiwan.

The correlation coefficients for the above variables, as matched with economic performance of real GDP and real GDP growth of the individual island economies are in Table 2. (CARICOM is excluded from the calculations.)

The importance of technology-intensive exports stands out clearly with respect to the level of real GDP achieved by the end of 2012. Of all the correlation computations undertaken, these particular types of exports have the highest positive association. Total trade and export trade as shares of GDP (nominal terms) are also important, although exhibit about one-half the positive relationship of technology-intensive exports.

**Table 1: Three Key Export Variables in Relative Economic Performance in Small Island Economies**

	Ratio of Technology-Intense Exports to Total Exports	Total Trade as a Percent of GDP	Exports as a Percent of GDP
<b>CARICOM</b>	<b>0.167</b>	<b>72.1</b>	<b>30</b>
Ireland	0.72	84	54
Taiwan	0.525	114.9	60
Hong Kong	0.517	328.8	225
Singapore	0.488	323.4	209
Malta	0.364	120.2	98
Barbados	0.249	61.6	47
Trinidad & Tobago	0.238	102	58
Cyprus	0.225	42.3	40
Bermuda	0.167	31	26
Dominican Republic	0.166	46.7	25
Jamaica	0.126	57.1	31
Bahamas	0.103	48.8	43
Mauritius	0.059	69.3	54
Madagascar	0.048	44.8	26
Fiji	0.042	82.8	49
Haiti	0.024	50	14
Sri Lanka	0.02	51.6	23
Papua New Guinea	0.005	87.5	51

Sources: The data were compiled from the United Nations Conference on Trade and Development (UNCTAD). Specifically UNCTADSTAT, international trade data, break out by product group, and UNCTADSTAT, economic trends, national accounts, nominal and real GDP, total and per capita, annual 1970-2012. The ratios were computed as an average over the years 2010 to 2012, so that no one year might drive the results.

### *Government Telecommunications Policies*

Government influence has many facets. Most analysts give significant weight to modern telecommunications infrastructure as a necessity for development. Increasingly, CARICOM governments are focusing on the need for digital communications networks. The call for modernization was clearly sounded at the Caribbean ICT Ministers' Forum, held August 7-9, 2013, by the Honourable Phillip Paulwell, Jamaica's Minister for Science, Technology, Energy and Mining. Paulwell challenged Caribbean nations to "...pursue what really should be our true goal: affordable and ubiquitous broadband internet access." He cited figures indicating that a 10 percent increase in broadband internet access leads to a 3.2 percent increase in GDP and a 2.6 percent gain in productivity.<sup>3</sup>

Key indicators of progress in ICT (information and communications technology) implementation are the International Telecommunication Union surveys of fixed and mobile broadband subscriptions by country, based on the penetration rate among potential users.<sup>4</sup>

**Table 2: Correlation Results for Export Variables**

	Real GDP 2012	Growth Rate of Real GDP 1995–2010
Ratio: Technology-Intensive Exports to Total Exports	0.85607	0.34312
Total Trade as a Percent of GDP	0.42565	0.17739
Export Trade as a Percent of GDP	0.46844	0.17898

Sources: Data from UNCTAD and the authors' correlation computations.

Government policies with regard to the business environment are broadly measured in two surveys. One by the World Bank develops an index across a number of variables, which is summarized in a ranking of countries with regard to the facility of doing business, and is called the “Ease of Doing Business Ranking.”<sup>5</sup> The second survey by Transparency International, based in Berlin, Germany, is called the “Corruption Perceptions Index,” and ranks countries with respect to the level of perceived corruption (e.g., bribery, payoffs, nepotism, etc.).<sup>6</sup> Both rankings put the best countries at the top (a numerically low value) and proceed through worsening conditions to the worst countries at the bottom (with numerically large values).

In summary, regarding the above-referenced surveys, the average of the individual rankings of CARICOM countries puts CARICOM, as a whole, in the upper-middle level of all surveyed countries with regard to penetration rates of fixed and mobile broadband access and in the lower tier of surveyed countries with regard to business environment.

The correlations of these indicators of government influence and policy with respect to real GDP, in Table 3, show a strong association of government policy in regard to modern telecommunications and with regard to how transparently governments conduct their day-to-day activities. (Note, the two ranking variables are, as expected, inversely related to economic performance.) Although not tested, it is highly likely that high scores on all four of these variables would be strongly correlated with a country's ability to attract foreign direct investment; gain access to global, as well as domestic, financial resources; and develop competitive export markets.

As with the previous correlations, the relationship to the GDP growth rate is not as strong as that of the level of real GDP. It should be noted, however, that the association of superior growth rates with more business friendly environments is fairly high. The correlations, while not implying causation, point to important distinguishing characteristics among island economies, the most important being a technology orientation. CARICOM and the individual countries within it, which

**Table 3: Correlation Results for Government Influence Factors**

	Real GDP 2012	Growth Rate of Real GDP 1995–2010
Fixed Broadband Subscribers Penetration Rate	0.73270	0.30890
Mobile Broadband Subscribers Penetration Rate	0.67860	0.10240
Ease of Doing Business Rank	-0.70502	-0.56289
Corruption Perceptions Rank	-0.71749	-0.36241

Sources: Data from International Finance Corporation and the World Bank, Transparency International, UNCTAD, and the authors' correlation computations.

are part of the sample, do not match up well in comparison to the leaders, and much additional effort is indicated to improve their standing—and hopefully, thereby, deliver a higher standard of living to their citizens.

### *Regional Integration*

Economic integration of small economies is one means to overcome their individual limitations and access a larger range of development options open to larger economies. CARICOM has its origins in the Treaty of Chaguaramus in 1973, and significant group-wide regulatory enhancements were instituted in the Revised Treaty of Chaguaramus in 2001, which created a single market and economy. At this point, CARICOM nations enjoy the free flow of goods and services, as well as the free movement of labor and capital (including licensing of businesses to operate across borders) within the bloc. CARICOM has also instituted a common external tariff and maintains rules of origin for duty-free exports among member countries.

In the broader context the question is whether economic integration via CARICOM membership has led to better economic performance, and, in particular, raised income per capita. The most exhaustive, although somewhat dated, analysis of the effects of CARICOM integration may be found in the 2002 IMF Working Paper by Egoume-Bossogo and Mendis.<sup>7</sup> Using a gravity model framework,<sup>8</sup> the authors conclude that, “CARICOM has been trade creating, even though trade with the rest of the world at the same time has been increasing.” The analysis, based on data from 1980 to 1999, indicates that diplomatic efforts to foster economic integration through its various stages during the ‘80s and ‘90s paid off. Moreover, the authors’ regression analysis indicated that in the pooled panel data spanning the period, a 1 percent change in income resulted in a 1.4 percent change in trade, the reciprocal implying that a 1 percent change in trade would be accompanied by a 0.71 percent

change in income. Thus, it would appear that CARICOM membership has been a decided plus during the period of the study.

For the succeeding 2000-2012 period, both overall trade and trade within CARICOM increased even more rapidly (140 percent and 176 percent), than did GDP (102 percent).<sup>9</sup> Technology intensive trade within CARICOM also increased substantially, at about the rate of nominal GDP.

The region has developed various regional strategies and policies to support the establishment of a digital economy. These include a regional e-government strategy, a trade-in-services action plan, a variety of small business development plans, a youth development plan, a cultural industries work plan, and a draft economic development plan. All these strategies have major ICT components.

## Examples of Regional Science and Technology Development

The strong correlation of broadband connections and technology-intensive exports with economic development and the important role of regional integration points to the need in small, island economies to encourage and incubate regional human capacity building, technology development, and cooperation across multiple sectors.

### *Wireless Networking for Educational Institutions*

JL Mobile is a small, Jamaican tech company, somewhat beyond the start up stage. The company has developed a cloud-based wireless network platform, Oromo, using mesh network technology, reaching distances up to 2.5 kilometers. The product is being tested at the University of the West Indies, Mona Campus, in conjunction with the university's Total Electronics Solution Tablet project.

Oromo is designed to deliver internet-based connectivity to educational institutions at low cost. In the words of JL Mobile's co-founder, Lloyd Laing, "The development of Oromo was spawned out of the disparity in internet delivery to educational institutions throughout Jamaica. Our R&D team saw a need and worked hard over the last six months to create an affordable cutting edge, high performance wireless system that can be compared with some of the best in the world, but at a price that any budget constrained institution in Jamaica can afford."<sup>10</sup> Clearly, given the immediate application, the positive externalities, or benefits, extend well beyond the JL Mobile's profit-making opportunity.

This tech-driven initiative makes use of something the Caribbean islands have in relative abundance, human capital in the form of tech savvy entrepreneurs. The Caribbean—and Jamaica in particular—is a hotbed of tech startups and technically proficient entrepreneurs in the field of programming and internet application products. It is hoped that production of the product will take place in Jamaica, possibly with the support of the government—in what could be an important global market, especially directed toward underdeveloped countries.

The development of Oromo is also an example of an effective collaboration between private sector entrepreneurs and the University of the West Indies, the regional tertiary institution (i.e., university) that serves seventeen English-speaking countries and territories around the Caribbean. In a similar vein, Jamaica's University of Technology maintains an entrepreneur incubator program, the Sapna Initiative, within its School of Computing and Information Technology.

In a recent op-ed, Julian Robinson, minister of state in the Ministry of Science, Technology, Energy and Mining, outlined an ICT roadmap for Jamaica in which substantial emphasis was placed on providing incentives for entrepreneurial initiatives in the ICT field.<sup>11</sup> Robinson stated, "It's...up to us as Government to make sure that if they [young entrepreneurs] choose to start their own businesses, they have the appropriate support...That support also includes financing, because we all know that without funds it's difficult to convert ideas into action." He went on to say, "Ultimately, if the GOJ [Government of Jamaica] assists in creating and exploiting opportunities for the ICT sector, the commercial incentive can lead to much-needed capacity building, the development of the IT skills of local developers and designers, and the emergence of new business models and entrepreneurial opportunities."

#### *Developing Digital Media Competencies in the Region*

The Caribbean Examination Council (CXC), created by intergovernmental agreement to conduct examinations and provide diplomas and certifications across the region, has collaborated with BrightPath and Columbus International, Inc. to produce an orientation video for a new curriculum, as detailed in the newly created Digital Media Syllabus,<sup>12</sup> on the application of digital media in a wide range of contexts, as well as an understanding of digital media engineering.

Columbus International is a privately held telecommunications provider for the Caribbean region and is incorporated in Barbados. Columbus provides cable television services, digital video, high speed internet access, digital telephony, and corporate data services (retail). It operates an undersea and terrestrial fiber optic cable network, providing telecom capacity and IP (internet protocol) services to international telecom carriers, internet service providers, and other value added service providers (wholesale). It operates in forty-two countries throughout the greater Caribbean and Andean regions, and in Central America.

The BrightPath Foundation is a Trinidad-based, international educational organization, concentrating on "building local capacity through values-based technology training, education sector support and resource development initiatives."

The CXC initiative provides an example of a three-point collaboration effort between government, a nonprofit, and the private sector—in this case public education, content development, and infrastructure, respectively. The effectiveness

of this initiative will further depend both on the availability of computer hardware throughout the region and the access to fixed broadband internet provided content.

Separately, but in the same vein, Columbus and BrightPath announced in July a broad-based partnership to develop digital content creation and technology-based learning systems in the Caribbean.

### *STEM: Promoting Student Interest in Science and Technology in the Caribbean*

STEM is a broad-based program promoting student interest in science, technology, engineering, and mathematics, the four components comprising the acronym. University of South Florida Associate Professor Maya Trotz, founder of the Caribbean Science Foundation, has led the effort to transform the way in which these subjects are taught in the Caribbean.

A significant aspect of her approach is the creation of student-led projects, pertaining in particular to water resources, clean energy, and nanotechnology, subjects of considerable importance worldwide, and in particular for the island economies of the Caribbean. Trotz collaborated with the Sagicor Visionaries Challenge, sponsored by Sagicor Financial Corporation, a Jamaica-based insurance and financial management company. In July of this year, Trotz brought twelve students and twelve teachers from twelve Caribbean nations to the USF campus in Tampa, Florida, to see STEM educational methods and topics first hand. The students and teachers were winners of the Sagicor Visionaries Challenge. Students and teachers from around the Caribbean were asked to identify a challenge faced by their respective countries and offer a solution.

The STEM project is a further example of collaborative efforts of foundations and educational institutions across the Caribbean and involving the Caribbean diaspora to make long-term investments in human capital, thus building the prospects for technology intensive products and services in the Caribbean—with government as a direct or indirect partner.

### **Implications for Government Policy**

The basic premise of this paper is that, as a starting point, small, island economies must look to export-led growth. That was borne out in the high correlation between the share of technology intensive exports and countries' levels of real GDP in 2012. Thus, it is not just exports that are important, but rather the subset of the export trade that has a high component of technology that appears to be critical. At the same time, the importance of government policy was shown with regard to telecommunications infrastructure and with respect to encouraging and maintaining a healthy business environment. The examples of ICT applications also show that the Caribbean economies benefit from being able to leverage resources and expertise from across the region. Finally, economic integration has played a

consistent role in encouraging trade in goods, as well as human resources, thereby bolstering growth and the prospects for growth among CARICOM countries.

These findings set out benchmarks that should drive governments' visions and objectives for development. Setting out the benchmarks in an economic development plan and committing to their implementation is the first step and will lead to many additional steps or phases. In particular, what does it take to achieve a high proportion of technology-intensive exports to total exports, which is a key characteristic of successful island economies? Here are some of the implications for government action:

1. Pick markets and industries for governmental backing that show strong growth potential in export markets—taking steps to incubate and support but not protect.
2. Think big, but start small with as little as a single high-tech investment project, if need be, encouraging local and international entrepreneurial and investment participation.
3. Foster economic and financial relationships on a global basis with the goal of unrestricted access to markets, bearing in mind that most exportable products, especially in technology-driven products, are likely to need easy access to parts and components not available locally.
4. Make consistent improvements to the ICT infrastructure across the region, specifically pursuing policies that will substantially increase the penetration rate of broadband internet users.
5. Set out the framework for achieving a top ranking in the ease-of-doing business index by
  - eliminating formal or informal protections of local monopolies;
  - legislating and aggressively enforcing contractual laws that protect private physical and financial property, as well as intellectual property;
  - waging an all-out campaign against bribery and corruption throughout the public sector;
  - reducing the incidence and impact of crime against persons and property.
6. Encourage collaborations across the region between the private, particularly entrepreneurial, sector and the research facilities of universities, as well as government agencies—but taking care not to burden projects with bureaucratic and procedural inefficiencies, and at the same time protecting the entrepreneur's intellectual property.

CARICOM governments and institutions can well serve their economic development interests by focusing on the need to raise the penetration of broadband internet use throughout their economies improving the business

environment—and, of course, improving ICT literacy throughout the educational system, especially by leveraging regional capacities. These are the types of things that governments can do well and are uniquely positioned to do. In a limited fashion, governments can select technology-intensive ICT segments for special encouragement. The rest, however, can be left up to the dynamics and incentives of the marketplace. **SD**

#### Endnotes

1. The advantages of size and diversity of resources is well understood at this point and was first rigorously established by Hollis Chenery in his groundbreaking paper “Patterns of Industrial Growth” (*American Economic Review*, September 1960).
2. William G. Demas’ “The Economics of Development in Small Countries with Special Reference to the Caribbean” (McGill University Press, 1965) provides a detailed discussion of the problems facing small, island economies. Nearly fifty years later this work, by the distinguished former president of the Caribbean Development Bank, perfectly describes the same dilemmas currently faced by many small, island economies.
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7. Philippe Egoume-Bossogo and Chandima Mendis, “Trade and Integration in the Caribbean,” IMF Working Paper, September 2002.
8. Ibid. See pages 4 and 5 for an extensive description of the gravity model and Appendix III for the underlying theory.
9. United Nations Commission on Trade and Development (UNCTAD) and authors’ compilations.
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12. “CXC launches Digital Media syllabus,” Observer Media Group, September 15, 2013, <http://www.antiguaobserver.com/cxc-launches-digital-media-syllabus/>.