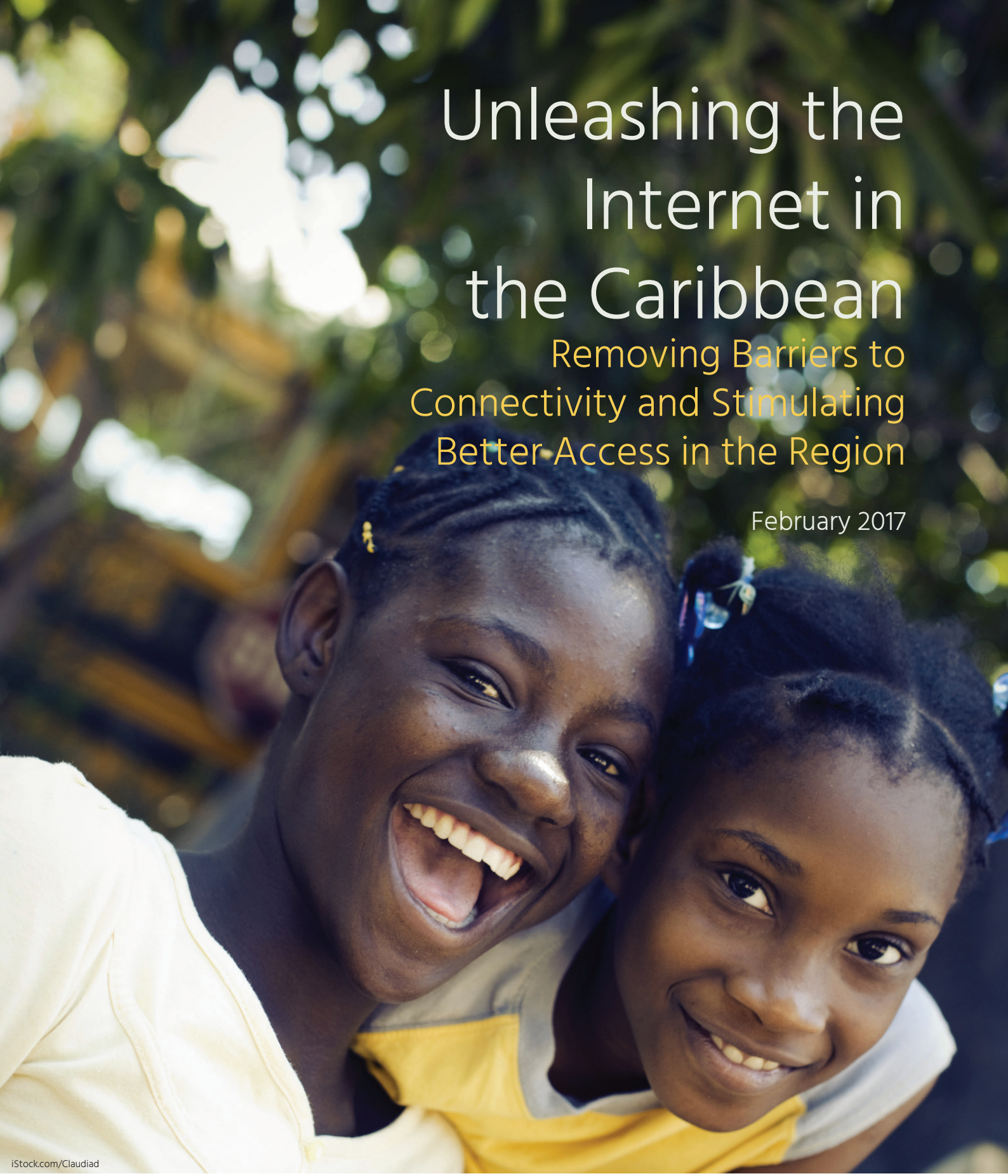
Unleashing the Internet in the Caribbean

Removing Barriers to Connectivity and Stimulating Better Access in the Region

February 2017



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CDS Caribglobal Data Services

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Internet Society

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Letter from the President

Internet connectivity is undoubtedly a crucial requirement for sustainable economic and social development around the world. The use of the Internet permeates every aspect of living, working and doing business; for developing countries, it is the catalyst to closing the development gap. The Internet also removes barriers between nations and supports the process of globalisation. It is therefore important that any barriers hindering the growth and development of the Internet be removed. It is within this framework that the Internet Society seeks to achieve its global vision of Internet for everyone via the promotion of an accessible, interoperable, open and resilient Internet.

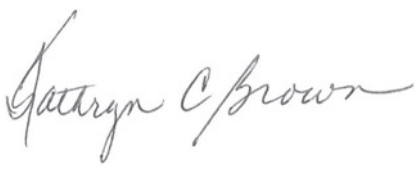
In recognition of the unique connectivity challenges faced by island nations, such as those of the Caribbean, this study presents a detailed look at the importance of infrastructure development, including the factors affecting local, regional and international connectivity, and identifies barriers to and opportunities for the creation of an enabling environment. This important addition to the "Lifting Barriers" series of reports—others having been conducted in Sub-Saharan Africa and Kyrgyzstan—gives a Caribbean perspective on the Internet infrastructure value chain, the enabling environment that is critical to infrastructure deployment, and the roles for various actors.

This first Internet Society report on the Caribbean focuses on a heterogeneous group of 11 countries representative of the Caribbean's diversity in size, language, political structure and economic development. The countries are also at different stages with respect to development in information and communications technology. Despite the differences, their geographical proximity and other commonalities provide a basis for cooperation and learning in many areas, including the development of a regional Internet ecosystem.

The report represents a well-timed and critical contribution to ongoing regional and local dialogue about what is required for both individual countries and the region as a whole to capitalise on the benefits of a connected society. While offering a unique insight into the challenges that face the countries of this region with respect to the deployment and use of critical Internet resources, the report also highlights key potential local and regional policy and regulatory implications for consideration.

The findings and recommendations arising from the study reflect the need for a holistic and (where possible) harmonised approach. There are, indeed, many opportunities to learn from each other and foster meaningful collaboration. This approach applies not only to the development of key Internet infrastructure, but also to the crucial environmental factors—policy, economic, political and social—that are necessary for the Internet to have its full impact on Caribbean development. Given the global mission and reach of the Internet Society, the report should also provide insight for other developing countries as they look to develop critical Internet resources, attendant with the enabling policy and regulatory environment needed to create a sustainable contribution to development.

Yours truly,



Kathy Brown
CEO and President, Internet Society

Acknowledgements

Preparation of this report was a regional effort. Special acknowledgements are due to: Ms. Michele Marius and Mrs. Bionda Fonseca-Hoeve, who conducted the primary research and prepared the report; they contributed regional knowledge and expertise, and their hard work and dedication to the project were invaluable. To those throughout the 11 target countries who completed questionnaires and provided additional data and information. To Mrs. Michele Thomas, Michael Jensen and Ryan Polk for feedback and editorial support on the draft and final versions of the report—your time and effort was greatly appreciated. Finally, to the Internet Society team, without whom this project would not have been possible: Raul Echeberria, vice president global engagement; Michael Kende, economist; Jane Coffin, director strategic development; Sebastian Bellagamba, director Regional Bureau Latin America and Caribbean; and Shernon Osepa, manager regional affairs Latin America and the Caribbean for the coordination of this project. Thank you all for your input and support.

The Internet Society demonstrates its commitment to Caribbean Internet development via regional efforts to build capacity, promote innovation and raise awareness via research, consultations and policy engagement. We look forward to continued partnerships with both the private and public sectors, as well as civil society, that are designed to break down barriers and expand opportunities for growth of this important ecosystem.

Executive Summary

The nations of the Caribbean region are scattered over an area of more than 2.75 million square kilometres. These small, developing countries are mostly isolated from each other by the Caribbean Sea and Atlantic Ocean. As such, they have greater Internet connectivity challenges than do mainland developing nations, which further limits the extent to which they can participate in the developing information society.

Commissioned by the Internet Society, this study identifies solutions that promote continued development of the Internet in the Caribbean, specifically with respect to infrastructure and access services, and provides recommendations to help address the region's unique challenges. The study focuses on the following 11 countries and territories, which were selected to sample the diversity of the region's 30 different sovereign countries and 17 island territories administered by France, the Netherlands, the United States and the United Kingdom: the Bahamas, Barbados, British Virgin Islands, Curaçao, Dominica, Grenada, Haiti, Jamaica, Sint Maarten, Suriname, and Trinidad and Tobago.

With regard to Internet infrastructure, most of the countries in this study have at least two independent submarine cable systems providing connectivity both regionally and to global Internet networks. Internet services are delivered in-country via a combination of fibre-optic, coaxial and copper cables, and fixed or mobile wireless networks. Second-generation (2G) mobile/cellular networks cover most of the population, providing basic telecommunications (voice and text messaging) services. Increasingly, newer third-generation (3G), fourth-generation (4G) and long-term evolution (LTE) mobile technologies that support mobile broadband Internet are being deployed.

Largely reflecting the varying levels of economic development in the region, Internet use varies considerably—from as low as 11% of the population in Haiti to almost 80% in Barbados and the Bahamas (2014). The density of fixed broadband subscribers is generally low—from less than 4 subscriptions per 100 inhabitants in the Bahamas to almost 27 subscriptions per 100 inhabitants in Barbados (2014). The rapid adoption and use of mobile/cellular phones in the region, however, fuelled by aggressive promotion of broadband services by mobile operators and the increasing deployment of free/public Wi-Fi networks, are likely to substantially increase the short- to medium-term Internet adoption and use.

With some exceptions, such as Haiti and the Bahamas, the coverage of Internet infrastructure is relatively good, but there is still room for improvement. There are a number of challenges, however, that constrain most countries in the region from becoming digital societies.

- Caribbean governments have been largely responsive rather than proactive in nurturing the development of the Internet to meet their countries' needs. As a result, the policy environment required to enable the development and use of Internet infrastructure—particularly legal frameworks that promote affordable services via properly managed competition—are underdeveloped in most countries and still oriented toward the promotion of basic voice communications.

- Government support structures, such as investment incentives to improve coverage, are limited. The development of relevant content, services and applications (particularly e-government) would drive demand.

- Even if Internet access costs were to drop significantly, low-income populations might still find Internet services and access equipment unaffordable or of limited value relative to their income levels.

- Although some countries report relatively high numbers of Internet subscribers among their populations, these numbers do not necessarily correspond to proficient or extensive use of the medium to harness its development potential.

We recommend the following to address these challenges:

- Develop clear and forward-looking policy and regulatory frameworks that focus on developing the Internet and information and communications technology (ICT) both in individual countries and across the region as a whole.

- Encourage greater private-sector participation and innovation by improving the enabling environment and the support ecosystem in general, paying particular attention to fostering increased competition in the Internet access market and promoting open access to shared facilities, such as telecentres and innovation hubs (iHubs).

- Implement initiatives that foster greater participation by the public, including initiatives that improve digital literacy and increase the availability of free access to public institutions.

- Ensure that the ICT projects implemented are properly aligned with the country's needs and development priorities.

- Adopt a regional approach and system of collaboration on common problems and goals, taking advantage of the benefits that emerge—especially with regard to implementation costs—due to the economies scale and scope that can be realised.

1 Introduction

Developing countries,[1] especially the small island developing states (SIDS)[2] characteristic of many countries and territories in the Caribbean region, are subject to a broad range of Internet connectivity challenges. In addition to difficulties related to their geographic isolation, small size and low income levels, SIDS often lack a sufficiently competitive communications market environment. Such environments add to their burdens and result in the high cost of Internet access and services, which, in turn, limits adoption and use by citizens and the extent to which they can participate in the digital revolution.

Information and communications technologies (ICTs), specifically the Internet, have become a multimode delivery channel for a variety of services, including voice, data and video services. The Internet is generally recognised as a catalyst to a country's economic growth and development, and to improving its global competitiveness. As with other regions, Caribbean countries are increasingly looking to the Internet to drive economic and social development. To effectively support these aspirations, however, some of the enabling elements of the supply chain still need to be put in place in many of the countries in order to create the foundation for the outcomes envisaged.

A variety of organisations such as the International Telecommunication Union (ITU), the United Nations (UN) Economic Commission for Latin American and the Caribbean (ECLAC) and the World Bank have been assisting the Caribbean region to focus on improving access to ICTs. This study, commissioned by the Internet Society (ISOC), examines the state of the Internet in the Caribbean, with the aim to position the countries of the region so they can more fully harness the Internet and transform themselves into digital societies.

The Internet: A Driver of Development

Although the Internet in the Caribbean is more than 20 years old, there is still a sense that it is a novel phenomenon, where emphasis is still on facilitating access and not necessarily on using it productively by improving efficiencies, optimising systems and processes and driving innovation. No Caribbean country has established Internet access as a basic right, though most policymakers readily acknowledge how critical it is to their country's economy and competitiveness.

Though it may be argued that Caribbean countries are struggling to ensure ready and cost-effective access to the Internet, for the connectivity that does exist, it is also widely recognised that there is relatively little local content online. As a result, the citizens of the region are rarely leveraging the potential of the Internet, for example by producing content or using it as a platform for business. Instead, most citizens are merely consumers of content created elsewhere.[3]

Furthermore, studies conducted by the World Bank and McKinsey & Company, among others, confirm a relationship between increased broadband Internet penetration and economic growth. Specifically, for every 10-percentage-point increase in broadband penetration in low- and middle-income countries, economic growth increases by 1.38 to 1.5 percentage points.[4] Hence, developing countries are being encouraged to focus on improving access to and the quality of Internet services and advised to pay particular attention to narrowing the digital divide in their emerging digital societies to make themselves more inclusive.

1 United Nations (2014). *World Economic Situation and Prospects: Country Classification.* http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf.

2 Ibid.

3 Dominica News Online (2016). "Call made for development of Dominican cyber content" http://dominicanewsonline.com/news/homepage/news/technology/call-made-for-development-of-dominican-cyber-content/.

4 World Bank (2010). Building broadband: Strategies and policies for the developing world, p. 2. http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Building_broadband.pdf.

Sustainable Development Goals

On 25 September 2015, the United Nations General Assembly (UNGA) unanimously adopted the 2030 Development Agenda, *Transforming our World: the 2030 Agenda for Sustainable Development*, which superseded and replaced the Millennium Development Goals (MDGs) established in 2000. The 2030 Development Agenda sets out the following 17 Sustainable Development Goals (SDGs):[5]

1. **No Poverty.** End poverty in all its forms everywhere.
2. **Zero Hunger.** End hunger, achieve food security, improve nutrition and promote sustainable agriculture.
3. **Good Health and Well-Being.** Ensure healthy lives and promote well-being for everyone at all ages.
4. **Quality Education.** Ensure inclusive and equitable quality education as well as promote lifelong learning opportunities for all.
5. **Gender Equality.** Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation.** Ensure availability and sustainable management of water and sanitation for all.
7. **Affordable and Clean Energy.** Ensure access to affordable, reliable, sustainable and modern energy for all.
8. **Decent Work and Economic Growth.** Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all.
9. **Industry, Innovation and Infrastructure.** Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.
10. **Reduced Inequalities**. Reduce inequality within and among countries.
11. **Sustainable Cities and Communities.** Make cities and human settlements inclusive, safe, resilient and sustainable.
12. **Responsible Consumption and Production.** Ensure sustainable consumption and production patterns.
13. **Climate Change.** Take urgent action to combat climate change and its impacts.
14. **Life below Water.** Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
15. **Life on Land.** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.
16. **Peace, Justice and Strong Institutions.** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable and inclusive institutions at all levels.
17. **Partnerships For the Goals.** Strengthen the means of implementation and revitalise the global partnership for sustainable development.

For all of these SDGs, the Internet—and by extension ICTs—are seen as crucial catalysts for their successful realisation. The role the Internet can play is varied, ranging from improving access to information to enabling the more efficient delivery of goods and services and optimising existing processes.

For those countries in the Caribbean that are members of the UN, it is expected that the SDGs and their associated 169 targets (to date) will be incorporated, as appropriate, into national and regional development plans and programmes. In light of the challenges and vulnerabilities characteristic of SIDS, the Internet could be a key way for Caribbean countries to tackle the SDGs, while also fostering both individual and regional economic and social development.

5 Sustainable Development Knowledge Platform. "Sustainable Development Goals". https://sustainabledevelopment.un.org/sdgs.

Methodology

The methodology employed for this study included two elements: desk research of relevant and publicly available literature, plus a survey to secure first-hand input from the countries under review. In order to represent a wide cross-section of national environments in the Caribbean region, the following 11 countries were selected for specific focus:

- The Bahamas
- Barbados
- British Virgin Islands
- Curaçao
- Dominica
- Grenada
- Haiti
- Jamaica
- Sint Maarten
- Suriname
- Trinidad and Tobago

The survey was electronically administered and designed to obtain the following information for each of the countries:

- The providers of Internet services and the technologies they use for their networks
- The critical Internet resources that are present
- The policy and regulatory framework in place, including legislation that provides an enabling environment for continued Internet development.

The survey (included in Appendix A) was directed to the telecommunications/ICT regulators in the countries of focus. Eight of the 11 countries completed the survey; survey outputs have been used, when appropriate, to validate and/or qualify information collated from other sources.

A particular challenge of this and other assignments which focus on the Caribbean and rely on data and formal reporting to illustrate occurrences in the environment and to support inferences and conclusions drawn, is the limited availability of suitable information in the public domain. While carrying out our desk research, it quickly became evident that regularly published country reports that document developments in a country's telecommunications and ICT space, and thereby provide context for each country's unique environment, are sorely missing. As a result, we made extensive use of the statistics published by international and nonregional organisations, such the International Telecommunications Union, the World Bank and the United States Central Intelligence Agency, to name a few.

For the purposes of this study, the following abbreviations for the 11 countries are used:

BAH	Bahamas	BDS	Barbados	BVI	British Virgin Islands
CUR	Curaçao	DOM	Dominica	GDA	Grenada
HAI	Haiti	JAM	Jamaica	SUR	Suriname
SXM	Sint Maarten	T&T	Trinidad and Tobago		

Structure of the Report

The remainder of this report is divided into six main sections.

Overview of the Caribbean (page 10) presents the socioeconomic and demographic characteristics of the 11 countries and discusses that their legal and regulatory frameworks.

Internet Infrastructure in the Caribbean (page 22) describes the state of Internet services for the overall region including the critical elements of the Internet supply chain such as the international Internet backbone the national/in-country network and the last mile to the end user.

Internet Adoption and Use (page 34) explores the adoption and use of the Internet in the Caribbean focusing on the surveyed countries.

Challenges of Unleashing the Internet (page 45) highlights the challenges related to infrastructure adoption and usage that are hindering the continued development of the Internet in the region.

Recommendations: Managing Challenges, Capitalising on Opportunities (page 55) outlines ways in which the challenges outlined in the previous section can be addressed.

Conclusions (page 61) summarises the main takeaways of the study.

2 Overview of the Caribbean

The Caribbean covers an area of more than 2,750,000 square kilometres (sq. km) bordered by North America to the north, Central America to the west and South America to the south. Generally speaking, countries considered part of the Caribbean lie within and at the border of the Caribbean Sea. The Greater Caribbean comprises more than 30 nations and territories scattered across 700 islands, islets, reefs and cays, and includes some countries in Central America and northern South America, such as Colombia, Costa Rica and Venezuela (Figure 2.1). In total, there are 12 sovereign small island countries and 17 island territories administered by France, the Netherlands, the United States and the United Kingdom.

Figure 2.1. Caribbean Countries Surveyed for this Study (Source: Microsoft Bing Maps[6])

The following two sections first present the geographic, demographic and economic indicators that provide an initial context for both the countries under review and the region as a whole; and then examine the enabling environment for Internet development in the region.

6 Retrieved from http://www.bing.com/.

Geographic, Demographic and Economic Indicators

The countries of the Caribbean vary considerably in terms of their size, demographics and economic characteristics (Table 2.1, below). At more than 163,000 sq. km, Suriname is the study's largest country in terms of geographic area, but it is not the most populous. The most populous country is Haiti, with almost 10 million inhabitants. The least populous and smallest territory is the British Virgin Islands with approximately 34,000 residents in 151 sq. km.

Country	Area (sq. km)	Pop. ('000)	Pop. Density (indiv./ sq. km)	Literacy (%)	Unemploy -ment (%)	Median Age (yrs)	GDP PPP (USD B)	Per Capita GNI (USD)
Bahamas	13,880	324	23.3	95.6	16.2	31.5	$9.23	$21,236
Barbados	430	290	674.4	99.7	11.4	38.0	$7.00	14,772
British Virgin Islands	151	34	225.2	97.8	8.7	35.9	$0.50	27,843
Curaçao	444	147	331.1	96.7	13.0	36.1	$3.13	20,167
Dominica	751	73	97.2	94.0	23.0	32.6	$1.02	6,955
Grenada	344	110	319.8	96.0	33.5	30.4	$1.46	8,109
Haiti	27,750	10,110	364.3	60.7	40.6	22.5	$18.87	815
Jamaica	10,110	2,950	291.7	87.0	16.3	25.3	$25.13	4,872
St. Maarten	261	40	153.3	95.0	12.0	40.4	$0.80	28,084
Suriname	163,820	579	3.5	94.7	9.0	29.1	$7.12	9,474
Trinidad and Tobago	5,128	1,222	238.2	98.8	5.9	35.0	$27.14	17,989

Table 2.1. Key Geographic, Demographic and Economic Indicators[7] for Select Caribbean Countries (Source: CIA[8], UN[9])

The Caribbean region, with approximately 192 persons per sq. km,[10] is not densely populated when compared with the global average of 364 persons per sq. km.[11] Barbados has almost twice the density of the next most-densely populated country (Haiti) and is the only country in the region that could be considered as having a high population density according to both global and Caribbean standards. With the exception of Barbados, Haiti, Curaçao and Grenada, the countries in Table 2.1 can be considered low-density, a status that is likely to result in less cost-effective network deployment.

With the exception of Haiti, the countries under review enjoy high literacy rates, which indicates their citizens might be in a better position to effectively capitalise on the Internet and ICTs. The level of unemployment, especially in Dominica, Grenada and Haiti, is over 20%, which is a source of concern. It not only suggests lower national productivity and competitiveness when compared with other countries, but also affects the number of citizens who can afford to use technology such as the Internet.

Haiti, Jamaica and Suriname can also be characterised as having a relatively young population, as reflected in Table 2.1, with median ages of 22.5, 23.1 and 29.1 years, respectively. In those countries, more than 50% of the population is below the age of 25, while in the other countries the median age is 35.4 years. Furthermore, when the unemployment rate is

7 Based on the most recent data collected or estimated, typically for 2013 or 2014.

8 CIA (2016). "The World Factbook". https://www.cia.gov/library/publications/the-world-factbook/.

9 UNdata. Retrieved from http://data.un.org/.

10 Worldometer (2016). "Subregions in Latin America and the Caribbean by population (2016)". http://www.worldometers.info/world-population/population-by-latin-america-and-the-caribbean-subregion/.

11 World Bank Data (2013). "Population density (people per sq. km of land area) for 2013". http://data.worldbank.org/indicator/EN.POP.DNST.

considered, especially in countries such as Haiti (40%) and Grenada (33.5%), it again suggests that large segments of the population are less likely to be able to afford Internet services.

Figure 2.2 illustrates the region's wide variation in gross domestic product (GDP), per capita GDP, and per capita gross national income (GNI). GDP ranges from USD 500 million in the British Virgin Islands to USD 27.14 billion in Trinidad and Tobago, while the British Virgin Islands has the second-highest per capita GNI (behind Sint Maarten). Similarly, across the region the average per capita GDP on a purchasing power parity (PPP) basis is USD 18,039—as low as USD 1,300 in Haiti and as high as USD 42,300 in the British Virgin Islands.

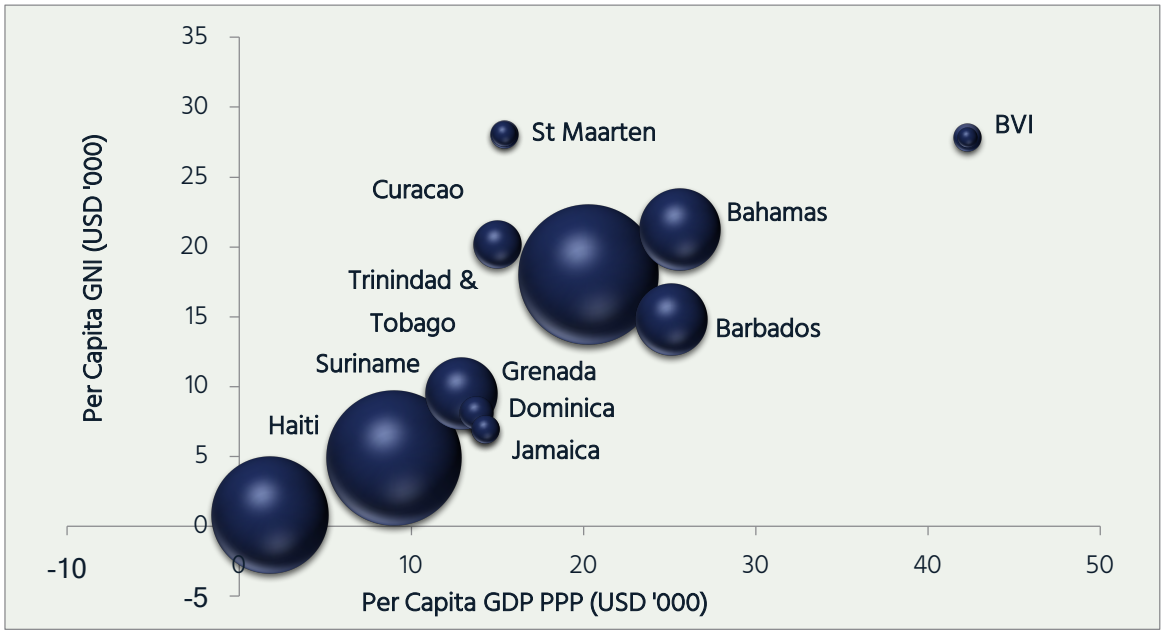


Figure 2.2. Per Capita GDP, Per Capita GNI, and GDP of Select Caribbean Countries (Sources: CIA[12], UN[13])

Moreover, due to their relatively high per capita GNIs, the majority of Caribbean countries are now classified as middle- or high-income countries. For example:

- Low-income countries: Haiti
- Middle-income countries: Dominica, Grenada, Jamaica and Suriname.
- High-income countries: The Bahamas, Barbados, British Virgin Islands, Curaçao, Sint Maarten, Trinidad and Tobago.[14]

Most countries, with the exception of Trinidad and Tobago, are heavily reliant on the services sector, which includes tourism, banking and financial services, and even IT services (Figure 2.3). In Trinidad and Tobago, however, the industrial sector, which includes oil, gas, steel, and food and beverage manufacturing, is the largest contributor to GDP.

12 CIA (2016). "The World Factbook". https://www.cia.gov/library/publications/the-world-factbook/.

13 UNdata. http://data.un.org/.

14 World Bank. "World Bank Country and Lending Groups". http://data.worldbank.org/about/country-and-lending-groups.

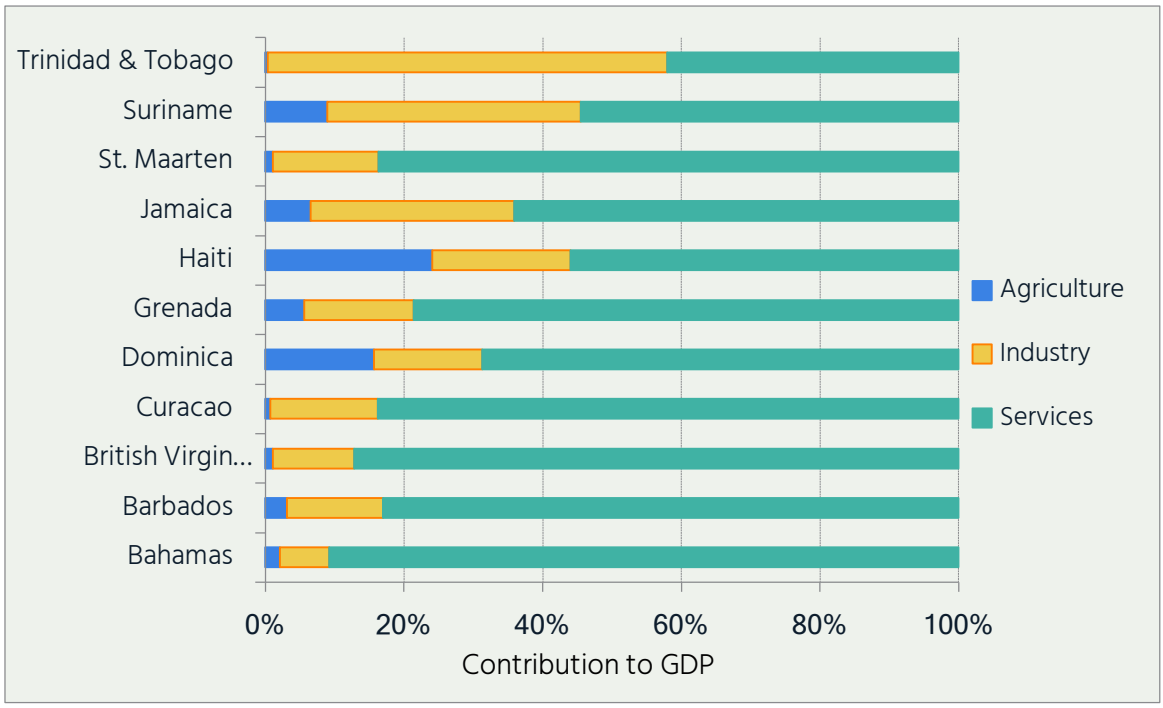


Figure 2.3. Estimated Contribution of Key Sectors to GDP in Select Caribbean Countries (Source: CIA[15])

It is interesting to note that agriculture, which has traditionally been the main source of revenue for Caribbean countries, now accounts for less than 10% of GDP in most countries in the region. The increasing reliance on services, and to a lesser degree industry, must be underpinned by the requisite support structures, including ICTs, to create the enabling environment for efficiency, competitiveness and investment.

Vulnerabilities of Small Island Developing States

Although most Caribbean countries are classified as middle- or high-income countries and are therefore no longer eligible for intensive donor support, all of the Caribbean islands are also classified as small island developing states (SIDS). SIDS are widely recognised as experiencing a broad range of special and specific disadvantages (Table 2.2, following page) that hinder their economic and social development. Generally, Caribbean countries experience virtually all of the vulnerabilities highlighted in Table 2.2, which essentially counterbalances all of the perceived strides the countries have made as reflected in their current GNIs and as evident, for example, in their literacy and unemployment rates (see Table 2.1, page 12). Their telecommunications and Internet infrastructures are likely to be challenged by the relatively high deployment costs in the region, which are due to the limited ability to exploit economies of scale. Furthermore, due to small population sizes, competition in the telecommunications and Internet-based sectors is likely to be limited, comprising either a single monopoly player or a small handful of players.

15 CIA (2016). "The World Factbook". https://www.cia.gov/library/publications/the-world-factbook/.

Disadvantages	Characteristics
Small size	Limited natural resource endowments and high levels of imports Limitations on import-substitution possibilities Small domestic market and dependence on export markets Dependence on a narrow range of products Limited ability to influence domestic prices Limited ability to exploit economies of scale Limitations on domestic competition Weak institutional capacity in the public services
Insularity and remoteness	High per-unit transport costs Uncertainties of supply Need to retain large stocks in-country to minimise shortages
Proneness to natural disasters	The Caribbean is prone to tropical storms, hurricanes, landslides, floods and earthquakes
Environmental factors	Greater pressures on the environment arising from economic development Fragile ecosystems that acutely feel the effects of climate change, global warming and rising sea levels
Other	High dependence on foreign sources of finance High emigration and brain drain

Table 2.2. Key Disadvantages and Characteristics of Small Island Developing States (Source: University of Malta[16])

Policy, Legal and Regulatory Context

Historically, telecommunications services in the Caribbean were delivered by monopoly carriers that were either government and/or privately owned. Fuelled by the need to improve competitiveness, the telecommunications sector was liberalised in the late 1990s and early 2000s, a move that also introduced new regulatory frameworks. Across the region, and particularly in the countries under review, both the establishment of Internet networks and the provision of Internet services have been liberalised (Table 2.3, following page).

In addition to the primary legislation and acts, other instruments, such as regulations, rules and orders, are usually prepared to support and supplement the policy framework, as shown in Table 2.4 (following page), which was drawn from a survey of telecommunications and ICT regulators. Acts and other forms of primary legislation tend to provide an overarching framework. Regulations, rules and orders that support the primary legislation tend to be subject-specific and related to the main areas of focus. As such, they are easier to amend than acts, which enables them to adjust to changing conditions and circumstances in the jurisdictions they serve.

16 Briguglio, L (1995), *Small Island Developing States and Their Economic Vulnerabilities*, p. 1616–1618. World Development, Vol. 23, No. 9. https://www.um.edu.mt/__data/assets/pdf_file/0008/147257/SIDS_and_their_ecn_vulnerability_Index.pdf.

Country	Telecommunications Regulatory Agency	Primary Legislation	Fixed-line		
				Mobile	Internet
Bahamas	Utilities Regulation & Competition Authority	Communications Act, 2009 as amended	C	C	C
Barbados	Telecommunications Unit, Government of Barbados	Telecommunications Act, 2001 as amended		C	C
British Virgin Islands	Telecommunications Regulatory Commission	Telecommunications Act 2006 as amended			
Curaçao	Bureau Telecommunicatie & Post	Telecommunication Ordinance (P.B. 1995)	C	C	C
Dominica	National Telecommunications Regulatory Commission	Telecommunications Act 2000, as amended	C	C	C
Grenada	National Telecommunications Regulatory Commission	Telecommunications Act 2000	C	C	C
Haiti	Conseil National des Telecommunications	Décret du 27 Septembre 1969	C	C	C
Jamaica	Office of the Utilities Regulation	Telecommunications Act 2000 as amended	C	C	C
St. Maarten	Bureau Telecommunications & Post St. Maarten	Landsbesluit opgedragen telecommunicatiediensten 1995		C	
Suriname	Telecommunicatie Autoriteit Suriname	Wet Telecommunicatie-voorzieningen 2004		C	C
Trinidad and Tobago	Telecommunications Association of Trinidad & Tobago	Telecommunications Act 2001, as amended	C	C	C

Table 2.3. Key Elements of the Legal and Regulatory Framework of Telecommunications Sectors in Select Countries
C = Competition, P = Partial competition, M = Monopoly (Sources: Regulators websites, ITU[17])

Topic	BAH	BVI	CUR	DOM	GDA	SXM	SUR	T&T
Licensing	A, R	A	A, R	A, R	A, R	A	O	A, R
Competition	A, R	A	R	A	U	A	O	O
Universal service/access	A, R	A	A, R	A, R	A, R	R, U	A	A
Access to facilities	A, R	A, R	A, R	A, R	A, R	A	A	A, R
Colocation	R	R	R	U	A, R	O	U	R
Infrastructure sharing	A, R	—	—	A, R	A, R	O	R	A, R
Wholesale pricing	A, R	R	R	U	A, R	O	A	—
Retail pricing	A, R	A, O	—	R	A, R	O	A, U	A, R
Dispute resolution	A, R	A, R	A, R	R	U	A	—	A, O
Quality of service	A, R	R	A, R	R	A, R	A	R	O
Consumer protection	A, R, O	R	R, O	U	A, O	A	O	A, O

Table 2.4. Survey Results: How Telecommunications Topics Are Addressed in the Legislative Framework of Select Caribbean Countries. A = Act, O = Other, R = Regulation, U = Unknown (Source: Consultants' Survey[18])

Across the countries examined, treatment of the crucial regulatory topics in Table 2.4 is uneven at best. In general, those topics that directly impact competition—including as colocation, infrastructure sharing, wholesale pricing and retail

17 ITU, ICT Eye (2016). "Country Profile: The Americas". http://www.itu.int/net4/itu-d/icteye/CountryProfile.aspx#TheAmericas.

18 Survey questionnaire, included as Appendix A.

pricing—have not been rigorously treated by having their policies enshrined either in the primary act or in regulations. Although it may be argued that a more loosely established or defined framework can provide more latitude to address unforeseen developments, it also introduces uncertainty and the potential for inconsistent and incoherent implementation of new rules and policies, which could inherently erode the underpinning framework.

It is important to highlight that in most countries, the primary legislation—usually a telecommunications act—is at least 10 years old. These laws and the regulatory frameworks were designed to focus primarily on voice services, and their delivery via fixed-line telephony and mobile/cellular networks. At that time, limited provision would have been made for the impact of technological convergence, or the role the Internet now plays in the delivery of voice, video, broadcasting (streaming) and other data services.

The following example highlights the limited powers of regulators in the eastern Caribbean region to regulate retail Internet rates. In countries overseen by the Eastern Caribbean Telecommunications Authority (ECTEL), such as Dominica and Grenada, the retail tariff regulations were passed as early as 2001, and replaced as recently as 2014. They were prepared in order to regulate fixed-line telephony services, which were controlled by a single monopoly carrier that traditionally would have been formally designated as dominant, or as possessing significant market power. As a result, the tariffs that would be subject to those regulations included, but were not limited to, circumstances when a monopoly existed, a provider had a dominant position in the particular market, or there was anticompetitive pricing or acts of unfair competition.[19]

The Impact of Dated Legislation and Policy on Regulation[20,21]

In October 2015, ECTEL, which is a regional component of the telecommunications regulatory machinery established in Saint Kitts and Nevis, Dominica, Grenada, Saint Lucia, and Saint Vincent and the Grenadines, expressed great concern regarding the intention of Flow, a regional telecommunications firm, to increase broadband Internet rates in those five countries. Discussions between Flow and the ECTEL commenced in July 2015, with the former agreeing to conditions proposed by the latter. However, prior to finalisation of those conditions, Flow publicly announced its intention to increase broadband Internet rates.

Flow was reportedly of the view that the amendments that had been made to the initial draft agreement rendered it unenforceable. On the other hand, the ECTEL was concerned that Flow chose to act "against the spirit of the discussions" held, and demanded that the firm "honor the commitments, including the provision of services at affordable prices."

At this time, the telecommunications acts in all of the five ECTEL member states were around 15 years old, and although work had commenced on new legislation as early as 2006, the proposed Electronic Communications Bill had not been enacted. The then-outgoing chairman of the ECTEL Council of Ministers, Minister Gregory Bowen of Grenada, noted that the absence of more current legislation, specifically the envisaged Electronic Communications Act, played a significant role in the behaviour of providers. He said:

> "We are bombarded with a plethora of complaints, immediately the merger has been approved, the requests for prices increase, and not only request but a demand because so far as the providers are concerned, there is nothing [written in the] law to prevent them from doing [so]."

19 Government of Grenada (2014), *Telecommunications (Retail Tariff) Regulations*, SRO 54 of 2014, p. A1056. http://www.ectel.int/wp-content/uploads/2015/12/GND-sro-54-2014-retail-tariff.pdf.

20 ICT Pulse (2015). "Why is the Caribbean plagued with flat-footed telecoms regulation?"http://www.ict-pulse.com/2015/10/caribbean-plagued-flat-footed-telecoms-regulation/.

21 The Montserrat Reporter Online (2015). "Outgoing ECTEL chairman wants stronger regulatory mechanism". http://www.themontserratreporter.com/outgoing-ectel-chairman-wants-stronger-regulatory-mechanism/.

Bearing in mind the aforementioned limitations, over the past decade there has been a global shift in emphasis from telecommunications to ICTs and the Internet. As a result, new ICT and Internet policies and plans are being prepared. In the Caribbean, just over half of the countries listed in Table 2.5 have published a national ICT policy and/or plan that outlines their priorities and strategies for the sector.

Country	Title of Policy	Year Adopted
Bahamas	Electronic Communications Sector Policy 2014	2014
Barbados	National Information and Communication Technologies Strategic Plan of Barbados 2010-2015	2010
British Virgin Islands	—	—
Curaçao	Masterplan Curaçao Information Society	2013
Dominica	In planning	—
Grenada	Information and Communication Technology 2006-2010 / A Strategy and Action Plan for Grenada	2006
Haiti	—	—
Jamaica	National ICT Strategy	2007
St. Maarten	—	—

Table 2.5. National ICT Policies Adopted in Select Caribbean Countries (Source: Broadband Commission[22], InfoDev[23], regulators' websites[24,25])

Regional ICT Initiatives

In addition to projects and initiatives undertaken by individual countries undertake to improve telecommunications and ICTs, a regional (or subregional) approach is frequently encouraged by regional organisations and international donor agencies, in order to capitalise on economies of scale and scope that can then be realised to address select challenges common to a number of Caribbean countries. In this section, four recently implemented regional ICT-related initiatives are outlined.

Regional HIPCAR Project

Over the five-year period between 2008 and 2013, 15 member states of the Caribbean Community (CARICOM)[26] participated in a project called the Harmonization of ICT Policies and Legislation Across the Caribbean (HIPCAR); this was organised by the International Telecommunications Union (ITU), the Caribbean Telecommunications Union (CTU) and CARICOM. The purpose of the project was to help Caribbean countries improve their competitiveness by harmonising their approaches to ICT development.[27]

In addition to providing technical assistance to the participating countries, a key output of the project was the preparation of policy guidelines and model legislation that could be "implemented by each country individually and by the region globally."[28] Table 2.6 lists the guidelines and model legislation prepared as part of the project.

22 Broadband Commission (2015). *The State of Broadband 2015: Broadband as a Foundation for Sustainable Development*, pp. 90–84. http://www.broadbandcommission.org/Documents/reports/bb-annualreport2015.pdf.

23 InfoDev (2009). *Survey of ICT and Education in the Caribbean: Country Reports (Volume 2)*. http://www.infodev.org/infodev-files/resource/InfodevDocuments_585.pdf.

24 Knowledge Platform Curaçao (2013). *Masterplan Curaçao Information Society*. http://www.btnp.org/images/stories/pdf/news/updated_masterplan_information_society_v1.pdf.

25 Government of Trinidad and Tobago (2013). *SmarTT: National ICT Plan 2014–2018*. http://www.mpac.gov.tt/publications/smartt-national-ict-plan-2014-2018.

26 Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

27 ITU. "HIPCAR Project: Enhancing competitiveness in the Caribbean through the harmonization of ICT Policies, Legislation and Regulatory Procedures". http://www.itu.int/en/ITU-D/Projects/ITU-EC-ACP/HIPCAR/Pages/default.aspx.

28 Ibid.

Guidelines	Topics
ICT legislative framework covering information society issues	E-commerce – transaction E-commerce – evidence Access to information Privacy and data protection Cybercrime and cybersecurity Interception of communications
Telecommunications-related issues	Universal service and access framework Licensing in a convergent environment Interconnection including cost modelling[29]

Table 2.6. Guidelines and Model Legislation Developed Under the HIPCAR Project (Source: ITU[30])

Based on the initial outputs produced, it was acknowledged that in most of the participating countries, important ICT-related matters were not being adequately addressed. In response, in addition to addressing select telecommunications-related issues, greater emphasis was placed on tackling such issues as electronic commerce (e-commerce), privacy, data protection, cybercrime and cybersecurity.

A priority during the HIPCAR project was ensuring that Caribbean technical experts and specialists participated in the preparation of project outputs. This ensured the relevance of the outputs and promoted the kind of buy-in among experts and specialists that would strengthen the likelihood of output adoption. Despite these efforts, in the three years since the project ended, few of the countries have formally adopted the policy guidelines or promulgated the draft legislation that was prepared. Since the countries were likely active in shaping the outputs, we can attribute the lack of implementation to possible factors, including:

- The countries were not required to formally commit to adopting the HIPCAR outputs.
- Limited political will to adopt HIPCAR outputs, which are not seen as a priority for most of the countries.
- Although the outputs might be on countries' policy and legislative agendas, there is no sense of urgency to put them into effect.
- Many of the countries may not yet be in a position in which the project outputs can be easily incorporated into existing national frameworks.

CARCIP

Launched in May 2012, the Caribbean Regional Communications Infrastructure Program (CARCIP) is a CTU initiative supported by ECTEL[31] and funded through a loan from the World Bank, which seeks to leverage the power of ICTs throughout the Caribbean region. CARCIP employs a three-pronged approach to fostering "greater regional integration and improved competitiveness"[32]:

- Improve regional connectivity infrastructure
- Foster ICT-led innovation
- Provide implementation support.

CARCIP aims to address the following key areas, depending on the needs of the participating countries[33]:

- Telecommunications regulation
- Landing stations and submarine cable
- Cross-border fibre links

29 Ibid.

30 Ibid.

31 Established on 4 May 2000 by the Treaty by the Governments of Five Eastern Caribbean States: The Commonwealth of Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines.

32 CTU. "About CARCIP". http://www.ctu.int/carcip/143.

33 World Bank (2011). *Caribbean Regional Communications Infrastructure Program (CARCIP): Concept and Status*, p. 10. http://www.ctu.int/download/World%20Bank%20-%20CARCIP%20update.pdf.

- Broadband backbone networks
- Broadband government virtual private networks
- Rural access
- Internet Exchange Points (IXPs) and data centres
- Emergency communications networks.

A major aspect of the work is helping to develop a framework by which public–private partnerships can support the expansion of broadband infrastructure. In addition, the design of expanded national broadband backbone networks is taking place in Saint Lucia and Saint Vincent and the Grenadines. It is expected that some of the funds also will be used to finance a submarine fibre backbone that will connect Saint Vincent and Grenada and extend between Saint Vincent and a number of outlying Grenadine islands. The national broadband backbone network design also includes options for the use of public–private partnerships in developing IXPs, data centres and other infrastructure and services.

Although all CARICOM member countries can participate in CARCIP, to date, only three ECTEL countries have signed up: Grenada, Saint Lucia, and Saint Vincent and the Grenadines. This is likely due to the financial constraints that many countries are under as a result of servicing World Bank loans.

The Caribbean Community Single ICT Space

The Caribbean Community (CARICOM) Single ICT Space is an element of the CARICOM Single Market and Economy (CSME) strategy that facilitates regional digital/ICT integration across CARICOM and between member countries. While a full description of the Single ICT Space is not publicly available, the plan is part of a five-year Caribbean Community Strategic Plan (2015–19) designed to establish:

> "A unified digital area where goods, people, services and capital can move freely; where everyone (from pre-kindergarten to post-retirement) can understand how to access and carry out online activities and access those across borders easily, safely and securely; where there is fair competition—regardless of nationality or place of residence—underpinned by a clear legal structure."[34]

To realise this vision, Dr. the Rt. Hon. Keith Mitchell, the Prime Minister of Grenada and CARICOM Lead Head of Government for Science and Technology (including Information and Communications), has identified priority items for completion by 2019, and described the corresponding challenges (Table 2.7).

Priority Items	Challenges
1. Bringing technology to the people, thus transforming them into digital citizens and digital entrepreneurs. 2. Cybersecurity. 3. Mobilisation of resources and formal commitments of CARICOM member states to invest in ICTs. 4. Developing the CARICOM Digital Agenda 2025.	1. The removal or reduction of voice and data roaming rates. 2. Spectrum management and reorganisation to facilitate increased competition in the market. 3. Advancing the regional legal and regulatory environment. 4. Use of the Caribbean Research and Education Network (C@ribNET) as a repository for the regional research and education elements, which could accelerate discovery of new products, product opportunities and processes and drive innovation. 5. Development of a roadmap for the Single ICT Space.

Table 2.7. Priorities of and Challenges to Realising the Single ICT Space (Source: Dr. the Rt. Hon. K. Mitchell, Prime Minister of Grenada[35])

34 Government of Grenada (2015). "Prime Minister's CTU Address, 2 February 2015". http://www.gov.gd/egov/news/2015/feb15/02_02_15/item_1/pm-address-ctu.html.

35 Ibid.

The roadmap for the Single ICT Space was to have been completed by July 2015,[36] but as of September 2016, this had not taken place.

Broadband Infrastructure Inventory and Public Awareness in the Caribbean

Launched in February 2013 with support from the Inter-American Development Bank (IADB), the Caribbean Association of National Telecommunications Organisations (CANTO) established the Broadband Infrastructure Inventory and Public Awareness in the Caribbean (BIIPAC) project, which comprised four main components[37]:

- Component 1. Broadband diagnosis and preparation of infrastructure maps
- Component 2. Review of regulatory and institutional frameworks and current sector trends
- Component 3. Implementation of ICT awareness- and capacity-building in the Caribbean
- Component 4. Preparation of regional public policy recommendations for the design of national broadband strategies.

Eight countries—Barbados, Belize, Dominican Republic, Guyana, Haiti, Jamaica, Suriname, and Trinidad and Tobago—committed to participate in the project. It was initially planned to end in 2015,[38] and was intended to achieve the following outcomes:

- Broadband diagnosis and infrastructure maps
    - Conclusions and policy recommendations for each participating Caribbean country
    - Strengthening of the DigiLAC database.
- Review of the regulatory and institutional frameworks
    - Recommendations to address current sector trends.
- ICT awareness- and capacity-building in the Caribbean
    - Seminars and the creation of a community of practice of regulators, public officials and experts, and the design of national capacity building programmes.
- Public policy recommendations for the design of national broadband strategies.[39]

Although the BIIPAC project ended in June 2016, the extent to which the desired results were achieved is not publicly available.

36 Ibid.

37 IADB (2012). *Technical Cooperation Document*, pp. 3-6. http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=37562583.

38 Ibid.

39 CANTO (2014). *Broadband Infrastructure Inventory and Public Awareness in the Caribbean (BIIPAC) Project.* http://www.itu.int/en/ITU-D/Regional-Presence/Americas/Documents/EVENTS/2014/1201-DO-Cnntvity/2-5-BIIPAC%20ITU%20Presentation%202014%2011%2025.pdf.

Summary

The Caribbean is not a homogeneous group of countries—wide variations exist between them, and each has unique attributes and challenges. Furthermore, although the countries are considered middle- and high-income nations based on their per capita GNI, many also are classified as SIDS and as such are subject to a broad range of vulnerabilities, including limited economies of scale, local competition and being prone to natural disasters. These vulnerabilities both affect their general economic development and point to challenges likely to be experienced when developing their telecommunications and Internet sectors.

All of the countries in the study have fully liberalised their telecommunications and ICT policy and regulation, and have relevant legal and regulatory frameworks in place. In the majority of instances, however, their laws are dated and may not adequately address matters specifically related to telecommunications, the Internet and any associated best practices.

Yet, Caribbean countries are increasingly focusing on ICTs and the Internet. More than half of the sample group have developed national ICT policies or strategy documents, although many of these will likely need updating to include more of a focus on broadband. Regional projects, such as HIPCAR[40] and CARCIP[41], have sought to strengthen the policy and legislative frameworks, but the limited adoption of outputs from HIPCAR and the fact that only four countries signed on to CARCIP suggest that a majority of Caribbean countries need to place a stronger priority on improving their telecommunications and ICT sectors. The impetus to effect far-reaching change is not readily evident.

40 ITU, HIPCAR Project (2016). "Enhancing competitiveness in the Caribbean through the harmonization of ICT Policies, Legislation and Regulatory Procedures" http://www.itu.int/en/ITU-D/Projects/ITU-EC-ACP/HIPCAR/Pages/default.aspx.

41 CTU. "About CARCIP". http://www.ctu.int/carcip/143.

3 Internet Infrastructure in the Caribbean

Most countries, including those in the Caribbean, consider the Internet a critical driver of economic and social development. As a result, agencies such as ECLAC are encouraging countries "to increase their efforts to reduce the digital divide in terms of access and quality of Internet access, and to facilitate the use of more sophisticated ICTs in order to continue their advance toward the construction of inclusive information societies."[42] Defining the current state of Internet access and services in the Caribbean region is a first step in the process of reducing the digital divide in Caribbean countries.

In this chapter, the state of Internet access and services in the region will be analysed by examining critical infrastructure elements of the Internet value chain (Figure 3.1). Every link of the chain is unique and essential in order to realise well-functioning, high-quality, end-to-end Internet access and services.

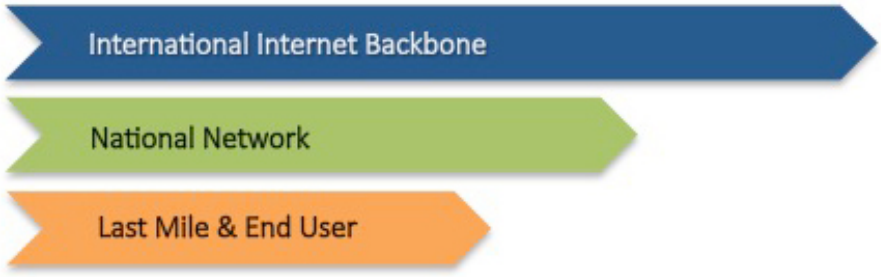


Figure 3.1. Key Network Connectivity Elements of the Internet Value Chain (Source: Consultants)

International Internet Backbone

Until fairly recently, satellite connections were the only way for island nations to gain access to global tele-communications networks. But the high cost of satellite capacity and the growing bandwidth requirements for broadband have led to increased investment in new submarine cables, to increase the bandwidth and redundancy and to better connect Central America with both North and South America. As a result, submarine cable is now the most widely deployed technology in the Caribbean for international connectivity.

Microwave, and to a considerably lesser degree satellite networks, are still being used across the region— primarily as backup links, particularly between islands within close proximity. In the case of multi-island states, microwave networks are the medium of choice to link islands, where distance allows and when submarine fibre has not yet been deployed.

42 ECLAC (2012). Submissions from entities in the United Nations system and elsewhere on their efforts in 2011 to implement the outcome of the World Summit on the Information Society (WSIS), p. 2. http://unctad.org/en/PublicationsLibrary/a67d66_ECLAC.pdf.

Submarine Cables

All Caribbean countries, including the 11 selected for this research, are connected to the Internet via submarine cable systems, at least for the main islands where the major populations are located (Figure 3.2).

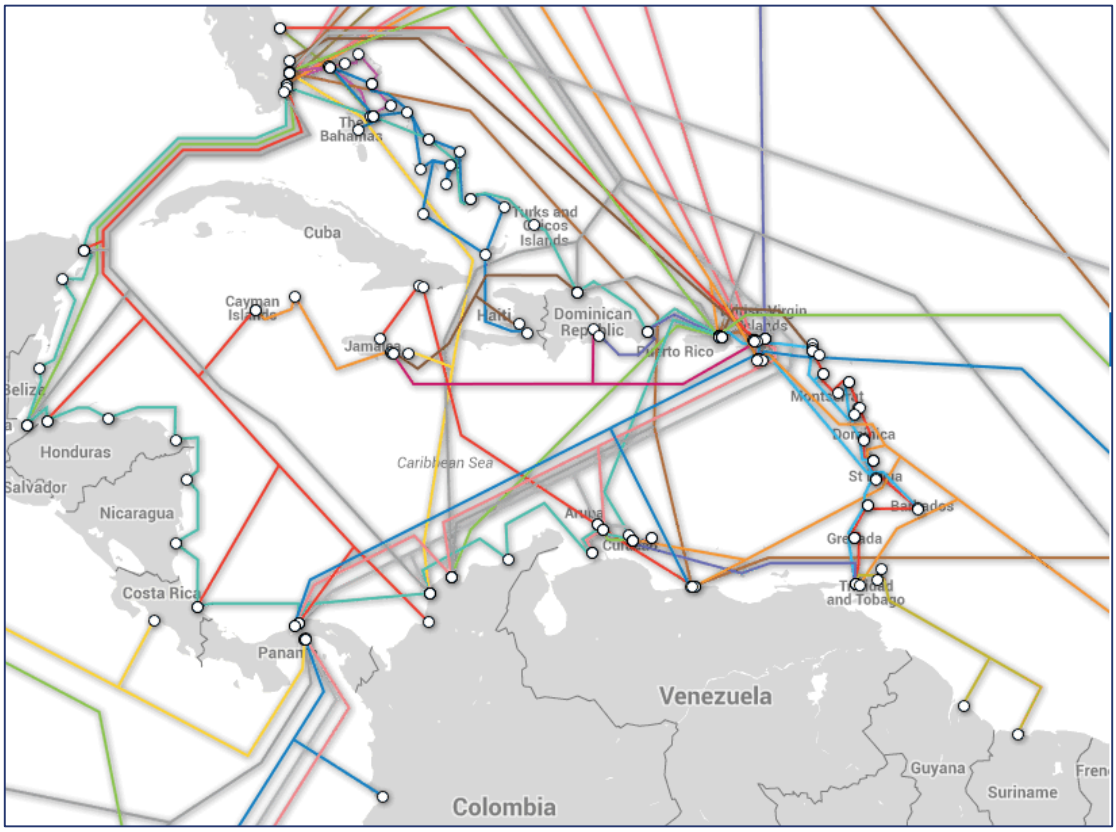


Figure 3.2. Submarine Cable Map of the Caribbean (TeleGeography[43])

Table 3.1 shows that every country in the sample group, with the exception of Suriname, has at least two landing stations from two independent submarine cable systems. Access to multiple cables provides redundancy if one cable fails, and also increases competition, applying downward pressure on international capacity pricing.

43 TeleGeography (2016). "Submarine Cable Map". http://www.submarinecablemap.com/.

Country	# of Landing Points	Submarine Cable Systems
Bahamas	3	ARCOS, Bahamas Domestic Submarine Network (BDSNi) and Bahamas Internet Cable System (BICS)
Barbados	2	Eastern Caribbean Fiber System (ECFS) and Southern Caribbean Fiber (SCF)
British Virgin Islands	3	Caribbean-Bermuda U.S. (CBUS), East-West, and Pacific Caribbean Cable System (PCCS)
Curaçao	6	Alonso de Ojeda, ARCOS, Americas-II, ECLink, Jerry Newton and PCCS/Alonso de Ojeda II
Dominica	2	Eastern Caribbean Fiber System (ECFS) and Southern Caribbean Fiber (SCF)
Grenada	2	Eastern Caribbean Fiber System (ECFS) and Southern Caribbean Fiber (SCF)
Haiti	2	Bahamas Domestic Submarine Network (BDSN), Fibralink
Jamaica	5	ALBA-1, Cayman-Jamaica Fiber System, Colombia-Florida Subsea Fiber (CFX-1), East-West and Fibralink
St. Maarten	2	Eastern Caribbean Fiber System (ECFS), Sint Maarten Puerto Rico Network One (SMPR-1)
Suriname	1	Suriname-Guyana Submarine Cable System (SG-SCS)
Trinidad and Tobago	5	Americas-II, Eastern Caribbean Fiber System (ECFS), ECLink, Southern Caribbean Fiber (SCF), Suriname-Guyana Submarine Cable System (SG-SCS)

Table 3.1. Submarine Cable Systems Landed in Select Caribbean Countries (Source: TeleGeography[44])

Although most countries have two or three cables, Jamaica and Trinidad and Tobago each have five, and Curaçao has six. In the case of Jamaica and Trinidad and Tobago, their considerably larger populations relative to other countries in the region make them key anchor points, as it is expected that they will generate significantly more traffic, thereby improving the cost recovery and profitability of the cables. In the case of Curaçao, it has established itself as a hub for submarine connectivity and was one of the first countries in the region to have an IXP (see the section "Internet Exchange Points", page 31). In addition, because it lies outside of the hurricane belt, it is an attractive location for data centres. Curaçao currently has internationally accredited Tier III and Tier IV data centres, and the Tier IV centre is one of only 11 in the world.

It is important to note that consortia, typically comprising private shareholders, own the majority of submarine cable systems in the region, as very few governments have the available finances to participate. These consortia tend to include telecommunications firms that operate and deliver services in the region. Table 3.2 lists the region's major multicountry submarine cable systems, the date they came into service, the countries they serve and some of the main owners.

44 Ibid.

Cable Name	Ready for Service	Cable Length (km)	Owners	Countries Landed
Americas-II	August 2000	8,373	AT&T, Verizon, Sprint, Orange, Cable & Wireless Communications Plc. (CWC), Columbus Networks Limited (CNL), et al.	Venezuela, French Guiana, Brazil, USA, Martinique, Puerto Rico, Trinidad and Tobago, United States Virgin Islands (USVI) and Curaçao
ARCOS	December 2001	8,600	CNL, Belize Telemedia, AT&T, Verizon Business, BTC, et al.	Belize, Nicaragua, Mexico, Colombia, Bahamas, Panama, Puerto Rico, USA, Turks and Caicos Islands, Guatemala, Nicaragua, Honduras, Costa Rica, Dominican Republic, Venezuela, Honduras, Mexico and Curaçao
Eastern Caribbean Fiber System (ECFS)	September 1995	1,730	France Telecom, CWC, AT&T, British Telecom, Verizon Business, Sprint, Guyana Telephone & Telegraph Co. Ltd. (GT&T), et al.	St. Kitts and Nevis, Barbados, St. Lucia, Trinidad and Tobago, Grenada, St. Vincent and the Grenadines, Martinique, Montserrat, Guadeloupe, Dominica, St. Maarten, Antigua and Barbuda and Anguilla
Southern Caribbean Fiber (of the Global Caribbean Fiber)	September 2006	2,100	Digicel (acquired in 2013)	St. Kitts and Nevis, Dominica, Trinidad and Tobago, St. Vincent and the Grenadines, Martinique, Barbados, St. Lucia, Grenada, Antigua and Barbuda and St. Croix (USVI)
Pacific Caribbean Cable System (PCCS)	September 2015	6,000	CWC, Telconet, Telefonica, Setar, United Telecoms Services (UTS)	Panama, Colombia, Aruba, USA, Ecuador, Panama, Puerto Rico and Tortola (British Virgin Islands)

Table 3.2. Multicountry Submarine Cable Systems in the Caribbean (Sources: TeleGeography[45], cable owners' websites[46])

Given the variety of owners of different submarine cable systems apparent in Table 3.2, it might appear that there is significant competition in the international market in the region. However, following recent consolidation and acquisitions, there are in fact only two significant players at both the international/ wholesale and retails levels in most of the countries in the study: Cable & Wireless and Digicel. As a result, concerns have been raised about limited competition in the submarine cable market, the increasing absence of carrier redundancy, and its impact on expectations for lowered Internet access prices.

45 Ibid.

46 Digicel (2013). "Digicel acquires submarine fibre assets across the Caribbean region". http://www.digicelgroup.com/en/media-center/press-releases/achievements/digicel-acquires-submarine-fibre-assets-across-the-caribbean-region.

The Caribbean's Changing Submarine Cable Space[47, 48, 49]

In 2013, Columbus Networks Limited (CNL) and Cable & Wireless Communications Plc (CWC) established a joint venture, CNL–CWC Networks Ltd., in order to provide "expanded wholesale bandwidth capacity to global, regional and local communications companies in the Caribbean and Americas Region". However, in March 2015, Cable & Wireless Plc (CWC's parent company) bought Columbus International (CNL's parent company), and six months later CWC was bought by Liberty Global Plc, a British broadband operator and one of the largest cable firms in the world, for USD 5 billion.

Similarly, Digicel, the largest mobile/cellular operator in the region (by market share), has been investing in its submarine cable system. In 2014, it bought the submarine cable assets of Global Caribbean Fibre and Global Caribbean Network to create a fibre-optic cable network of approximately 3,100 km providing capacity from Trinidad in the southern Caribbean to Puerto Rico in the north[50]. The firm has approval to build out networks connecting the Bahamas, Haiti and Jamaica,[51] and connecting Guyana.

In additional, over the past year the firm has launched Digicel Play, offering voice telephony, broadband Internet and subscriber television services using fibre and digital technologies. At the time of publication, Digicel Play is available in Anguilla, Barbados, Dominica, Jamaica, Trinidad and Tobago, and Turks and Caicos Islands, and there are imminent plans to roll out the service in Saint Kitts and Nevis.

National Network

The national network within a country consists of the links between the international backbone and the final connection between the local exchange and the end user (the "last mile"). It therefore comprises the national backbone and the middle mile that links the backbone to the local exchange (in the case of fixed networks) or to mobile and other wireless transmission towers from which customers are served. Traditionally, the national backbone has consisted of the microwave links and copper cables that were used to deliver the basic telephone service. Increasingly, however, across the whole region fibre-optic cable is now being used for the national backbone, often supplemented by the existing copper network and microwave links—initially used to provide redundancy. Fibre is also being rolled out in and around major cities in metropolitan area networks (MANs) in order to ensure that there is adequate bandwidth to provide quality service in the more densely populated urban areas.

Finally, as previously mentioned (see "International Internet Backbone", page 22), microwave links are still being used to provide connections within particular islands and to connect constituent islands in multi-island states without fibre. For example, in Saint Vincent and the Grenadines, the islands in Bequia, Canouan and Union, are connected to Saint Vincent via microwave.

47 Cable & Wireless Communications (2013). "CWC agrees strategic alliance with Columbus Networks". http://www.cwc.com/assets/uploads/files/Press%20Releases/2013/CWC%20agrees%20strategic%20alliance%20with%20Columbus%20140513.pdf.

48 Kaiteur News (2014). "Digicel submarine cable approval…Jagdeo was not speaking on administration's behalf – Dr. Luncheon". http://www.kaieteurnewsonline.com/2014/10/17/digicel-submarine-cable-approvaljagdeo-was-not-speaking-on-administrations-behalf-dr-luncheon/.

49 Digicel (2015). "Innovation in Communication and Entertainment". http://www.digicelgroup.com/content/digicel/digicelgroup/en/what-we-do/tv-and-broadband.html.

50 Digicel (2014). "Digicel Completes Acquisition of Submarine Fibre Assets across the Caribbean". http://www.digicelgroup.com/en/media/news/2014/09/12/digicel-completes-acquisition-of-submarine-fibre-assets-across-the-caribbean.html.

51 Jamaica Observer (2011). "Digicel submarine cable to link Jamaica with Haiti, Bahamas". http://www.jamaicaobserver.com/business/Digicel-to-build-fibre-links---Telecoms-firm-plans-to-link-submarine-cable-from-Jamaica-to-Haiti--Bahamas_8416794.

More isolated, smaller islands may still rely on satellite links to connect to the main island. Satellites also provide an important emergency communications function, as shown in following example taken from Haiti.

Satellite: A Critical Lifeline after Haiti's Earthquake[52, 53]

In January 2010, Haiti experienced a magnitude 7.0 earthquake.[54] The country's underdeveloped telecommunications infrastructure, as compared with other Caribbean countries, was severely damaged, including its only submarine cable (part of the BDSN).

The day after the earthquake, to support first responders and the longer-term relief and humanitarian efforts to follow, Te´le´coms Sans Frontie`res (TSF), the UN agency responsible for emergency telecoms support, arrived in Port-au-Prince to establish satellite communications with free equipment and financing from Inmarsat. Global mobile services, including telephone and data services, were provided to users via portable or mobile terminals communicating to ground stations through 11 geostationary satellites. To accommodate the bandwidth needed for the relief effort and onsite media, Inmarsat reallocated spot beams from its I-4 satellites to Haiti. In the first two weeks after the earthquake, more than 100 humanitarian organisations relied on satellite connectivity to coordinate and manage their work.

Last Mile to End User

The "last mile" refers to the communications link between the customer and the closest local exchange, base station, or wireless node. It is where the greatest service differentiation takes place and, therefore, is where competition is likely to be strongest. Table 3.3 shows the various means by which Internet services are delivered to residential customers across the region, as well as the maximum transmission speeds possible using the specified technologies.

Note that none of the countries in the region or this study have required their incumbent fixed-line operators to offer wholesale rates to other Internet service providers (ISPs) for access to their last-mile networks—an arrangement known as "local loop unbundling". Fixed-line network operators tend to have a monopoly on the last mile, which is generally considered a barrier to market entry. This barrier to entry, reduces take up for business customers located in the major urban areas where copper cable has been deployed.

52 Google (2010). *Ideas for Haiti's Internet Reconstruction.* http://www.google.org/docs/Haiti.pdf.

53 Inmarsat (2013). *Haiti earthquake aftermath – first responders rely on BGAN.* http://www.inmarsat.com/wp-content/uploads/2013/10/Inmarsat_Haiti_Earthquake_Aftermath.pdf.

54 See, e.g., New York Times, "Fierce Quake Devastates Haitian Capital". http://www.nytimes.com/2010/01/13/world/americas/13haiti.html.

Medium	Technology	Transmission Speed (Max)	Comments
Copper lines	ADSL/ADSL2	12 Mbps	ISPs, e.g., LIME (regional), Telesur (Suriname), UTS, Telem (St. Maarten) and Marpin (Dominica)
Wireless	GPRS	171 kbps	Low speed connectivity ideal for short message services (SMSs)
	EDGE	384 Kbps	Most mobile networks support EDGE as a
	Wi-Fi (2.4/5GHz ISM bands)		Antigua Computer Technology, DEKAL Wireless (Jamaica), Neptuno and WISCNet (Puerto Rico)
	HSPA/HSPA+	56 Mbps	Upgraded base stations (mostly in large urban areas) of some mobile networks
	WiMAX[55]	40 Mbps–1 Gbps	Jamaica Government (TV White Space), CCT, Scarlet (WiMAX)
	LTE	100 Mbps	Spice Mobile (Grenada), Flow/LIME, Digicel, BTC (Bahamas), Smart (Belize), UTC/Chippie (Curaçao), Kia (Bonaire), Only (Martinique), and TSTT/Bmobile (Trinidad and Tobago)
Coaxial cable	Broadband over coax cable	100 Mbps	Bahamas Cable, Flow (Antigua, Barbados, Curaçao, Grenada, Jamaica, St. Lucia, St. Vincent and the Grenadines, and Trinidad), and Digicel (Anguilla, Dominica, Jamaica, Montserrat, Nevis, and Turks and Caicos Islands)
Fibre-optic cable	FTTx/xPON	>100Mbps	In countries such as Barbados and Jamaica, Flow has been deploying fibre to the home, with maximum download speeds of 300 Mbps. Digicel is deploying fibre networks in Barbados, Haiti, Jamaica and Trinidad.

Table 3.3. Technologies Delivering Internet Service in the Caribbean (Source: ICT Pulse[56], project survey)

55 Worldwide Interoperability for Microwave Access.

56 ICT Pulse (2011). "EDGE, WiMAX, 3G, 4G: what's the difference?" http://www.ict-pulse.com/2011/07/edge-wimax-3g-4g-what's-the-difference.

Transmission Speeds

According to the ITU, the standard for broadband is a transmission speed of at least 1.5–2.0 Mbps.[57] Other organisations, such as the Organisation for Economic Co-operation and Development (Oecd), have adopted the following minimum speeds for wired and wireless broadband Internet services[58]:

- Basic broadband: 256 kbps (download), 128 kbps (upload)
- Advanced broadband: 2 mbps (download), 512 kbps (upload)
- Total broadband—a service that can support all applications available on the Internet: 10 Mbps (download), 768 kbps (upload).

Figure 3.3 shows a rolling average of actual upload and download speeds for fixed broadband (wired and wireless) networks over a 30-day period ending in February 2015 in the countries under review (with the exception of Sint Maarten, for which data was not recorded). The data was sourced from speed tests that were conducted; these were carried out within 300 miles of the server.[59]

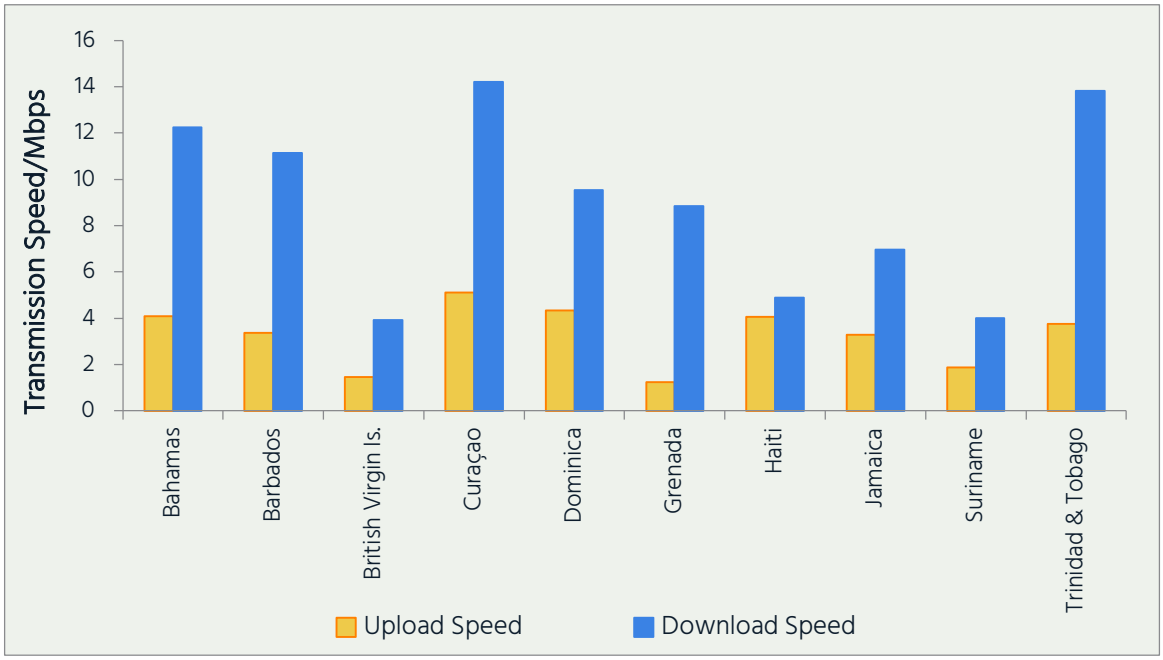


Figure 3.3. Upload and Download Broadband Speeds in Selected Caribbean Countries, 2015 (Source: Ookla[60])

As can be seen, there is a wide disparity in transmission speeds across the region. The slowest upload and download speeds were recorded in the British Virgin Islands (1.46 Mbps and 3.92 Mbps, respectively), while the fastest upload and download speeds were recorded in Curaçao (5.11 Mbps and 14.21 Mbps, respectively). Even the speeds in Curaçao are below the global average of 10 Mbps (upload) and 22 Mbps (download).

With regard to the extent to which Caribbean households have access to connections that can support total broadband service, only four of the countries shown have download speeds over 10 Mbps: the Bahamas, Barbados, Curaçao, and Trinidad and Tobago. However, all 10 countries recorded upload speeds in excess of the 768 kbps standard. The results suggest that while Caribbean users will have a reasonably good experience in accessing some applications and services online, the quality of bandwidth-heavy services such as video streaming is likely be affected in countries where the average download speed is under 10 Mbps.

57 ITU (2011). "ITU and its Activities Related to Internet Protocol (IP) Networks. Chapter Seven: Case Study – How ITU's Broadband Standards Improve Access to the Internet". http://www.itu.int/osg/spu/ip/chapter_seven.html.

58 OECD (n.d.). "ECLAC Proposes Parameters for Defining Broadband in Latin America". http://www.cepal.org/cgi-bin/getProd.asp?xml=/socinfo/noticias/noticias/4/44884/P44884.xml&xsl=/socinfo/tpl-i/p1f.xsl&base=/socinfo/tpl/top-bottom.xslt.

59 Ookla. "Ookla Net Index". http://www.netindex.com. (Note: this service has been discontinued.)

60 Ibid.

It should be noted that, in order to fully compare the utility of Internet access in the various countries, the traffic caps on services imposed by operators need to be taken into account. Such caps can significantly restrict the amount of multimedia consumption, particularly when using mobile broadband networks, where data packages can be prohibitively expensive for lower-income groups.

Critical Internet Resources

"Critical Internet resources" are essential elements in an Internet network without which Internet connectivity would not be possible. The term is also used to identify those resources that should be located in-country to facilitate continued Internet communication in the event that international links to the wider Internet fail. For the purposes of this study, three critical resources will be discussed: root name servers, country-code top-level domain (ccTLD) name servers, and IXPs.

Root Name Servers

Worldwide, there are 12 independent organisations running 13 root servers. These are "a key element of the underlying domain name system [DNS] infrastructure of the Internet"[61] as they provide an authoritative directory of network addresses. Within the Caribbean, five of the countries in this study have a copy of a root name server in-country (Table 3.4).

Country	Location	Server Type	Operator
Dominica	Roseau	D, E	University of Maryland, NASA Ames Research Centre
Grenada	St. George's	D	University of Maryland
Haiti	Port au Prince	D, F	University of Maryland, Internet Systems Consortium, Inc.
Jamaica	Kingston	F	Internet Systems Consortium, Inc.
St. Maarten	Philipsburg	F	Internet Systems Consortium, Inc.
Trinidad and Tobago	Port of Spain	D, E	University of Maryland, NASA Ames Research Centre

Table 3.4. Root Name Servers Located in Select Caribbean Countries (Source: root-servers.org[62])

Countries with a local root name server enjoy the major benefit of improved speed in resolving Web addresses, including translating uniform resource locators (URLs) and host names into network-readable addresses. For end users, this means reduced page-loading times. In addition, from a national security perspective, a local root name server facilitates greater self-sufficiency and resilience, because URLs and email addresses can be resolved in-country—there is no need to access the wider Internet or a server located overseas.

Country-Code Top-Level Domain (ccTLD) Name Servers

All 11 countries under review have their own country-code top-level domain (Table 3.5). However, not all countries directly manage the registry for their ccTLD: the British Virgin Islands, Dominica and Grenada delegate that authority to an international firm, KSregistry GmbH, while in the remaining countries, the registry responsibilities reside in universities (e.g., the Bahamas, Curaçao and Jamaica), government/public authorities (e.g., Barbados, Haiti and Trinidad and Tobago), and other third-party firms (e.g., Sint Maarten and Suriname).

61 ICANN (2008). "Milestone Agreement Reached Between ICANN, and F Root Server Operator, Internet Systems Consortium | First-of-its-kind agreement recognizes mutual responsibilities, supports enhanced Internet stability". https://www.icann.org/news/announcement-2008-01-04-en.

62 http://www.root-servers.org/.

Country	ccTLD	Registry	Sponsor
Bahamas	.bs	BSNIC (College of the Bahamas)	College of the Bahamas
Barbados	.bb	Telecoms Unit (Government of Barbados)	Government of Barbados
British Virgin Islands	.vg	Ksregistry GmbH/nic.VG	Telecommunications Regulatory Commission
Curaçao	.cw	University of Curaçao	University of Curaçao
Dominica	.dm	Ksregistry GmbH/nicDM	DotDM Corporation
Grenada	.gd	Ksregistry GmbH/nicGD	NTRC Grenada
Haiti	.ht	nic.ht	Consortium FDS/RDDH
Jamaica	.jm	University of the West Indies	University of the West Indies (Jamaica)
St. Maarten	.sx	SX Registry SA B.V.	SX Registry SA B.V.
Suriname	.sr	Telesur	Telesur
Trinidad and Tobago	.tt	Trinidad and Tobago Network Information Centre	University of the West Indies (Trinidad)

Table 3.5. Status of ccTLDs in Select Caribbean Countries (Source: IANA[63])

The ccTLDs for Curaçao (.cw) and Sint Maarten (.sx) are relatively new, having been introduced in 2012. Prior to that, the countries used ".an" for the Netherlands Antilles, but on 10 October 2010, the Netherlands Antilles group was officially dissolved.[64] Following the dissolution, Curaçao and Sint Maarten became distinct territories within the Dutch Kingdom, and were each assigned their own ccTLD.

Internet Exchange Points

The main purpose of an IXP is to keep local Internet traffic local, and thereby reduce costs and improve the performance associated with traffic exchange between ISPs.[65] Furthermore, from a national security perspective, locally hosted and locally destined content does not have to exit and re-enter a country's borders; it can be routed through a locally established IXP, essentially creating a national Internet network. In the Caribbean, if there were no IXPs present, *all* Internet traffic between users of different networks would probably have to be routed through the United States,[66] even if the sender and the recipient were in the same country.

At the time of publication, 9 of the 11 countries have IXPs (Table 3.6). The two countries without are the Bahamas and Suriname.

63 IANA. "Root Zone Database". http://www.iana.org/domains/root/db.

64 The countries comprising the Netherlands Antilles were Aruba, Bonaire, Curaçao, Sint Maarten, Saba, and Sint Eustatius.

65 Internet Society. "Internet Exchange Points (IXPs)". http://www.internetsociety.org/what-we-do/issues/internet-exchange-points-ixps.

66 Especially the network access point (NAP) for the Americas in Miami, Florida.

Country	City	Internet Exchange Name	Users	Traffic/ Gbps	Established
Barbados	Bridgetown	Barbados Internet Exchange	*	*	February 2014
British Virgin Is.	Road Town	British Virgin Islands IXP (BVIX)	*	*	June 2011
Curaçao	Willemstad	Caribbean Internet Exchange	13	8.140	April 2009
Dominica	Roseau	Dominica National IXP (DANIX)	6	0.068	February 2013
Grenada	St. Georges	Grenada Internet Exchange (GREX)	6	0.003	May 2011
Haiti	Port au Prince	AHTIC IXP	9	0.479	May 2009
Jamaica	Kingston	Jamaica IXP	*	*	August 2014
Sint Maarten	Philipsburg	Open Caribbean Internet Exchange (OCIX)	8	1.080	October 2008
Trinidad & Tobago	Barataria	Trinidad and Tobago Internet Exchange (TTIX)	7	0.350	April 2014

Table 3.6. IXPs in the Caribbean (Sources: Packet Clearing House[67], local newspapers[68]) *No data available.

Based on the survey data, all of the participating countries that have an IXP, with the exception of the British Virgin Islands, have local DNS caches. The presence of an IXP can attract content providers, such as Google, Akamai and Netflix, to deploy in-country content servers which significantly improve the speed of delivery and cut international bandwidth costs for network operators. Curaçao has successfully realised this, having attracted Google and Akamai to join the Caribbean Internet Exchange (CAR-IX); as a result, cached content is locally available to the other CAR-IX users, resulting in much lower latency[69] and reduced cost[70]. In addition, Cable & Wireless is using its ownership of international submarine cable capacity to serve customers in a number of islands with Google Global Cache[71] content hosted in Jamaica.

67 Packet Clearing House. "Internet Exchange Directory". https://prefix.pch.net/applications/ixpdir/?new=1&show_inactive=1&sort=Country&order=asc.

68 Barbados Government Information Service (2014). "Barbados To Establish IXP". http://gisbarbados.gov.bb/blog/barbados-to-establish-ixp/.

69 *Latency* is the time elapsed between the transmission of Internet protocol (IP) packets from the originator and reception of those IP packets at the receiver. It is one of the four parameters that define the quality of service (QoS) of an Internet connection. See 03b Networks, *What is Network Latency and Why Does It Matter?* http://www.o3bnetworks.com/wp-content/uploads/2015/02/white-paper_latency-matters.pdf.

70 Flow (2011). *Developing and Promoting ICTs in Grenada.* http://www.ctu.int/download/EdmundBurkeFLOW_PromotingICT_inGrenada2011.pdf.

71 Google. "Our Edge Network is how we connect with ISPs to get traffic to and from users". https://peering.google.com/#/, https://isp.google.com/iwantggc/.

Summary

In general, the Caribbean has a relatively comprehensive Internet infrastructure. Most of the countries that were reviewed have at least two separate submarine cable systems landing within their jurisdiction, offering some redundancy with respect to the circuits and networks available. Recent regionwide mergers and acquisitions, however, have reduced carrier redundancy: now, a single carrier tends to own more than one submarine cable system, thereby lessening competition in the wholesale and international segments.

National and last-mile networks typically comprise a combination of fibre-optic, copper and wireless technologies. The quality of the Internet, in terms of transmission speeds, varies widely across the region, yet most households are able to obtain a download speed of at least 2 Mbps, which satisfies the ITU's definition of broadband Internet and, according to the OECD, supports advanced broadband services.

Finally, with regard to the critical Internet resources that countries ideally should manage themselves in order to increase their Internet infrastructure security, more than half of the countries examined have their root name servers located in-country, and eight have their ccTLD name servers in-country. Nine of the 11 countries have established national IXPs, and virtually all of the countries have DNS caches, which can improve the end-user experience by speeding up website access and page loading, and reducing latency.

4 Internet Adoption and Use

A key measure of success of any carrier's investment in deploying an ICT network is the extent to which consumers access and use the network. Another significant measure of success is whether a reasonable return on investment in infrastructure and service deployment is realised. Mainstream Internet services were launched in the Caribbean in the early to mid-1990s, starting with dial-up over copper lines. Today, service is delivered via coaxial, copper and fibre-optic cables, and wirelessly using third- and fourth-generation technologies, Wi-Fi and WiMAX.

In this chapter, we examine the adoption and use of the Internet in the Caribbean, with a particular focus on the 11 countries under review. We explore Internet usage, subscription density for Internet services, the affordability of both fixed broadband and mobile/cellular Internet, and the possible impact of mobile/cellular services on Internet adoption and use.

Usage

Over the six-year period ending in 2015, the percentage of the population that was considered Internet users increased steadily in most of the countries studied (Figure 4.1). The greatest increase within that period was recorded in the Bahamas, where the percentage of Internet users jumped approximately 35 percentage points, from an initial 43% in 2010 to 78% in 2015. The smallest change over that same period, an increase of 3.8 percentage points, from 8.4% in 2010, was recorded in Haiti.

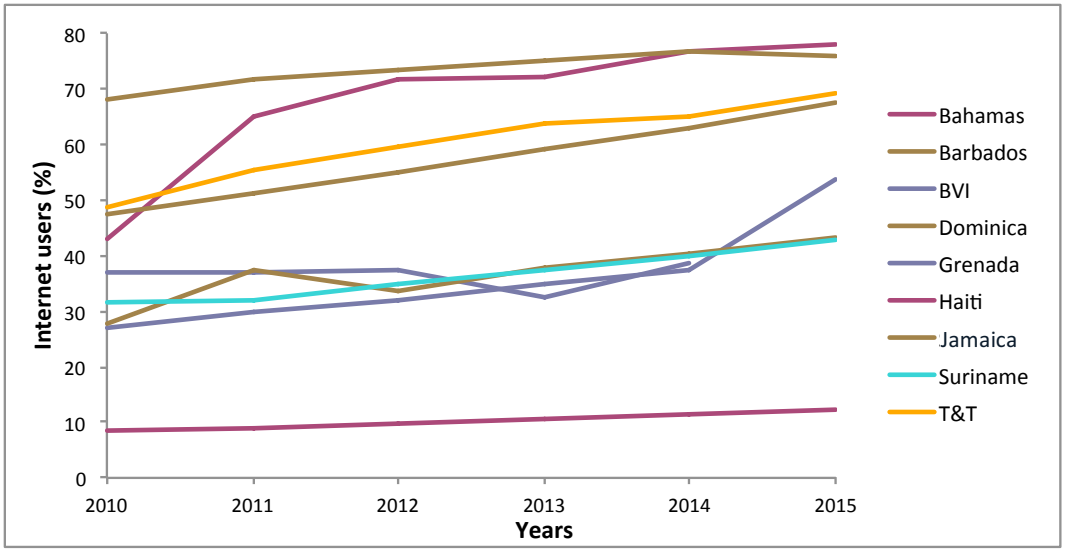


Figure 4.1. Percentage of Individuals Using the Internet in Select Caribbean Countries, 2010–15 (Source: ITU[72])

An examination of the state of Internet usage as of 2015 showed that the countries with relatively high per capita GNI, such as the Bahamas, Barbados, and Trinidad and Tobago, also recorded the highest percentage of Internet users (Figure 4.2). Similarly, those with relatively low per capita GDPs, such as Haiti, Jamaica and Suriname, recorded considerably lower Internet usage densities.

72 Extrapolated from ITU, "Percentage of individuals using the Internet". http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2016/Individuals_Internet_2000-2015.xls.

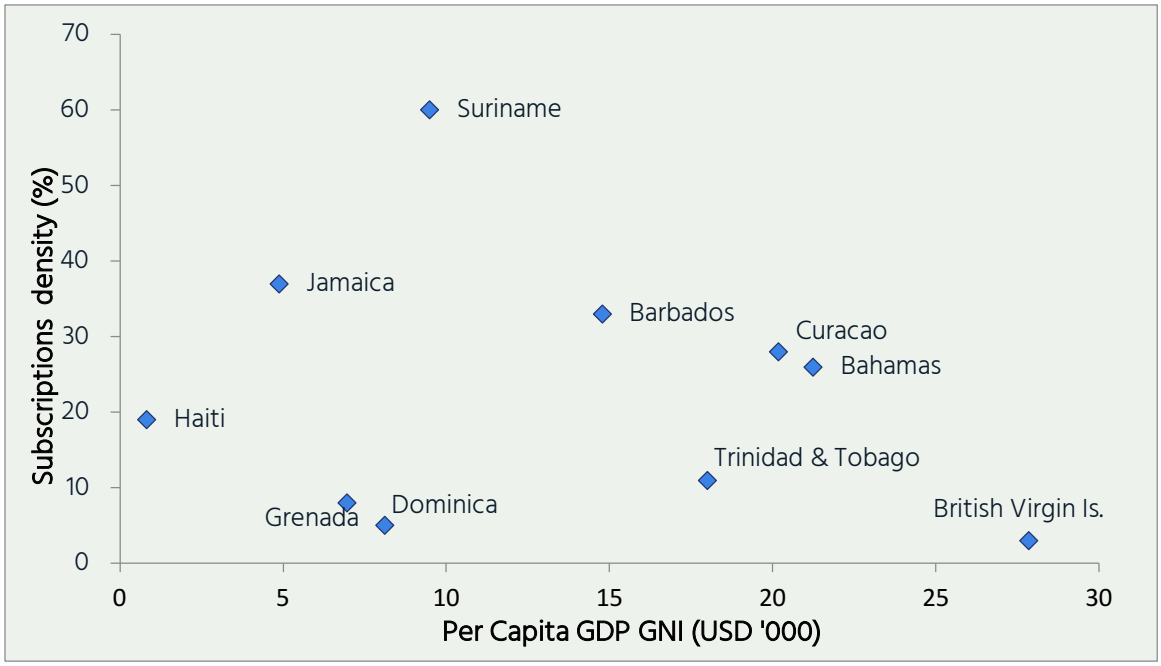


Figure 4.2. Percentage of Individuals Using the Internet in Select Caribbean Countries, 2015 (Source: ITU,[73] UN[74])

Subscription Density

In this section, three additional measures of Internet service uptake are discussed in order to provide a more comprehensive picture of Internet use in the Caribbean: the subscription density of fixed broadband, the number of households with Internet access, and the penetration of mobile/cellular broadband subscriptions.

Fixed Broadband

Figure 4.3 (following page) shows the subscription density for fixed broadband Internet services over a six-year period, 2010 through 2015. Reflecting slow growth in fixed-line infrastructure, the density has been increasing slowly but steadily for most countries. The greatest net change in subscription levels was recorded in the Bahamas (14.1 subscriptions added per 100 inhabitants), followed by Dominica and Trinidad and Tobago (9.2 and 8.4 subscriptions per 100 inhabitants, respectively).

73 Ibid.

74 UNdata. http://data.un.org/.

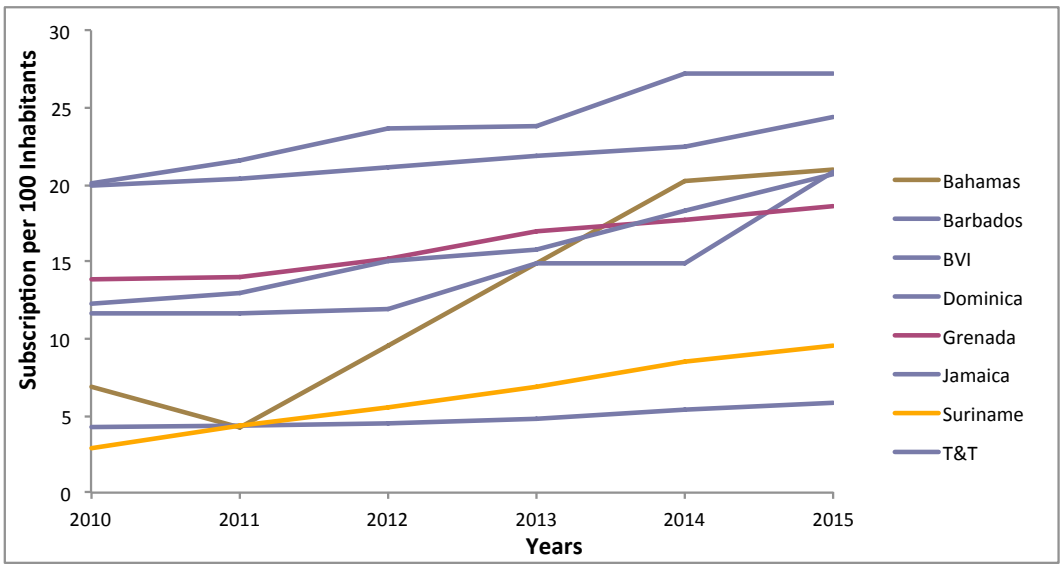
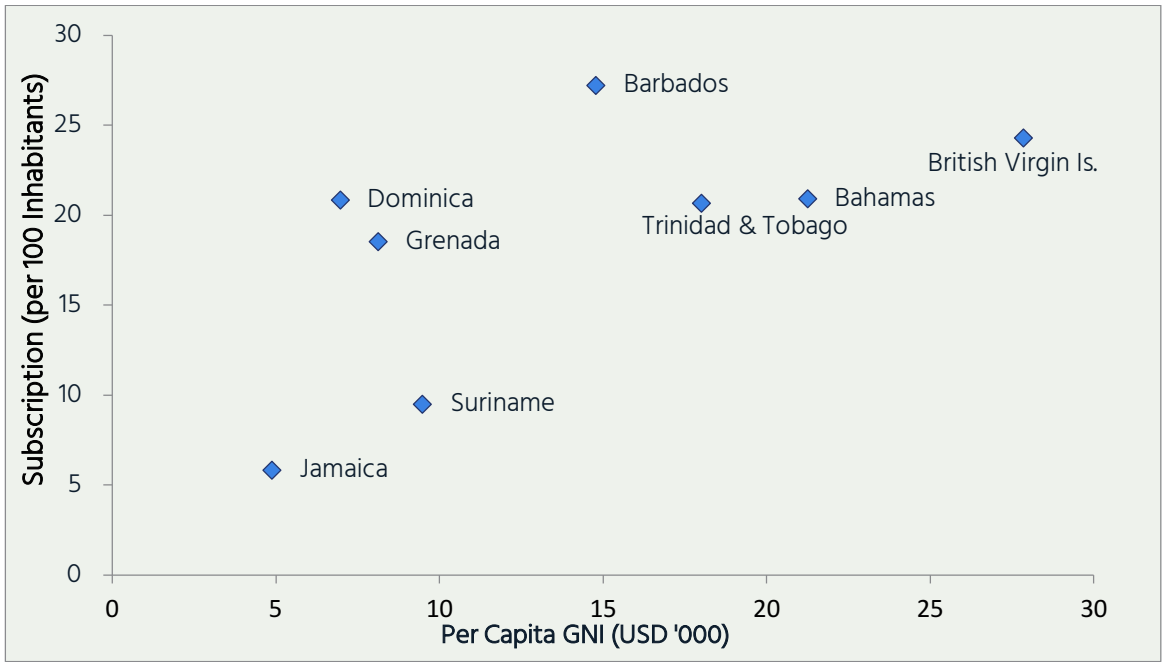


Figure 4.3. Fixed Broadband Internet Subscription Density in Select Caribbean Countries, 2010–15 (Source: ITU[75])

An exception of note is the Bahamas, where the fixed broadband Internet subscription density decreased by nearly 3 percentage points between 2010 and 2011. A possible contributor to that trend could have been the strong rise in mobile/cellular subscriptions at that time in the Bahamas, which resulted in individuals cancelling their fixed-line subscription and relying exclusively on mobile/cellular phones for their communication needs. However, from 2012, there has been considerable growth in the take-up of fixed broadband services, which could be attributed to increasing demand for competitively priced, high-speed Internet services.

An examination of the latest publicly available subscription-density figures indicates that, as expected, countries such as Jamaica and Suriname that have relatively low per capita GNIs also tend to have low fixed broadband subscription densities (Figure 4.4, following page). The converse appears true for Barbados, the British Virgin Islands, and Trinidad and Tobago.



75 ITU (2016). "Fixed (wired)-broadband subscriptions". http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2016/Fixed_broadband_2000-2015.xls.

Figure 4.4. Fixed Broadband Internet Subscription Density in Select Caribbean Countries, 2015 (Source: ITU[76] UN[77])

Households with Internet Access

Figure 4.5 provides a comprehensive overview of Internet service penetration in the Caribbean by focusing on the subscription density among households of Internet services (not solely fixed broadband) in the countries under review for which data was publicly available.

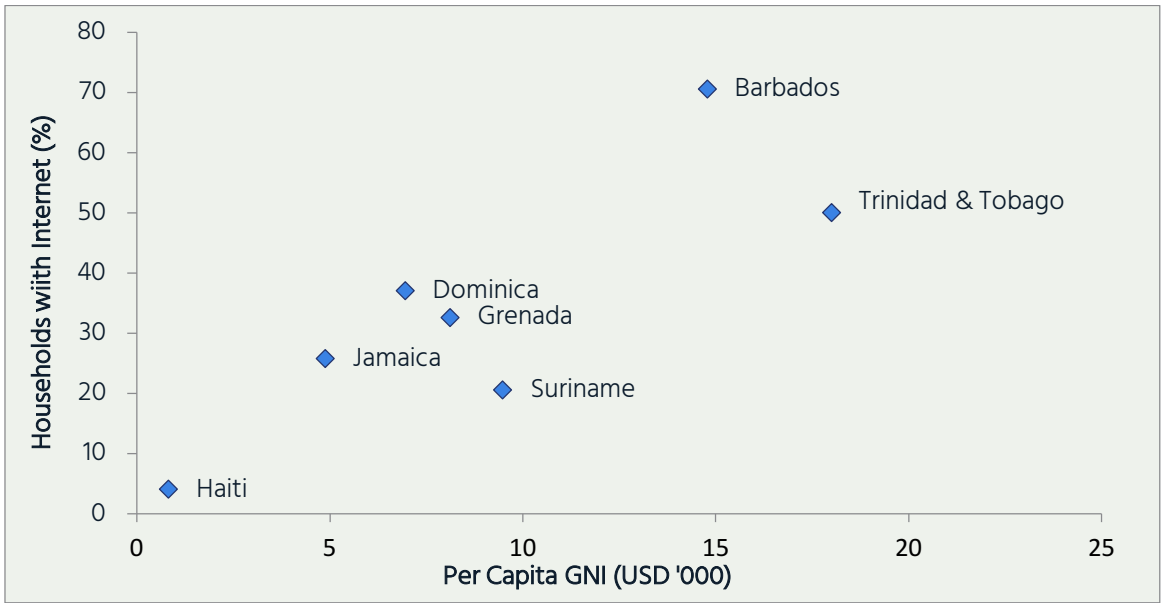


Figure 4.5. Percentage of Households with Internet Service in Select Caribbean Countries, 2014 (Source: Broadband Commission[78], UN[79])

Data reveal that, in general, subscription densities across the region appear to increase with increasing per capita GNI. While higher per capita GNIs can indicate the extent to which a country's citizens can afford luxury goods, there may also be a relationship between household subscription densities and network coverage. A high household subscription density could indicate more extensive population coverage of Internet networks, resulting in greater access to and availability of Internet services.

Mobile/Cellular Broadband

As mobile/cellular technology that supports the Internet continues to be rolled out across the Caribbean—and consumers secure devices that better allow that capability—mobile/cellular broadband will become increasingly commonplace, particularly if prices for mobile data access drop. Figure 4.6 shows mobile/cellular broadband subscription penetration versus per capita GNI in five countries where data has been recorded or estimated.

Although mobile/cellular broadband service is still relatively new, its subscription density has outstripped that for fixed broadband subscriptions, but it has not yet exceeded the percentage of households with Internet in most of the countries for which a comparison can be made. As mobile/cellular providers shift their focus from voice to data-related services, however, the rates will become more attractive, and promotion of mobile/cellular broadband will increase. As a result, subscriptions levels are expected to increase considerably.

76 Ibid.

77 UNdata. http://data.un.org/.

78 Broadband Commission for Digital Development (2014). *The State of Broadband 2014: Broadband for All*, pp. 100–101. http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf.

79 UNdata. http://data.un.org/.

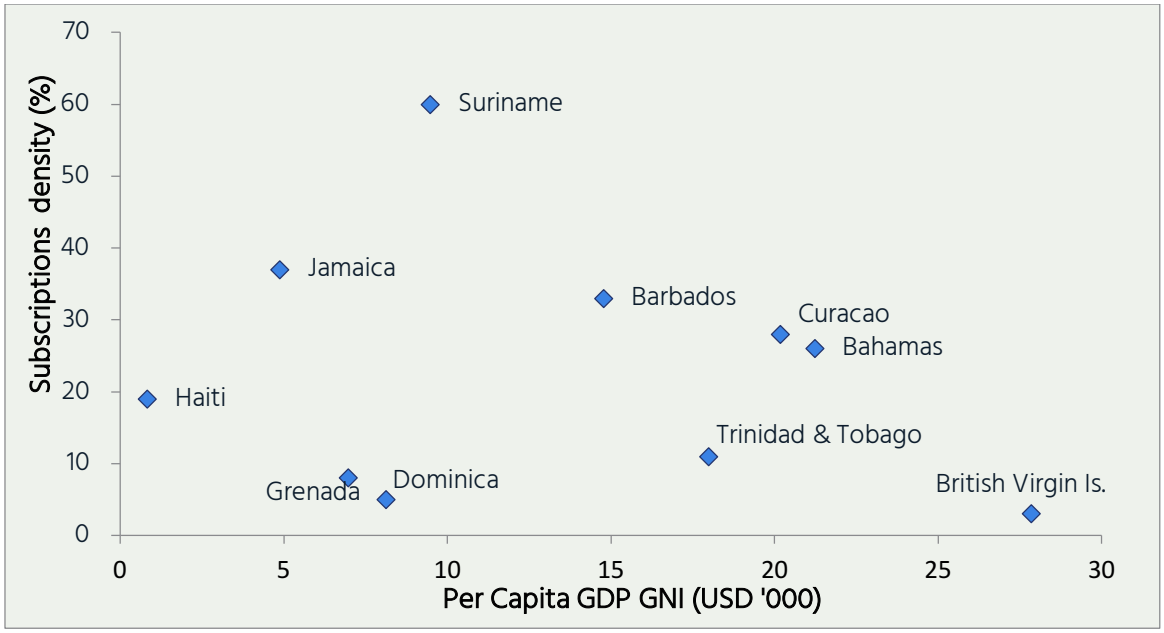


Figure 4.6. Active Mobile/Cellular Broadband Subscription Density in Select Caribbean Countries, 2015 (Source: Broadband Commission[80], UN[81])

An anomaly of note is the British Virgin Islands, which has the highest per capita GNI of the countries examined, but has a mobile/cellular broadband subscription density more consistent with countries with a much lower per capita GNI. This may be attributed in part to the fact that, although the country has one of highest mobile/cellular subscription densities in the region, its Internet use is unusually low at just 38.% of the population in 2014.[82] The local regulator has indicated that affordability of telecommunications services is still an issue, limiting the participation of citizens in the country's nascent Internet economy.[83]

Service Affordability

For most individuals, a critical consideration when deciding whether to subscribe to an Internet service is its affordability relative to other expenses. Figure 4.7 shows the average portion of an individual's monthly income that would be spent on a fixed broadband Internet plan with an advertised download speed of 2 Mbps with uncapped data capacity (the norm in the Caribbean for fixed broadband Internet).

80 GSMA Intelligence. http://www.gsmaintelligence.com.

81 UNdata. http://data.un.org/.

82 ITU (2016). "Percentage of individuals using the Internet". http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2016/Individuals_Internet_2000-2015.xls

83 Telecommunications Regulatory Commission (2014). *Telecommunications Markets in the British Virgin Islands 2009–2013.* http://www.trc.vg/images/attachments/Market_Data_2015/telecommunications%20markets%20in%20the%20bvi%202009-2013_powerpoint%20-%20pubic%20version.pdf.

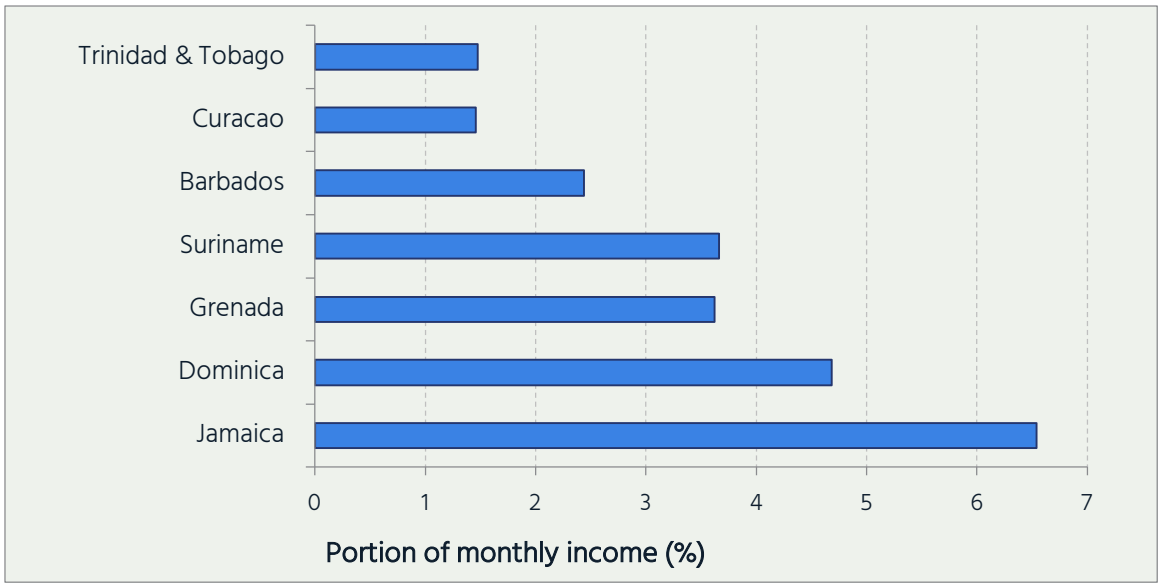


Figure 4.7. Portion of Monthly Income as a Percentage for 2 Mbps Fixed Broadband Internet Plans in Select Caribbean Countries, 2015 (Source: ICT Pulse[84], UN[85])

The portion of income a 2 Mbps fixed Internet plan was likely to consume ranged from just over 1.2% in Trinidad and Tobago to nearly 6.5% in Jamaica. Averaged across the countries examined, the portion of a typical monthly income that would be expended is approximately 3.4%.[86]

The average percentage of income that was spent on mobile/cellular Internet plans with a data cap of 1 GB ranged from approximately 0.5% in Barbados to more than 2.5% in Grenada (Figure 4.8). Across the countries assessed, the average proportion of a typical monthly income was approximately 1.4%.

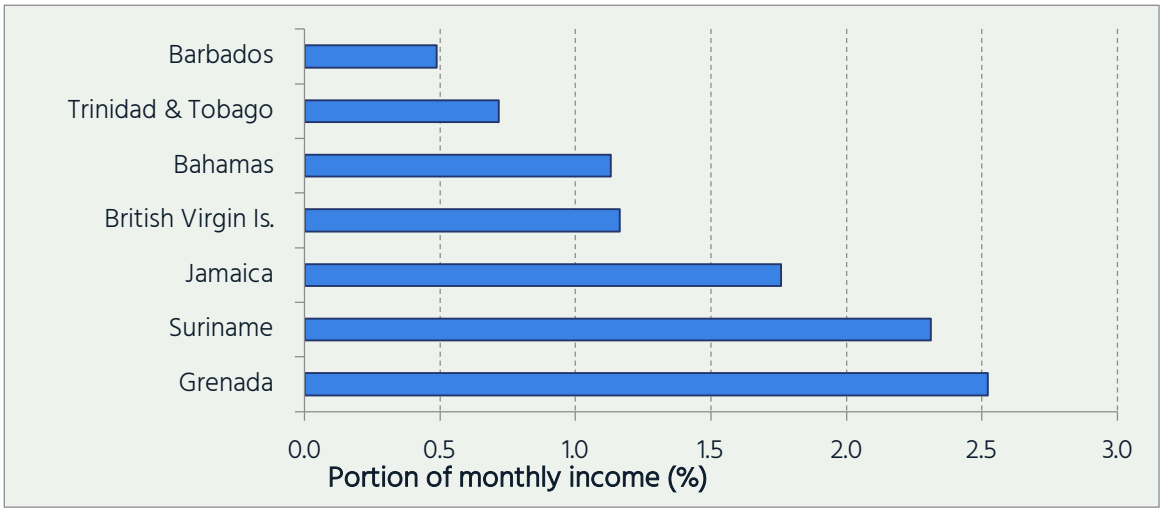


Figure 4.8. Portion of Monthly Income Spent on Mobile/Cellular Data Plans with a 1 GB Cap in Select Caribbean Countries, July 2014 (Source: ICT Pulse[87], UN[88])

In both instances, the plans—2 Mbps for fixed broadband Internet and 1 GB data cap for mobile/cellular Internet—can be considered the most basic that can be secured. It is emphasised, however, that both of those services are likely to be

84 ICT Pulse (2014). "Snapshot: update on the affordability of Internet service in the Caribbean in 2014" http://www.ict-pulse.com/2015/06/snapshot-2015-update-affordability-internet-service-caribbean/.

85 UNdata. http://data.un.org/.

86 Data was not readily available for Sint Maarten and Haiti. The ISPs in the Bahamas and the British Virgin Islands did not offer a 2 Mbps plan (although faster plans were available).

87 ICT Pulse (2014). "Snapshot: 2014 update on mobile data affordability in the Caribbean". http://www.ict-pulse.com/2014/07/snapshot-2014-update-mobile-data-affordability-caribbean/.

88 UNdata. http://data.un.org/.

add-ons to a fixed-line telephony or mobile/cellular plan, and hence would merely be a portion of the total monthly amount an individual might spend on telecommunications services.

One of the global targets set by the Broadband Commission for Digital Development is for broadband services to consume less than 5% monthly GNI per capita.[89] In its 2014 review of the state of broadband worldwide, the Commission noted, "The majority of countries had reached the Commission's target of offering basic fixed-broadband services at <5% of monthly GNI per capita, but broadband still remains unaffordable in many parts of the developing world."[90]

In the Caribbean, six out of the seven countries shown in Figure 4.7 achieved the Commission's target. The data, however, which use GNI as the national average, do not take into account the wide distribution of income levels in the region: there are still many people in lower-income groups that would be unable to afford a fixed Internet plan or a reasonable level of mobile broadband data usage.

Impact of Mobile/Cellular Service on Internet Adoption and Use

As discussed previously, although the subscription density for fixed broadband Internet is relatively low—for example, a maximum of 25 subscriptions per 100 inhabitants in Barbados—the actual number of Internet users can be up to three times higher, indicating a relatively high level of sharing. Although resources like Internet cafés and telecentres exist in the Caribbean, they are not as prevalent as in other regions; thus, such resources might be a limited contributor to the reported Internet usage figures. As a result, the higher usage figures are probably attributable to the use of multiple devices connected to the same upstream Internet link.

The introduction of low-cost mobile/cellular devices to the Caribbean in the early 2000s resulted in their proliferation. As of 2015, mobile/cellular subscription penetration ranged from approximately 80 subscribers per 100 inhabitants in Haiti to more than 175 subscribers per 100 inhabitants in Suriname, where users are likely to have multiple subscriptions to different operators in order to take advantage of the lower rates for on-network calls. Across the countries sampled, subscriptions averaged 132 subscribers per 100 inhabitants (Figure 4.9). As with other developing regions, prepaid mobile/cellular subscriptions predominate over post-paid subscriptions, as they offer consumers budgetary control while still providing the ability to access services.

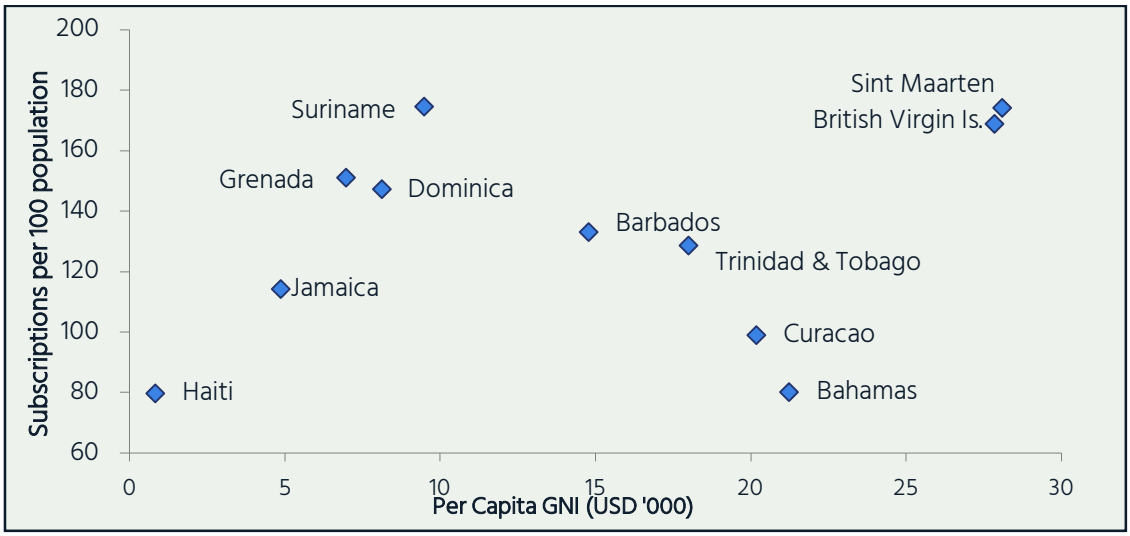


Figure 4.9. Mobile/Cellular Penetration in Select Caribbean Countries, 2015 (Sources: GSMA Intelligence[91], UN[92])

89 Broadband Commission for Digital Development (n.d.). Advocacy Target 2: Making broadband affordable – by 2015, entry-level broadband services should be made affordable in developing countries. http://www.broadbandcommission.org/Documents/Targets-Separated/Target-2.pdf.

90 Broadband Commission for Digital Development (2014). *The State of Broadband 2014: Broadband for All*, p. 39. http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf.

91 GSMA Intelligence. http://www.gsmaintelligence.com.

92 UNdata. http://data.un.org/.

Fixed–Mobile Substitution (FMS)

The availability of low-cost mobile/cellular service to large segments of the population that did not previously have access to a basic telecommunications service, plus the resulting widespread adoption, has outstripped fixed-line subscriptions across the region (Figure 4.10). In 2000, the average mobile/cellular subscription density was less than a quarter of that of the fixed-line service. The densities averaged 8 subscriptions per 100 inhabitants for mobile services, and 30 subscriptions per 100 inhabitants for fixed services. By 2015, however, the average mobile/cellular subscription density was nearly five times that of fixed-line, having jumped to approximately 120 subscriptions per 100 inhabitants, while the number of fixed line subscriptions declined slightly.

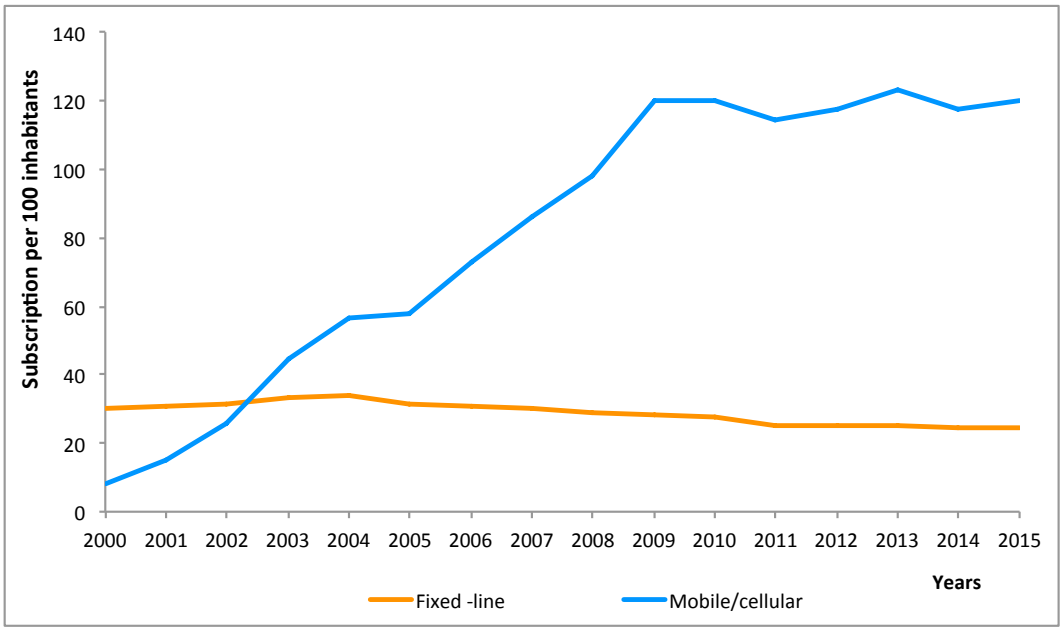


Figure 4.10. Average Fixed-line and Mobile/Cellular Subscription Penetration Trends in Select Caribbean Countries, 2000–15 (Source: ITU[93])

As Figure 4.10 indicates, there has been a steady but small decline in fixed-line subscription density across the region over the past 15 years, from approximately 30 subscriptions per 100 inhabitants to 25 subscriptions per 100 inhabitants. This decline is mostly attributed to FMS, in which consumers abandon the fixed-line telephone service in favour of mobile/cellular communication services. The high mobile/cellular subscription levels that now exist throughout the Caribbean have effectively made mobile/cellular the medium of choice for the average residential customer to access Internet services.

FMS has been a phenomenon worldwide, both in developed and developing countries. Figure 4.11 (following page) shows that across 228 territories worldwide, the trend for the average fixed-line and mobile/cellular subscription penetration mimics that shown for the Caribbean in Figure 4.10. Historically, the fixed-line telephony service was expensive and generally limited to urban areas. The introduction of low-cost mobile/cellular service, which was both more affordable and more readily accessible in less urban and rural areas, provided an attractive option to citizens, who either could not afford the fixed-line service or were not located in areas where the service was available.

93 ITU (2016). "ICT Facts and Figures 2016 – Time Series by Country". http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

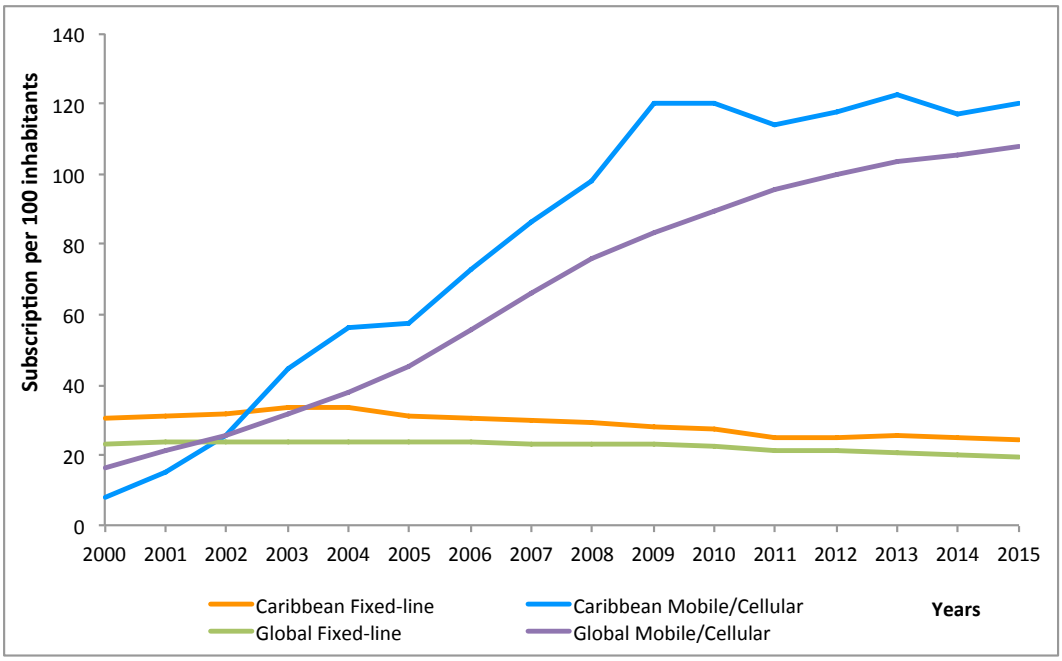


Figure 4.11. Average Fixed-line and Mobile/Cellular Subscription Penetration Trends in 228 Territories Worldwide and select Caribbean countries, 2000–15 (Source: ITU[94])

Mobile/Cellular Data and Wi-Fi

Over the past decade, smartphones have become increasingly available at a broad range of price points (Figure 4.11), and they have become the most common means by which the general public accesses the Internet. As a result, carriers appear to be aggressively promoting their mobile data services by offering a wide variety of plans, particularly to prepaid consumers. And their strategies seem to be working: Jamaica's Digicel reportedly sold more than 60,000 smartphones in 30 days in November 2014,[95] and in September 2014, the firm registered its one-millionth mobile data customer.[96]

In addition, the two main mobile/cellular carriers across the region, Digicel and Flow, have both implemented zero-rating for some popular online platforms, including Facebook, WhatsApp, Instagram, Twitter and Wikipedia.[97, 98]

When zero-rating has been established, customers can access specific sites or services on their smartphones without consuming any data under their mobile/cellular data cap allowance. Zero-rating is frequently criticised as being anticompetitive, and inconsistent with the principles of network neutrality. It can be argued, however, that it actually narrows the digital divide by fostering greater online participation by users who might not readily afford service, as well as by stimulating the demand for and use of mobile data.[99, 100]

94 Ibid.

95 Jamaica Observer (2014). "Smartphones hot for Christmas", published 23 December 2014. http://www.jamaicaobserver.com/news/Smartphones-hot-for-Christmas_18136982.

96 Jamaica Observer (2014). "Digicel surprises one millionth customer with $1m". http://www.jamaicaobserver.com/news/Digicel-surprises-one-millionth-customer-with--1m_17464210.

97 Jamaica Observer (2015). "Digicel Offers Free Social Networking For All Data Customers". http://ow.ly/IYD93076kiv.

98 C&W Communications (2015). *Cable and Wireless and Wikimedia Foundation Sign Partnership Deal.* http://www.cwc.com/live/news-and-media/press-releases/cable-and-wireless-and-wikimedia-foundation-sign-partnership-deal.html.

99 A workshop entitled "SIDS Roundtable: the 'Free Internet' – Bane or Boon?" exploring this theme, including multiple competing perspectives and relevant recommendations, was held at the 10th Internet Governance Forum in Joao Pessoa, Brazil, on 12 November 2015. For a report on the roundtable and information about the session, see http://digitalwatch.giplatform.org/sessions/sids-roundtable-free-internet-bane-or-boon. A video recording of the session is available at https://www.youtube.com/watch?v=W91f9Q8CccA.

100 Zero-rating has become a contentious debate, specifically as it concerns the digital divide, development, and the Global South.
For a perspective challenging the notion that zero-rating is beneficial to narrowing the digital divide, see Kivuva, M. (2015) "Zero Rating, a Poisoned Chalice for the Developing World", http://www.circleid.com/posts/20151124_zero_rating_a_poisoned_chalice_for_the_developing_world/.
For a view in support of the notion, see Donoso, J. (2016) "The Biggest Beneficiary from Zero-Rating: The Developing World". http://www.freedomworks.org/content/biggest-beneficiary-zero-rating-developing-world.

The 11.11.11 ON—Wi-Fi Barbados Project[101, 102]

In November 2011, the prime minister of Barbados, David Thompson, stated the goal of realising ubiquitous Internet access "from bus stop to rum stop". Inspired by this, the Barbados Entrepreneurship Foundation (BEF) launched a campaign among the Barbados business community to achieve free, island-wide Wi-Fi connectivity within one year. The BEF campaign, "11.11.11 ON—Wi-Fi Barbados", encouraged businesses to configure their internal networks to include a guest/public network that allowed free wireless Internet access. The BEF also bore the cost of restructuring their networks, which ran from a few hundred to a few thousand US dollars.

The BEF recognised a number of potential benefits to the country if 100% Wi-Fi coverage was achieved, including improved international competitiveness, a reduction in the digital divide, and increased tourism and business opportunities.

By 2013, more than 100 free Wi-Fi access points had been established and 75% of Barbados' population was able to access those services.[103]

Furthermore, the widespread ownership of smartphones means that consumers can connect to the Internet via Wi-Fi, which is increasingly available across the region. Free public Wi-Fi is being encouraged in public institutions, such as post offices, schools, and specifically libraries; while in the private sector, businesses are making portions of their wireless networks available to the public in commercial areas, to improve the user experience.

While the Barbados Wi-Fi project is one of the best known in the region, other countries, such as Curaçao, have introduced similar initiatives, most of them on a smaller scale. Saint Lucia recently announced its intention to realise islandwide coverage, but unlike the private-sector-driven Barbados project, this initiative is government-driven as part of the government's Island-Wide Network Project, scheduled for completion in 2018[104].

Free Wi-Fi in Downtown Willemstad, Curaçao[105]

Launched by the Curaçao Tourism Board in December 2013, the project to provide free Internet in downtown Willemstad sought to make free Internet services available to tourists, specifically passengers of cruise ships visiting the island. Visitors can access free Wi-Fi connectivity at the Mega Pier and at the Otrobanda and Punda areas.

101 ICT Pulse (2011). "From bus stop to rum shop: how Barbados plans to achieve 100% Wi-Fi coverage". http://www.ict-pulse.com/2011/06/from-bus-stop-to-rum-shop-how-barbados-plans-to-achieve-100-wi-fi-coverage.

102 ICT Pulse (2011). "From bus stop to rum shop: has Barbados' Wi-Fi project been a success?" http://www.ict-pulse.com/2011/11/from-bus-stop-to-rum-shop-has-barbados%E2%80%99-wi-fi-project-been-a-success.

103 Barbados Entrepreneurship Foundation (2016). "The Wi-Fi Project". http://www.barbadosentrepreneurshipfoundation.org/the-wifi-project/.

104 Caribbean News Now! (2015). "St Lucia government signs MOU for island-wide Wi-Fi". http://www.caribbeannewsnow.com/headline-St-Lucia-government-signs-MOU-for-island-wide-Wi-Fi-25817.html.

105 Curaçao Chronicle (2013). "Free Internet In Downtown Willemstad". http://curacaochronicle.com/tourism/free-internet-in-downtown-willemstad/.

Summary

Internet use is increasing across the region. In 2014, it ranged from approximately 11% of the population in Haiti to almost 80% of the population in the Bahamas and Barbados. Fixed-broadband Internet subscription penetration is considerably lower, but for the most part it has been steadily increasing over the past five years. More important, it is being overtaken by growth in the mobile/cellular broadband segment, though data tracking the growth of that segment over a period of years is limited.

The widespread proliferation of mobile/cellular devices has created a foundation for increased adoption of Internet services via data plans offered by service providers, and/or via newly established Wi-Fi networks. Furthermore, many of the region's mobile/cellular carriers are updating their networks to support broadband Internet, and they are aggressively promoting those services by introducing more affordable smartphones, as well as offering a broad range of data plans and other inducements to suit their customers' budgets.

5 Challenges of Unleashing the Internet

Compared to some other developing countries and regions, the Caribbean possesses relatively well-developed Internet infrastructure, and connectivity has improved considerably. The most significant contributors to this improvement are related to international connectivity and the use of mobile broadband, including:

- Deployment of submarine cables to most countries in the region.
- Deployment of extensive mobile/cellular networks in virtually every country.
- Relatively high mobile/cellular subscription penetration that facilitates the mobile/cellular Internet data plans being strongly promoted.
- Roll-out of newer mobile/cellular technologies, such as HSPA+ and LTE, that better support broadband Internet.
- Growing take-up of smartphones that better support Internet access.

In addition to individual countries' efforts to improve the availability of the Internet, this report has detailed a number of regional projects and initiatives that have been implemented to improve the enabling environment and Internet infrastructure in the region, notably HIPCAR, CARCIP and BIIPAC. However, as reflected in the *2015 Global Information Technology Report* from the World Economic Forum (WEF),[106] most Caribbean countries have only achieved marginal improvements in their network readiness when compared with other countries worldwide—this fact was reinforced by the World Bank's *Digital Dividends* report in 2016.[107] Moreover, those improvements are not significant enough to drive innovation and to enable the region:

> "to fully leverage ICTs to foster its competitiveness potential, highlighting the rise of the new digital divide—that is, the divide between countries that are achieving positive economic and social impacts related to the use of ICTs and those that are not."[108]

This chapter outlines the key challenges that are hindering the continued development of the Internet in the Caribbean, and where possible highlights the opportunities to meet those challenges. First, we focus on infrastructure and the enabling environment, then discuss the adoption and use of Internet services in the Caribbean.

Infrastructure and Enabling Environment

Underdeveloped Enabling Environment

The extent to which a country has created the requisite enabling environment to foster Internet infrastructure investment, along with ubiquitous take-up and use of those services, is dependent on the system of policies, laws and incentives that are established to support those goals. As discussed previously ("Policy, Legal and Regulatory Context", page 14), most Caribbean countries have independent telecommunications regulators, but their legislation was enacted several years ago and may not readily facilitate the full integration and adoption of newer technologies, such as ICTs and the Internet.[109] As relatively small countries that lie within a common geographical area and enjoy some commonalities, a regional approach—or participation in a shared project—is frequently encouraged, in order to benefit from economies of

106 World Economic Forum (2015). *The Global Information Technology Report 2015: ICTs for Inclusive Growth.* http://www3.weforum.org/docs/WEF_Global_IT_Report_2015.pdf.

107 World Bank (2016). "World Development Report 2016: Digital Dividends". https://www.worldbank.org/en/publication/wdr2016.

108 World Economic Forum (2014), *The Global Information Technology Report 2014: Rewards and Risks of Big Data*, p. 26. http://www3.weforum.org/docs/WEF_GlobalInformationTechnology_Report_2014.pdf.

109 In this respect, it is noteworthy that a number of countries in the region, notably those of the ECTEL group (Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines) are in the process of updating their national ICT policies.

scale and scope. However, regional projects tend to experience a number of challenges that can undermine a project's success unless they are properly managed, including the following:

- Differing politics, policies and priorities among the participating countries.
- Differing systems and processes, which might be even more evident when projects include countries from the French and/or Dutch Caribbean, in addition to former British colonies and protectorates still under the jurisdiction of France, the Netherlands and the United Kingdom.
- Differing levels of development and infrastructure.

These challenges can also exist, to some degree, within a country. For example, a change in government may not only cause a change of political direction, but also change the policies and emphasis given to ICT and Internet development. In addition, many countries depend on external funding from international donor agencies in order to finance their projects. As a result, project outcomes tend to fulfil the imperatives of the funding agency, and may not necessarily those of the country itself.

Finally, although a number of Internet and ICT-related initiatives and projects are being implemented at both the national and regional levels, they can appear disjointed, and may not necessarily be aligned to a longer-term vision or plan (see "Policy, Legal and Regulatory Context", page 14). Frequently, projects and initiatives are designed to realise "quick wins"—to obtain (some) success in the shortest time in order to maintain political favour, particularly if elections are imminent. Yet, with this emphasis on quick success and short-term goals, the impetus to establish and ensure long-term cooperation to achieve sustainable outcomes tends to be absent.

Limited Government Intervention

Historically, the best practice for liberalising and developing competition in the telecommunications sector was for the government to relinquish its stake in the incumbent service provider and adopt an arms-length approach, especially once a regulator had been established. In the Caribbean, that approach was adopted, and to a considerable extent, infrastructure build-out and the services offered continue to be the sole remit of the licensed telecommunications firms.

Sometimes policymakers encourage providers to expand their networks to underserved areas, or introduce newer technologies. The extent to which these requests are fulfilled is primarily a commercial decision; however, when countries have clear objectives, priorities and goals, it may no longer be appropriate for the players to exclusively dictate how the networks and the market evolve. As such, government intervention may be necessary. Such intervention may be especially necessary in the Caribbean: historically, competition in the region has been low as local markets were largely dominated by Cable & Wireless. Today, the landscape has essentially evolved into a strong and vertically integrated duopoly where the two players (Flow and Digicel) have control over both the national markets and international/wholesale submarine fibre infrastructure.

In relation to infrastructure, for example, in most Caribbean countries three areas could benefit from government intervention:

- Build-out of Internet networks in underserved areas.
- Improved competition at the retail level.
- Expansion of in-country, national terrestrial fibre-optic networks, as was done in Singapore, Australia and New Zealand. In the case of the Caribbean islands, this task is particularly expensive, as it means extending submarine cable networks to inhabited islands, such as those in the Grenadines and the Bahamas, that are currently dependent on microwave or satellite links.

To have those issues addressed in a timely manner, governments are likely to need access to financing, and to develop a mechanism through which the works can be implemented. Depending on the country, the available funds, and the framework that has been established, it may be possible for the Universal Access (or Universal Service) Fund to support

those projects.[110] For example, in Jamaica the Universal Service Fund is being used to connect schools, libraries, post offices and healthcare institutions to the country's island-wide broadband network. As of 31 March 2015, the following had been connected[111]:

- 60 of 60 hospitals and healthcare centres
- 41 of 41 libraries
- 208 of 208 educational institutions
- 68 of 77 post offices.

Regionally, projects such as CARCIP are also offering support to the participating countries to develop their infrastructure. Due to budgetary constraints on incurring additional loans, however, only 4 countries out of 20 have signed on to the programme. Furthermore, in the absence of a comprehensive and long-term plan, as well as clear goal-setting from international finance providers/donors, it is still likely that isolated projects will not cohere into a seamless and well-functioning network.

Limited Incentives for Investors

Although most Caribbean countries have identified the Internet as critical to their economic and social development and therefore a high priority for investment, the efforts to attract the needed investment have been limited in practice. Frequently, policymakers appear to be of the view that investors are eager to enter their countries' market and are prepared to pay top price for the licences being offered. However, unlike when the markets were first being liberalised and there were greenfield opportunities, that is no longer the case for most Caribbean countries, as they tend to already have two strong players and maturing markets. Under such circumstances, prospective investors are likely to classify most Caribbean countries as high risk, and the potential for a profitable business case that could provide the desired return on investment might not be readily evident.

110 For more information on Universal Access and Service Funds, see Intelecon (2009), *Universal Access and Service Funds: 2009 Update from Intelecon.* http://www.inteleconresearch.com/pages/documents/UASFFunds2009update-Oct2009.pdf.

111 Universal Service Fund, Jamaica (2016). "Island-wide Broadband Network". http://usf.gov.jm/broadband.php.

Jamaica's 700 MHz Auction

In April 2013, the Jamaican Spectrum Management Authority proposed an auction of frequencies in the 700 MHz band with the intention of licensing them for broadband wireless access services.[112] A reserve price of between USD 40 million and USD 45 million was set for the sub-bands being auctioned, and a deposit of between USD 2.7 million and USD 3 million would need to accompany any applications. Following the publication of the Request for Bids/Request for Proposals in May 2013, it was anticipated that the auction would be completed by the end of the calendar year.

However, it was not until April 2014 that the government announced that it had sold one of the three 700 MHz bands it had planned to auction to Digicel, for just USD 25 million. Following the sale, the Minister responsible for telecommunications, Philip Paulwell, admitted:[113]

> "In retrospect, it would have been difficult for us to have got as much as we thought. There was value in it, and even after we were seeking to negotiate, we were way below the US$25 million. People were coming to us at 10. Getting 25 in the end has been quite significant…"

It is also important to emphasise that the cost and ease of doing business in a country will affect, among other things, its attractiveness to prospective investors. According to the annual *Doing Business* assessments conducted by the World Bank, it is becoming increasingly difficult to do business in the Caribbean, when compared with other countries worldwide.[114] Figure 5.1 shows that the ease of the doing business has declined in Caribbean countries examined by the World Bank that are also the focus of this report—the one exception is Jamaica. (Note: with respect to ranking, the larger the number, the poorer a country's performance.)

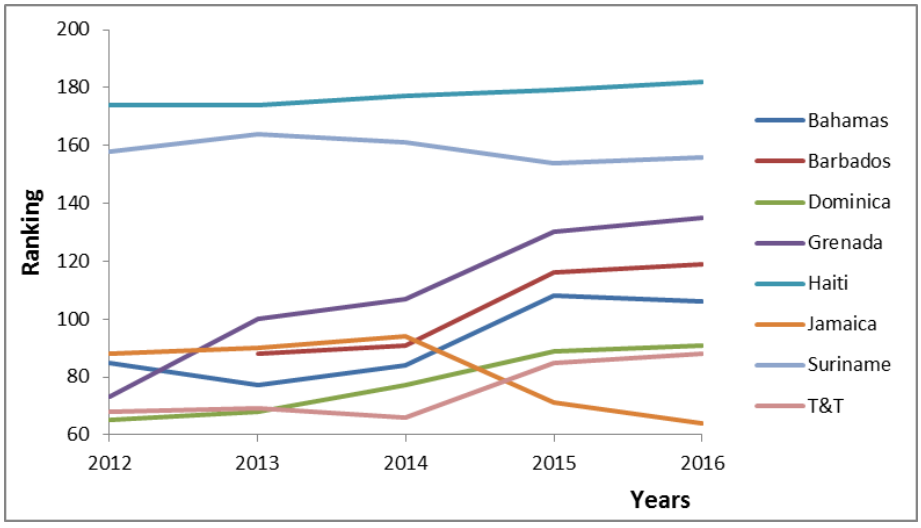


Figure 5.1. Ease of Doing Business Ranking of Select Caribbean countries, 2012–16 (Source: World Bank[115, 116, 117, 118, 119])

112 Spectrum Management Authority, Jamaica (2013). *Information Memorandum: Licensing the 700 MHz Band (Channels 54-69, i.e., 698-806 MHz).* http://www.sma.gov.jm/sites/default/files/publication_files/INFORMATION_MEMORANDUM_700MHz_Auction_Jamaica.pdf.

113 Jamaica Gleaner (2014). "Digicel Buys 700MHz Band At Near Half Price". http://jamaica-gleaner.com/gleaner/20140403/lead/lead4.html.

114 World Bank (2015). *Doing Business 2016: Measuring Regulatory Quality and Efficiency.* http://www.doingbusiness.org/reports/global-reports/doing-business-2016.

115 Ibid.

116 World Bank (2014). *Doing Business 2015: Going Beyond Efficiency.* http://www.doingbusiness.org/reports/global-reports/doing-business-2015.

117 World Bank (2013). *Doing Business 2014: Understanding Regulations for Small and Medium-Size Enterprises.* http://www.doingbusiness.org/reports/global-reports/doing-business-2014.

118 World Bank (2012). *Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises.* http://www.doingbusiness.org/reports/global-reports/doing-business-2013.

119 World Bank (2011). *Doing Business 2012: Doing Business in a More Transparent World.* http://www.doingbusiness.org/reports/global-reports/doing-business-2012.

Although competition can encourage more efficient operations and reduced rates among the players in a particular market, a country's business environment is an important determinant in the rates set and the services offered. In this respect, virtually all Caribbean countries have considerable room for improvement in their ease of doing business.

Adoption and Usage

Affordability Challenges

The inability of the average consumer to comfortably afford Internet services is still a significant barrier to Internet connectivity and usage in the Caribbean. Despite decreases in fixed and wireless Internet prices across the region in recent years, there is still a significant percentage of the population for whom the Internet is beyond their budget.

As mentioned earlier ("Geographic, Demographic and Economic Indicators", page 11), most Caribbean countries are classified as middle- and high-income countries based on their per capita GNI, which is essentially an averaged figure, and it does not accurately reflect the actual spread of income levels in a particular country. In developing countries, where poverty tends to be higher than in developed countries, there is likely a significant segment of the population whose actual income is considerably lower than the average as measured by the per capita GNI.

Unequal income distribution, coupled with high unemployment and illiteracy rates, also affect Internet adoption and use. For instance, Haiti has an unemployment rate of more than 40%, and literacy is only around 60% (see Table 2.1, page 11); this suggests that a considerable portion of its population would be unable to afford basic amenities, let alone Internet services.

In order for the Internet to be more accessible for the very low-income segment of the population, the cost of ownership needs to be revised (or subsidised) to be better aligned with their purchasing power and income. Cost of ownership includes the cost of the device, as well as the cost of Internet access (such as via a data plan or Wi-Fi), which can have a significant impact upon the adoption of Internet ("Service Affordability", page 38).

It is only when service penetration is high, specifically among segments of the population at the bottom of the socioeconomic pyramid, that meaningful engagement with the Internet can occur, enabling its transformational effects, which could include advancing and supporting the realisation of the SDGs.

Limited User Capability

Illiteracy and digital illiteracy[120] can have a negative effect on the adoption of the Internet. In order to successfully exploit its full potential, individuals must possess some degree of reading/language proficiency. In the 11 countries under review, and with the exception of Haiti and Jamaica, literacy rates are more than 90%, which suggests that most countries have satisfied this basic requirement. However, literacy alone does not guarantee proficient Internet use: an equally critical consideration is the extent to which individuals can access the medium and develop their own experience and proficiency—often referred to as *digital media literacy*.[121] Development of skills in this area is especially critical for increasing digital engagement— in particular, social, political and democratic engagement—and spurring local content production.[122] The ITU speaks of "digital natives", youths aged 15–24 who have five years or more experience using the Internet.[123] Figure 5.2 shows the percentage of the population in select Caribbean countries that are digital natives. These

120 Digital illiteracy refers to the lack of familiarity with technology; it may incur high costs for societies. For more information, see Berg, S (2013). "The High Cost of Digital Illiteracy", https://www.hastac.org/blogs/steven-l-berg/2013/08/04/high-cost-digital-illiteracy. See also Dudeney, G.(2011) "No place in class for digital illiterates", https://www.theguardian.com/education/2011/dec/06/teaching-digital-literacy.

121 See MediaSmarts "The Intersection of Digital and Media Literacy" http://mediasmarts.ca/digital-media-literacy/general-information/digital-media-literacy-fundamentals/intersection-digital-media-literacy.

122 Hobbs, R. (2010). Digital and Media Literacy: A Plan of Action, A White Paper on the Digital and Media Literacy Recommendations of the Knight Commission on the Information Needs of Communities in a Democracy. https://blogs.uoregon.edu/artinsociety/files/2010/11/Digital_and_Media_Literacy_A_Plan_of_Action.pdf.

123 ITU (2013). *Measuring the Information Society*, p. 139. http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2013/MIS2013_without_Annex_4.pdf.

data suggest that the majority of the population—in most instances, more than 90%—is not yet proficient in using the Internet, and thus might not be able to truly harness its potential.

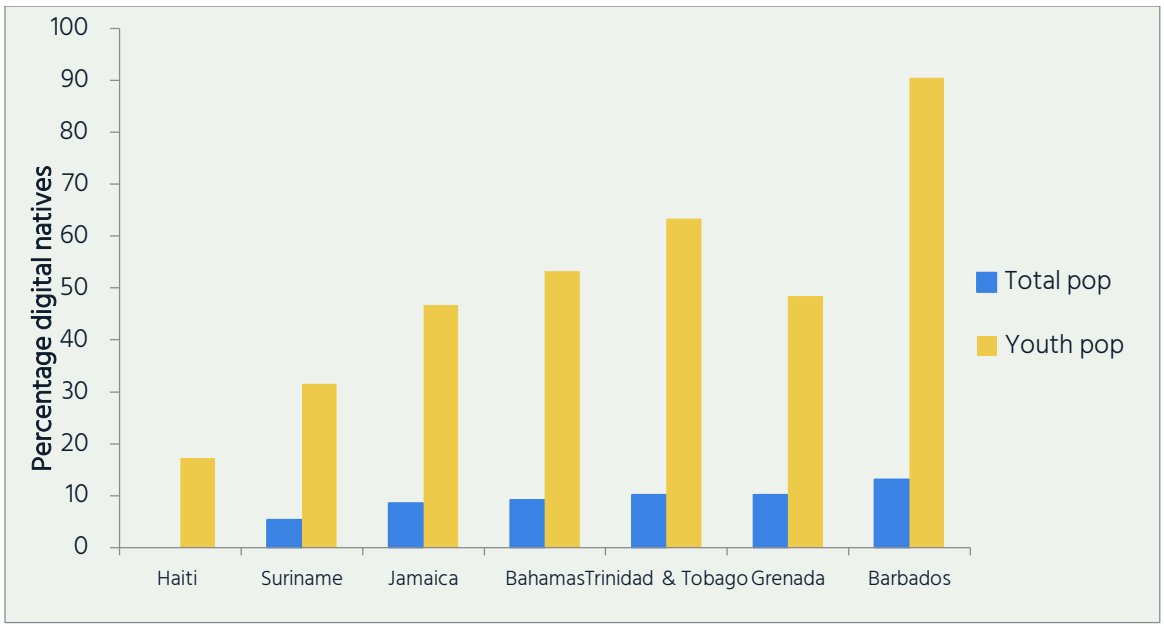


Figure 5.2. Percentage of Youth and Wider Population Classified as Digital Natives, 2012 (Source: ITU[124])

It is also important to emphasise that access to or familiarity with the Internet does not automatically imply proficient or effective use of the medium. Hence, although increased access to Internet can reportedly improve productivity and a country's GDP, these benefits are only realised when it is used effectively and innovatively. Therefore, in the Caribbean, there is still scope for increased use of ICTs in the classroom and for capacity-building, for example, as a way to inculcate and ground children in that environment.

Limited ICT/Internet Use in the Public and Private Sectors

In addition to individuals developing and harnessing their skills, Internet use would be strengthened considerably if the public sector was fostering its use through both the systems and processes it implements. There is a wide variation in efforts to develop e-government in the Caribbean: some countries, such as Barbados and Trinidad and Tobago, have prepared comprehensive plans and are in the process of implementing them; others, such as Haiti, are still grappling with limitations in telecommunications infrastructure, and are not yet in a position to focus on services and transactions that can be conducted online.[125]

124 Ibid, p. 143.

125 United Nations Department of Economic and Social Affairs (2014). *United Nations e-Governments Survey 2014: E-Government for the Future We Want.* http://unpan3.un.org/egovkb/Portals/egovkb/Documents/un/2014-Survey/E-Gov_Complete_Survey-2014.pdf.

e-Government in the Caribbean[126, 127]

The *2014 e-Government Survey,* published by the UN Department of Economic and Social Affairs (UN-DESA), includes 16 Caribbean countries among the 193 countries examined: Antigua and Barbuda, the Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago. For each country, an e-Government Development Index (EGDI) was calculated. The EGDI measures "the willingness and capacity of governments to use ICTs to deliver public services by assessing national websites and how e-government policies and strategies are applied in general and in specific sectors for delivery of essential services."[128] The EGDI comprises three subindices:

1. **Human Capital Index**. Examines adult literacy gross enrolment ratio, expected years of schooling, and mean years of schooling across all levels of the educational system.
2. **Telecommunications Infrastructure Index.** Examines connectivity with regard to fixed-line, mobile/cellular, fixed broadband and wireless broadband subscriptions, along with Internet use per 100 inhabitants.
3. **Online Services Index (OSI).** Examines the scope and quality of service offered by a cross-section of government websites, based on the following four-stage online services development process:

    Stage 1. Emerging information services—where websites provide information on public policy, governance, laws, regulations, relevant documentation and types of government services provided.

    Stage 2. Enhanced information services—downloadable forms for government services and applications, plus a number of other features such as audio, video and multilingual capabilities, as appropriate.

    Stage 3. Transactional services—where websites engage in two-way transactions with users. At this stage, the websites should be able to support both financial and nonfinancial transactions.

    Stage 4. Connected services—where Government websites that have completely changed how they interact with their citizens.[129]

Governments, being the largest employer and purchaser of goods and services in most Caribbean countries, have considerable influence on the systems and processes adopted in the private sector. Thus, they can take the lead in terms of the wider adoption and integration of electronic systems and processes, developments that will not only ripple through the commercial sector but also affect their citizens and society as a whole.

As shown in Figure 5.3, based on the results of the UN's *2014 e-Government Survey,* Caribbean countries scored relatively well in terms of the indices for human capital and telecommunications infrastructure, including among other things adult literacy, years of schooling, fixed and mobile/cellular penetration, and Internet use. However, they scored poorly on the Online Services Index (OSI), which focuses on the types of services that governments deliver online.

126 Ibid.
127 ICT Pulse (2014). "Snapshot: 2014 update of e-Government in the Caribbean". http://www.ict-pulse.com/2014/07/snapshot-2014-update-e-government-caribbean/.
128 Ibid.
129 Ibid.

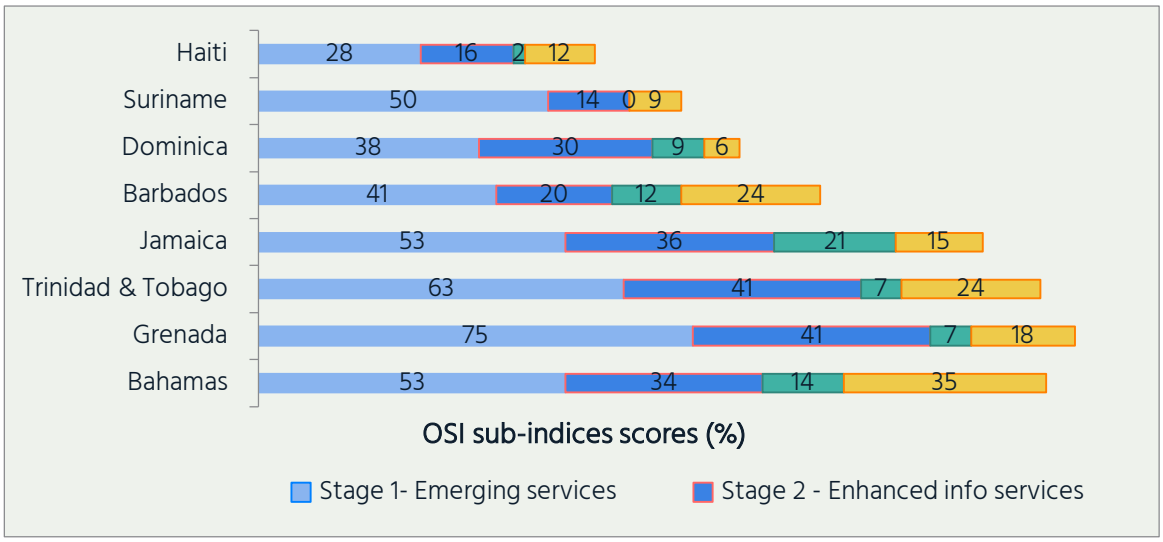


Figure 5.3. Scores Used to Determine the Online Services Index for Select Caribbean Countries, 2014 (Source: UN-DESA130)

With regard to Stage 1 of the OSI, Caribbean countries are satisfying some of the requirements by providing basic documents and guidelines on their government websites. Yet most countries are not performing in providing "Enhanced information services" (Stage 2). With respect to "Transactional services" (Stage 3), the low scores appear to reflect the underdevelopment and underutilisation of ICT systems by governments.

Limited ICT/Internet Use in the Private Sector

The Network Readiness Index, published by the WEF, includes business and government use of ICTs as a key component in its assessment. Among the Caribbean countries included in this assessment,[131] the usage indicator frequently receives the lowest score, which suggests room for improvement.[132]

The private sector in the region, especially the entrepreneur and micro, small and medium enterprises (MSMEs) that operate in the ICT space, experience a number of challenges, including the following:

- Limited options for financing digital (or Internet-based) projects
- Underdeveloped frameworks to support e-commerce and online payments
- Limited programmes to support and nurture in-country and regional ICT projects.

For digital or Internet-based ventures, most commercial banks and lending institutions in the Caribbean are reluctant to offer loans or other forms of financing when tangible assets are not readily available to hold as collateral. Although though a venture may be a legally owned and legally incorporated entity, its principals are frequently required to personally underwrite loans made to the business, meaning that there can be considerable personal risk to business owners, which acts as a deterrent to many that seek to start their own business or grow an existing one.

With regard to e-commerce and online payments, many of the local and international banks in the region do not readily offer those facilities in general and even less so to MSMEs. For the few that do, the process and requirements are onerous, and it is also costly to maintain. Hence, adoption is usually among large corporations, with MSMEs either failing to make use of online payments completely, or using circuitous (and expensive) alternatives. More important, it also means that Caribbean MSMEs are limited in their ability to create and sell content online, which in turn hinders the development of the Internet ecosystem in individual countries and the region as a whole.

130 United Nations Department of Economic and Social Affairs (2014). *United Nations e-Government Survey 2014.* http://unpan3.un.org/egovkb/Portals/egovkb/Documents/un/2014-Survey/E-Gov_Complete_Survey-2014.pdf.

131 Barbados, Haiti, Jamaica, Suriname, and Trinidad and Tobago were the countries from this report's sample group that were also included in the WEF's *Global Information Technology Report 2015.*

132 World Economic Forum (2015). *Global Information Technology Report 2015: ICTs for Inclusive Growth.* http://www3.weforum.org/docs/WEF_Global_IT_Report_2015.pdf.

A popular alternative used by Caribbean businesses to conduct online/electronic transactions is PayPal, which is available in 203 markets worldwide and in all Caribbean countries. Use of the payment platform is easy to set up, but gaining access to the funds received is not as straightforward. Caribbean businesses that use PayPal tend to route funds received through a United States or Canadian bank account. However, the added transaction costs—including those already deducted by PayPal—along with the delay in having those funds available locally for use by the business, could undermine its overall sustainability.

The PayPal Challenge in the Caribbean[133, 134]

Caribbean residents can establish and use PayPal accounts to purchase goods and services worldwide using either their credit cards or funds already credited to their PayPal accounts. On the merchant side, PayPal can facilitate transactions on behalf of Caribbean businesses with customers worldwide.

For all payments received, variable transaction fees (based on the sums involved) are deducted; however, monies lodged in the PayPal account of a business cannot be transferred to its local bank accounting the Caribbean, as the requisite relationship between PayPal and Caribbean banks has not been established. Instead, the account owner can request from PayPal that funds be withdrawn via cheque, which incurs a processing fee of USD 11.00, and may take up to six weeks to clear when it is lodged in the business' local bank.

For some countries, which include Barbados, Dominica, Grenada, and Trinidad and Tobago, arrangements exist where funds in a PayPal account can be automatically transferred to either a linked United States bank account or a Visa credit card. All payments are subject to a 30-day hold period, and fees may be incurred.

133 PayPal. "PayPal Merchant Fees". https://www.paypal.com/webapps/mpp/merchant-fees.

134 PayPal (2014). "PayPal Receive Funds and Automatic Transfer Agreement". https://www.paypal.com/jm/webapps/mpp/ua/recpymt-full.

Summary

Caribbean countries, and the region as a whole, have been experiencing a broad range of challenges that affect the continued development of Internet infrastructure, the enabling environment, and the adoption and use of the online medium. These challenges affect adoption and use of Internet services among citizens, and this underdevelopment then hinders the extent to which the medium can be leveraged to realise the SDGs.

In addition to the challenges related to infrastructure and the enabling environment, which governments can directly influence, service affordability may be an even more crucial issue that requires deliberate focus in order to encourage increased take-up and use of Internet services. Service affordability is directly related to the rates set by network carriers and service providers, which need to adapt their businesses to the changing landscape whilst balancing their own needs and imperatives.

Revenues from both mobile/cellular and fixed-line voice services have been decreasing due to increased use of instant and text messaging, as well as voice over Internet Protocol (VoIP) services. The growing popularity of the Internet provides an avenue to generate much-needed revenues.

Due to the speed of technology advancement, the timeframe within which to recover the cost of new infrastructure is getting shorter, which in turn affects prices imposed for the services offered.

Most telecommunications network carriers and service providers in the region are not government-owned. Although policymakers have been advocating lower Internet rates to allow even consumers in the lower socioeconomic brackets to access services, the firms must ensure that they price their services at levels that facilitate a reasonable return on investment, that is, to the satisfaction of owners and shareholders.

Furthermore, both the public and private sectors should be leveraging ICTs more than they are currently doing. In the private sector, especially the MSME segments, critical challenges include the limited, expensive and complicated options to facilitate electronic payments, and the limited avenues for funding that are open to online and service-based businesses. The absence of end-to-end online engagement limits the scope of Caribbean businesses (and governments), many of which would benefit considerably from being able to conduct online transactions in the regional and international marketplace.

Finally, Caribbean governments should be more aggressively using the Internet to engage local businesses and residents, and to capitalise on both the cost and process efficiencies that could be realised. Deeper integration of ICTs, not only to optimise their systems and processes, but also to improve and strengthen engagement with their customers and the wider society, will have the additional effect of transforming how citizens use the Internet. Doing so will also increase the Internet's importance in their daily lives.

6 Recommendations: Managing Challenges, Capitalising on Opportunities

In the previous chapter, we identified key challenges that have affected the continued development of infrastructure, and the growth in Internet adoption and use in the Caribbean. Many of those challenges are exacerbated by the SIDS characteristics of Caribbean countries, which make their resolution even more difficult. In this chapter, recommendations in the following areas are made that should help manage those challenges and capitalise on opportunities:

- A policy and implementation framework
- Private sector participation and innovation
- E-participation by the wider society
- Government intervention
- Investment opportunities
- Regional approaches and collaboration.

Policy and Implementation Framework

In order to address the currently underdeveloped enabling environment for the provision of Internet infrastructure and services in the Caribbean, the existing policy framework would need to be re-examined. In the first instance, it is critical for the countries to clearly articulate their vision and goals as they relate to the Internet. Thereafter, they can determine their present situation and develop strategies and implementation plans in order to achieve the agreed-upon goals. Trinidad and Tobago's 2014–18 national ICT plan, SmarTT, is a good example of a comprehensive roadmap that the country has prepared to guide its efforts to more fully harness ICTs and the Internet.

Regionally, there has been a growing movement toward a harmonised approach in the CARICOM Single ICT Space. Although the creation of a single ICT space for the Caribbean is still in the nascent stages, it is recommended that countries still collaborate on developing common ICT-related policies and laws going forward, in order to leverage economies, as well as scale and scope, that no individual country would enjoy on its own. A similar approach proposed for employment at the country level, includes the following recommendations:

- Articulate a clear vision and clear goals for the region
- Develop plans and strategies to take the region from the present situation to the desired outcome
- Identify areas of commonality and divergence among the participating countries that could benefit from regional collaboration to achieve mutually beneficial results.

From Fast-Forward to SmarTT[135]

Trinidad and Tobago's national ICT plan for 2014–18, SmarTT, is the twin island state's latest iteration of its national ICT strategy, which started with Fast-Forward, launched in 2003. SmarTT is the first stage in a 12-year ICT roadmap that will end in 2028; the focus for the 2014–18 period is on increasing "ICT utilisation and uptake within the public and private sector, and among citizens."[136]

To achieve that objective, work will be done under the following five themes: Innovation and Human Capital Development; Access and Digital Inclusion; e-Business and ICT Sector Development; Infrastructure Development; and e-Government.

Themes	Key Imperatives
Innovation and Human Capital Development	Building an e-Ready Society through ICT Enriched Learning Creating and Promoting Local Digital Content Establish a Culture of Research and Development
Access and Digital Inclusion	Providing ICT Services for Digital Inclusion Increasing the Accessibility and Affordability of Technologies Increasing ICT Learning and Awareness Facilitating R&D Focused on Bridging the Digital Divide
e-Business and ICT Sector Development	Stimulating ICT Demand to Encourage e- Commerce Adoption Developing e-Business Capacity Enabling the Production, Distribution and Promotion of Local ICT Products and Services Enabling Other Sectors through ICT Facilitating Leadership and Coordination of Efforts among Key Stakeholders
Infrastructure Development	Enhancing Infrastructure, Access, ICT Policies and Regulatory Oversight to Facilitate Sustainability. Instituting Appropriate Governance Structures to Drive Infrastructure Planning and Development Building Information Society Capacity to Ensure Availability of Internet Resources and Viability of the Internet Economy
e-Government	Migrating to Transactional e-Services Collaborating to Implement Shared ICT Systems and Services Building Government Infrastructure to Develop and Support a Vibrant e-Government Ecosystem Securing the ICT Environment

Table 6.1. Themes and Key Imperatives of SmarTT (Source: Government of Trinidad and Tobago[137])

As part of the enabling environment, the legislative and regulatory frameworks would also need to be revised to better address ICTs and the Internet. As discussed in "Regional ICT Initiatives" (page 17), under the HIPCAR project there was a concerted effort to update policies and legislation. Although very few of the countries outputs have been formally adopted to date, those documents may still provide an excellent starting point to develop and successfully implement a revised framework. Furthermore, greater effort could be made to access and better utilise the outputs of the CARCIP and BIIPAC projects, and lessons could also be learned from the work among the ECTEL countries to update their ICT policies and legislation.

It must be emphasised, however, that successful and timely implementation of the developed strategies and plans is critical, and is often not given the requisite attention. The ICT and Internet space is dynamic and evolving, and countries

135 Government of Trinidad and Tobago (2013). *SmarTT: National ICT Plan 2014–2018.* http://www.mpac.gov.tt/publications/smartt-national-ict-plan-2014-2018.

136 Ibid, p. 23.

137 Ibid, pp. 25–56.

must be prepared to act quickly so that the projects and initiatives they intend to develop are relevant, effective and yield the desired results.

Private Sector Participation and Innovation

In addition to the policies, laws and regulations that support infrastructure build-out and service delivery, it is crucial that the enabling environment fosters innovation and participation across the private sector spectrum—from MSMEs to large corporates and multinational firms. Such a posture not only fosters greater participation by citizens in the digital economy, it can also encourage innovation and wealth creation.

In order to address some of the ICT-related challenges faced by the region's private sector as outlined in "**Limited ICT/Internet Use in the Public and Private Sectors**" (page 50), the supporting ecosystem would need to be better developed, for example, by the following initiatives:

- Facilitating alternatives to the traditional financial institutions for financing digital (or Internet-based) projects, such as venture capitalists, angel investors and crowd funding.
- Implementing policies and laws that support e-commerce and online payments, and engaging major payment platforms and gateways to ensure that local MSMEs in particular are not unduly disadvantaged when using such facilities.
- Fostering strategic programmes and partnerships based on policy objectives that support and nurture private sector participation, entrepreneurship and innovation. This would include support for iHubs, incubator facilities and coworking spaces.

Currently, Caribbean businesses across the region are developing electronic payment platforms, specifically for use by mobile/cellular devices. Internet-based payment platforms that can be used successfully in the region are still rare, however. One exception is CX PAY, which is based in Curaçao.

CX PAY in Curaçao[138, 139, 140]

Established in 2014, CX PAY BV is a payment gateway that processes online transactions in Curaçao. It offers a range of services, including gateway services, payment solutions, routing interfaces and recurring billing, as well as client support services. The platform is Payment Card Industry-compliant, and it features a customer vault to protect customer information, a three-step redirect application programming interface payer authentication, batch processing, recurrent billing and electronic invoicing.

Because it is located in Curaçao, CX PAY is able to strengthen its value proposition due to the existence of an electronic zone (e-Zone) and export facilities in Curaçao that accommodate and support businesses active in international trade, services, or use e-commerce. Firms located in the e-Zone, or those that benefit under the export regime, enjoy fiscal incentives such as significantly discounted corporate income tax—between 2% and 4%, as opposed to the standard tax rate of 22% as of 2016.

138 CX PAY. "Features". https://cxpay.cw/#features.

139 Facebook. "CX PAY: About". https://www.facebook.com/CXPAY/info/?entry_point=page_nav_about_item&tab=page_info.

140 PricewaterhouseCoopers (PwC) (2015). "Curaçao: Corporate–Taxes on corporate income" (last reviewed: 17 December 2015). http://taxsummaries.pwc.com/uk/taxsummaries/wwts.nsf/ID/Curacao-Corporate-Taxes-on-corporate-income.

e-Participation by the Wider Society

In order to realise the improvements in productivity and GDP that can result from increased access to broadband Internet services, citizens must be in a position to make greater use of the medium in addition to governments and businesses. A crucial challenge in enabling wider private participation is that individuals toward the bottom of the socioeconomic pyramid are unable to afford suitable devices such as smartphones. Most Caribbean countries have implemented programmes to increase access to technology and the Internet, such as installing computer laboratories in schools, as well as implementing initiatives like One Laptop per Child and those promoting tablet computers for students. The privately driven "One Tablet per Haitian" initiative, described in the box below, is an example of a programme that is not only providing access to devices, but is also bolstering the country's manufacturing sector.

To achieve optimal results, it is essential that such programmes are comprehensive and relevant; options for access must be available for broader segments of society and supported by appropriate content. For example, within the school system there could be an emphasis on fostering Internet access at the primary school level, not just at secondary schools and tertiary institutions. Furthermore, technology can be more integrated into the classroom via the broad range of available tools.

Among the general public and adult population, Wi-Fi hotspots, telecentres and community access points could provide Internet access, particularly for those who cannot afford their own personal devices or the cost of Internet access subscriptions. With regard to appropriate content, there is considerable scope for local content development that could support, among other things, training and e-learning, knowledge and information sharing, as well as improvement and optimisation of government and business processes.

One Tablet per Haitian: Tablet Computers Assembled in Haiti[141, 142, 143]

Established in 2013 with USD 200,000 in start-up funds from the United States Agency for International Development (USAID), Sûrtab assembles tablet computers using imported Asian hardware components. The firm produces mini tablets (7-inch/18 cm) that run on the Android operating system and range in cost from USD 100 for a Wi-Fi tablet with 512 MB of RAM, to around USD 285 for a 3G model with 2 GB of RAM. Although Sûrtab only employs 50 people (2014), it is contributing to the revitalisation of the Haitian manufacturing sector, which in the 1970s and 1980s was known for computer-board assembly and low-value garment making. More important, the operation is producing low-cost, high-demand devices that cater to the markets in developing countries. For example, in 2014, the firm received an order from Venezuela for 10,000 tablets.

Caribbean governments can be leaders in this respect by increasing their implementation of e-government systems and processes. Increased adoption of e-governance across government ministries, departments and agencies will improve the internal operating efficiency of those organisations, and facilitate increased online and remote engagement with citizens. Similarly, it will build demand for Internet access among the public, and thereby increase the attractiveness of investing in the sector, both at an infrastructural level and for content and applications.

141 Reuters (2014). "RPT-Impoverished Haiti manufacturing its own Android tablet". http://www.reuters.com/article/haiti-tablet-idUSL2N0MD03S20140317.

142 Medium (2013). "One Tablet Per Haitian". https://medium.com/@tatewatkins/one-tablet-per-haitian-9550ea661cd4.

143 Geezam (2014). "Venezuela Orders 10,000 Sûrtab Tablets – How Jamaica Can Duplicate Haiti's Tablet Manufacturing". http://www.geezam.com/venezuela-orders-10000-surtab-tablets-how-jamaica-can-duplicate-haitis-tablet-manufacturing/.

Finally, the role of civil society in fostering greater e-participation by the wider society cannot be under-estimated. Many of the agencies involved must ensure that the programmes and initiatives they support foster realisation of the SDGs and focus on developing countries and SIDS.

In addition to having access to funding, civil society can provide technical assistance, specifically on best practice and models that have been successfully implemented in other SIDS. Since many of the agencies have a presence across in the Caribbean, either in individual countries or through regional offices, they tend to be in the best position to identify common challenges. Depending on the challenges, there may be a basis to address them regionally, thus taking advantage of economies of scale and scope.

Government Intervention

In addition to establishing the needed frameworks upon which the requisite Internet infrastructure and services can be better developed, Caribbean governments should also reserve the right to intervene more directly and drive anticipated changes. Based on the examples outlined in "**Limited Government Intervention**" (page 46) of expanding the terrestrial fibre-optic network or extending existing and new networks in currently underserved areas, it is likely to be necessary for governments to create projects to drive those activities.

While many Caribbean countries cannot finance such projects directly, the following options could be explored:

- Implementing the project under the Universal Access/Universal Service framework
- Securing support from donor agencies
- Making the project a public–private partnership venture, with mutually beneficial results.

Investment Promotion

Following the 2008 global financial crisis and the recession that ensued in many countries around the world, the private sector has in general become more risk averse, and to varying degrees more focused on cost containment and improving efficiency to maximise the return on investment. Such a posture becomes even more evident when a prospective investor is considering entry into a previously untested market. If it does decide to invest, its strategy is likely to be conservative in order to limit risk and exposure.

The Caribbean region, particularly the SIDS within it, is highly dependent on foreign direct investment to both drive economies and to provide jobs and knowledge transfer. It is also worth noting that virtually all Caribbean countries have large diaspora populations, specifically in the United States, the United Kingdom and Canada, for current and former British colonies; and in France and the Netherlands, for the French and Dutch dependencies. These populations are important as major sources of remittances from abroad, and many are also eager to invest in their home countries. Aside from capital and knowledge gained outside of their home countries, many individuals within the various diaspora populations possess intimate knowledge and cultural awareness of, as well as strong links to, their home countries, and many are looking for opportunities to either return home, or contribute to their country's betterment in some way.

As described in "**Limited Incentives for Investors**" (page 47) and "ard tax rate of 22% as of 2016.

e-Participation by the Wider Society" (page 57), Caribbean governments must be prepared to clearly articulate their countries' needs in order to ensure that the projects implemented align with national goals and outcomes. If a proposed initiative can be driven and financed by the private sector, it may be necessary to present the opportunity in a way that might include, but not be limited to, discussions on the venture's long-term viability, the return on investment

permissible, and the types of support and incentives that the government (and other agencies, institutions and organisations) can provide.

Regional Approach and Collaboration

Expanding on the discussion in "Policy and Implementation Framework" (page 55), Caribbean countries can benefit considerably from adopting a regional (or common) approach to address specific issues.[144] Currently, there are numerous regional groupings, such as the Organization of American States (OAS), CARICOM and the Organization of Eastern Caribbean States (OECS), as well ICT organisations such as the CTU, ECTEL and the CARICOM Regional Organization for Standards and Quality (CROSQ), all of which aim to foster collaboration and knowledge sharing toward mutually desired goals, and could benefit from a more coherent strategy for the region as a whole.

By adopting a regional approach, depending on the circumstances being addressed, the participating countries may benefit from improved economies of scale and scope, and from sharing resources, minimising duplication of effort, and increased leverage in negotiations on behalf of multiple countries. It must be emphasised, however, that a regional approach is a complex one requiring greater coordination, collaboration, and commitment by the countries involved to achieve the agreed and desired outcomes.

ECTEL: A Regional Approach to Telecommunications Regulation[145]

ECTEL is part of a two-tiered regulatory machinery, comprising a local telecommunications regulatory office
—the National Telecommunications Regulatory Commission (NTRC)—in each of the five participating OECS states, with ECTEL as the hub. Each NTRC is vested with the authority to regulate the telecommunications sector in its own country, while ECTEL's purpose is to ensure that a harmonised policy and regulatory regime is maintained across the five member countries, with the objective of creating a "single telecommunications space." ECTEL's role is primarily to provide advice and thought leadership, and to be a repository of technical expertise that is not readily available within the NTRCs. But to maintain harmony, under some circumstances, the NTRCs refer matters of licensing, numbering and spectrum management to ECTEL for recommendations. In some instances, the NTRCs may not act independently of ECTEL's advice; where they are simply be required to consider it, they generally tend to follow the advice provided.

Furthermore, under the treaty, a regional approach to telecommunications regulation was safeguarded by having the participating countries commit to (a) collaborate and coordinate with each other and with ECTEL; (b) take all appropriate measures to ensure implementation of the policy and recommendations of ECTEL; and (c) meet the financial and other commitments under this treaty to ensure the efficient operations of ECTEL.[146]

As the Caribbean region moves toward greater integration and cohesion via initiatives such as CSME and the CARICOM Single ICT Space, it may be necessary to improve the coordination and collaboration between countries for the greater good, including social, economic and developmental benefits. This requires countries to embrace efforts for deeper regional integration, to support advancement of the entire region, and not just of individual countries.

144 This was a recommendation supported by both Dr. Vint Cerf and regional experts during the IGF's 2015 workshop "SIDS Roundtable: the 'Free Internet' - Bane or Boon?". See https://www.youtube.com/watch?v=W91f9Q8CccA.

145 NTRC Saint Vincent and the Grenadines. *Treaty Establishing the Eastern Caribbean Telecommunications Authority.* http://ntrc.vc/docs/about/ECTEL_Treaty.pdf.

146 Ibid, pp. 5–6.

7 Conclusions

The Caribbean region comprises a diverse group of countries, in terms of size, population, economics and Internet development. Based on reforms that have occurred since the early 2000s, the region has enjoyed increased availability and access to Internet services that are being delivered over a variety of media, including fibre-optic, coaxial and copper cables, and wireless networks. The explosion in the use of mobile/cellular phones across the region positions these countries to significantly increase adoption and use of the Internet via mobile/cellular broadband and Wi-Fi, but they are challenged to ensure the following:

- The existing framework more comprehensively addresses bottlenecks in the adoption of the Internet and ICTs, and is sufficiently forward-looking to accommodate the technological developments, innovation and changes in attitude and behaviour that are occurring.
- The Internet is being used by governments, businesses and individuals in ways that improve productivity and competitiveness, and contribute meaningfully to national and economic development.

Although each Caribbean country is unique, as SIDS there can be considerable benefits to collaborating on a common approach to realising individual and regional goals, including those set out as SDGs. This is particularly evident in the need for regional cooperation to exploit the economies of scale in the deployment of submarine fibre networks, and the readiness of international funding agencies to support regional projects such as CARCIP and BIIPAC, as well as initiatives managed by regional organisations.

Furthermore, although the Single ICT Space initiative is still in the nascent stage and the movement toward broader and deeper integration is strengthening, success will only be realised when there is concerted regional coordination and collaboration. However, there must be the political will to do so: namely, a commitment to the process and to achieving the agreed-upon results within the stipulated timeframes.

Once the appropriate framework has been established, both the public and private sectors will be critical to the deployment of infrastructure, adopting available technologies, and harnessing the Internet and ICTs in order to develop new or refine existing products and services to meet their needs and/or those of consumers. In the region, government-implemented systems and processes tend to be models for—or at the very least, to shape—the practices adopted by the private sector and wider society. Hence, via deeper integration of ICTs, such as transitioning to more e-governance and making online engagement mandatory for certain transactions, Caribbean governments can influence the extent to which their societies embrace the Internet. For the private sector, an enabling environment that fosters innovation and entrepreneurship is essential, for which governments have a key role yet again.

Finally, it is crucial that Caribbean societies move beyond using the Internet primarily for entertainment and the consumption of content. In order to more fully capitalise on the medium, increased access to devices via ownership and/or ready access to Wi-Fi hotspots and telecentres is necessary. Coupled with development of digital media literacy, such actions may help encourage local content production and online engagement. In addition, prices for service plans need to be affordable—not just in terms of per capita GNI, but taking into account the income spread across a society, specifically the income of those at the bottom of the socioeconomic pyramid, where the digital divide manifests its most significant effects.

Appendix A. Survey

The purpose of this questionnaire is to secure first-hand insight on the state of Internet infrastructure in select Caribbean countries. The responses provided will be used to propose recommendations that could be made toward removing barriers to connectivity in the region.

Please answer ALL of the questions.

The information provided will be kept confidential. However, we request that you share your contact details with us (question 12) in the event we have follow-up questions and to allow us to forward to you a copy of the report when published.

Thank you!
The Research Team: Bionda Fonseca-Hoeve and Michele Marius
On behalf of Shernon Osepa, Manager Regional Affairs LAC, Internet Society

1. Please select your country.

2. Please list the local Internet Service Providers (ISPs), their year of establishment, how they deliver service to consumers, and each ISPs approximate market share.

Operator	Year of establishment	Service delivery technology	Market share
LIME			
Flow			
Karib cable			
Digicel			
CCT			
Marpin			
Cable Bahamas			
TSTT			
Bahamas Telecoms Co.			
Logic Communications			
SAT Telecom			
Green Dot			
Telesur			
DEKAL Wireless			
Telei			
Unica			
Telem			
UTS			
Caribserve			
Tres			
Other			

3. Has your organisation, and/or any other stakeholders, implemented any projects or initiatives to increase take-up [adoption] and use of the Internet in your country?
4. Are there any projects or initiatives that your organisation and/or any other stakeholders plan to implement to increase take-up and use of the Internet in your country?

5. Key Internet statistics
   - What Internet speed is defined as "broadband" in your country: 256kbit/s, 1 Mbit/s, 2 Mbit/s or other?
   - What is the fixed broadband Internet subscription penetration rate (subscriptions per 100 population) in your country as at 2013?
   - What is the mobile/cellular broadband Internet subscription penetration rate (subscriptions per 100 population) in your country as at 2013?
   - What is the wireless broadband Internet subscription penetration rate (subscriptions per 100 population) in your country as at 2013?
   - What is the Internet user density (users per 100 population) in your country as at 2013?

6. Current state of the telecommunications infrastructure

What percent of the country has no fixed-line telephone infrastructure (i.e., geographic coverage)?	
What percent of the population has no access to fixed-line telephone service (i.e., population coverage)?	
What percent of the country has no mobile/cellular infrastructure (i.e., geographic coverage)?	
What percent of the population has access to no mobile/cellular service (i.e. population coverage)?	
What percent of the country has no Internet infrastructure (i.e., geographic coverage)?	
What percent of the population has access to no Internet service (i.e., population coverage)?	

7. What are the key challenges or impediments that are hindering the continued development of your country's Internet infrastructure?

8. What Critical Internet Resources does your country have? Select all that apply
   - ☐ Internet Exchange Point (IXP)
   - ☐ DNS caches, such as by Google, Akamai, etc.
   - ☐ Submarine cabling
   - ☐ Internet backbone/backhaul
   - ☐ 2 or more independent submarine cable systems
   - ☐ Other (please specify)

9. Internet traffic

Has your country experienced increased Internet usage, in terms of bandwidth, over the past three (3) years?	
Has your country experienced increased Internet usage, in terms of number of users, over the past three (3) years?	

What specific factors, if any, might have contributed to the increase in traffic?

10. Are there any particular sectors/industries that contributed significantly to increased Internet usage? Select all that apply.

☐ Agriculture	☐ ICT & Telecoms	☐ Youth
☐ Commerce & Industry	☐ Energy	☐ Sports
☐ Health	☐ Other (please specify)	☐ Tourism
☐ Foreign Affairs	☐ Mining	☐ None/Not applicable
☐ Water	☐ Education	

11. What kind of investment is required to improve connectivity and the major areas of investment? Select all that apply.

Options	Strong disagree	Disagree	Neutral	Agree	Strongly agree
Government funding					
Donor funding					
Grant funding					
Private Sector					
Public-Private-Partnership					
Other_____					

Other (please specify)

12. Does the legislative framework in your country explicitly address the following topics? Check all that apply.

Topic/Issue	Primary Act	Regulations	Other	Unknown
Licensing				
Competition				
Universal access and service				
Access and interconnection including rights of way				
Colocation				
Active and passive infrastructure sharing				
Wholesale pricing				
Retail Pricing				
Dispute resolution				
Quality of service				
Consumer interest and protection				

Other (please specify)

13. Please provide your contact details for further questions if necessary.

Name	
Position	
Organisation	
Country	
Email Address	
Phone Number	

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Appendix B. List of Figures

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Appendix C. List of Tables


Grand Bahama
Freeport
Great Abaco
THE BAHAMAS
Bimini Islands
New Providence
Nassau
Eleuthera
Cat Island
Andros Island
San Salvador
Great Exuma
Long Island
Samana Cay
Crooked Island
Mayaguana
Acklins Island
Turks and Caicos Islands (U. K.)
Grand Turk
Great Inagua
NORTH ATLANTIC OCEAN
Cienfuegos
CUBA
Nuevitas
Camaguey
Holguin
Manzanillo
Santiago de Cuba
Guantanamo
Cap-Haitien
HAITI
Port-au-Prince
Cayes
Santiago
DOMINICAN REPUBLIC
Santo Domingo
Mona Passage
San Juan
Puerto Rico (U. S.)
Basseterre
ST. KITTS AND NEVIS
Montego Bay
Kingston
JAMAICA
Caribbean Sea
Aruba (NETH.)
Oranjestad
Netherlands Antilles (NETH.)
Curacao
Willemstad
Barranquilla
Santa Marta
Cartagena
Maracaibo
Puerto Cabello
Caracas
Barquisimeto
Valencia
Maracay
Cumana
Barcelona
Maturin
Panama
Balboa
Monteria
La Palma
Merida
Ciudad Bolivar
Cucuta
San Cristobal
VENEZUELA
Bucaramanga
Medellin
Puerto Ayacucho
COLOMBIA
Pereira
Bogota
Ibague
Buenaventura

Appendix D. List of Abbreviations

3G	Third Generation (of mobile/cellular telecommunications technology)
4G	Fourth Generation (of mobile/cellular telecommunications technology)
.bb	Country-code top-level domain of Barbados
.bs	Country-code top-level domain of the Bahamas
.cw	Country-code top-level domain of Curaçao
.ht	Country-code top-level domain of Haiti
.jm	Country-code top-level domain of Jamaica
.sr	Country-code top-level domain of Suriname
.sx	Country-code top-level domain of Sint Maarten
.tt	Country-code top-level domain of Trinidad and Tobago
ADSL	Asynchronous Digital Subscriber Line
API	Application programming interface
BAH	Bahamas
BDS	Barbados
BDSN	Bahamas Domestic Submarine Network
BICS	Bahamas Internet Cable System
BIIPAC	Broadband Infrastructure Inventory and Public Awareness in the Caribbean
BSNIC	Bahamas Network Information Centre, College of the Bahamas
BVI	British Virgin Islands
C@ribNET	Caribbean Research and Education Network
CANTO	Caribbean Association of National Telecommunications Organisations
CARCIP	Caribbean Regional Communications Infrastructure Program
CARICOM	Caribbean Community
CAR-IX	Caribbean Internet Exchange
CBUS	Caribbean-Bermuda U.S. (submarine cable network)
ccTLD	Country-code top-level domain
CFX-1	Colombia-Florida Subsea Fiber
CNL	Columbus Networks Limited
CROSQ	CARICOM Regional Organisation for Standards and Quality
CSME	CARICOM Single Market and Economy
CTU	Caribbean Telecommunications Union
CUR	Curaçao
CWC	Cable & Wireless Communications Plc.
E- (e-)	Electronic
ECTEL	Eastern Caribbean Telecommunications Authority
ECFS	Eastern Caribbean Fiber System
ECLAC	Economic Commission for Latin American and the Caribbean
DNS	Domain name system
DOM	Dominica
EDGE	Enhanced Data rates for Global Evolution
FMS	Fixed-Mobile Substitution
GB	Gigabytes
Gbps	Gigabits per second
GCN	Global Caribbean Network
GDP	Gross Domestic Product
CDA	Grenada
GNI	Gross National Income
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
GT&T	Guyana Telephone & Telegraph Co. Ltd.
HAI	Haiti
HIPCAR	Harmonization of ICT Policies, Legislation, and Regulatory Procedures in the Caribbean
HSPA/HSPA+	High Speed Packet Access/ High Speed Packet Access plus
IADB	Inter-American Development Bank
ICT	Information and Communications Technology
ISOC	Internet Society
ISM	Industrial, Scientific, and Medical (radio bands)
ISP	Internet Service Provider
ITU	International Telecommunications Union
IXP	Internet Exchange Point
JAM	Jamaica
kbps	Kilobits per second
LTE	Long-Term Evolution
MAN	Metropolitan Area Network
Mbps	Megabits per second
MDG	Millennium Development Goal
MSMEs	Micro, Small, and Medium Enterprises
NASA	National Aeronautics and Space Administration
NTRC	National Telecommunications Regulatory Commission
OAS	Organisation of American States
OECD	Organisation of Economic Co-operation and Development
OECS	Organisation of Eastern Caribbean States
PCCS	Pacific Caribbean Cable System
PCI	Payment Card Industry
PPP	Purchasing Power Parity

RAM	Random Access Memory
SCF	Southern Caribbean Fiber
SDG	Sustainable Development Goal
SG-SCS	Suriname-Guyana Submarine Cable System
SIDS	Small island developing states
SUR	Suriname
SXM	Sint Maarten
T&T	Trinidad and Tobago
TSF	Télécoms Sans Frontières
UN	United Nations
UNGA	United Nations General Assembly
UN-DESA	United Nations Department of Economic and Social Affairs
URL	Uniform Resource Locator
USAID	United States Agency for International Development
USVI	United States Virgin Islands
UTS	United Telecoms Services
WAN	Wide Area Network
WEF	World Economic Forum
Wi-Fi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WSIS	World Summit on the Information Society

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