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Study on the State of Agriculture in the Caribbean:

ANNEXES

ANNEXES

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- Luis Loyola (DPIC) prepared Annex 2: Infrastructure and irrigation needs in the Caribbean region;
- Ida Christensen (SP1) prepared Annex 3: Gender equality and youth empowerment in the Caribbean region;
- Rouja Johnstone (DPIA) prepared Annex 4: Fisheries policy and investment strategy in the Caribbean region;
- Steven Watkins (DPIB) prepared Annex 5 and Annex 6: (5) Horticulture in the Caribbean, and (6) Livestock in the Caribbean; and
- Tomoko Kato (SP1) prepared Annex 7: Mainstreaming nutrition into agriculture investment in the Caribbean region.

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Introduction to Annexes 1–7

Information is the cornerstone of strategic planning for future growth. These seven annexes to the **Study on the State of Agriculture in the Caribbean** bring the key cross-cutting issues of agricultural sector development into focus: (1) climate change adaptation; (2) infrastructure and irrigation; (3) gender equality and youth empowerment; (4) fisheries and aquaculture; (5) horticulture; (6) livestock; and (7) nutrition. Each annex explores the multidimensional aspects of the agriculture sector in the Caribbean, including the many challenges facing the Caribbean Development Bank's (CDB) Borrowing Member countries (BMCs). The investment priorities identified will contribute in various forms to the guiding principles of the CDB's revised Agriculture Policy and Strategy Paper (APSP), jointly prepared by the Food and Agriculture Organization of the United Nations (FAO) and CDB. By identifying key trends in agriculture in BMCs and shedding light on the way forward, these annexes will inform CDB's investment strategy for improved productivity, inclusive growth and sustainability within the region's agriculture sector.

Annex 1: Climate change adaptation in the Caribbean region

The Caribbean is among the world's most vulnerable regions to the adverse impacts of climate change. The changing magnitude and frequency of extreme events pose a serious long-term threat to communities and ecosystems in the region. Increasingly severe droughts, more intense hurricanes and sea level rise are among the impacts which have already been documented in the region, while projections expect current trends to continue during the course of this century. Climate change adaptation strategies are thus vital to sustainable agriculture and food production, natural resource management, biodiversity conservation, and health.

The adaptation priorities identified by BMCs are key to building the resilience of traditional sectors in the region, such as agriculture and fisheries, and supporting the growth of emerging sectors, such as tourism. Strategic investments supporting adaptation to climate change also provide significant nutrition, gender equality and food security co-benefits.

Annex 1 identifies the challenges facing BMCs in the context of climate change and presents a holistic perspective of climate change adaptation (CCA), identifying key bottlenecks to adaptation along with linkages between adaptation and sustainable development at the local level and the sectoral level – agriculture, infrastructure and water resource management, coastal zone and disaster management. The scope and objectives of CDB are reflected in the key climate change adaptation investments proposed in Annex 1, while the climate change impacts and vulnerability information presented will support the plans and priorities identified by BMCs as well as their development outcomes.

Annex 2: Infrastructure and irrigation needs

The trend in agricultural growth has been declining in the Caribbean region, with BMCs becoming increasingly dependent on food imports. At the same time, income insecurity and unemployment have increased in rural areas. However, through targeted investments in infrastructure, the many challenges facing the region's agriculture sector can be addressed: low productivity, climate change and natural hazards, infrastructure limitations, commercial integration, limited access to international and tourism markets, and more.

Investing in specific infrastructure is a key factor in strengthening value chains. This annex focuses on priorities and guidance for investments in infrastructure to foster sustainable value chain financing and development, with key findings on opportunities for investments in infrastructure drawn from *the Study on the State of Agriculture in the Caribbean*.

Resilient, climate-proof infrastructure, including irrigation and drainage, is essential for the improved productivity and competitiveness of the agricultural sector in BMCs; it enables farmers to comply with the demands from high-value chains in the domestic, regional and international tourism, processing and retail sectors.

Annex 3:
Gender equality and youth empowerment

Gender equality and youth empowerment are at the core of sustainable development. Annex 3 builds on the findings of FAO's background study, *Investing in Agriculture in the Caribbean: Development in the Era of Climate Change,* which concludes that gender equality and youth integration in agriculture are essential considerations for improving the productivity and competitiveness of the agricultural sector in BMCs.

The critical aspects of accelerating progress on gender equality and youth empowerment in agriculture are divided into five sections with the following focus: (1) key social inequalities in agriculture; (2) the region's institutional and policy framework to address gender inequality and youth disempowerment; (3) the CDB's comparative advantage in promoting gender equality and youth empowerment; (4) important ongoing initiatives and opportunities for BMCs to enhance partnerships and to deliver more effectively on their gender and youth objectives; and (5) options for mainstreaming gender and youth in agriculture sector policy and strategy (ASPS).

Sixteen specific recommendations are made for key intervention areas, and some final suggestions are added for the CDB's consideration regarding the implementation of ASPS gender equality and social inclusion objectives.

Annex 4:
Fisheries policy and investment strategy

This study provides an overview of the fisheries sector in the Caribbean, highlighting key investment opportunities to support sector development in BMCs. The investment strategy envisaged adopts a comprehensive approach that addresses the constraints encountered by public and private stakeholders in the fisheries sector, as well as public institutions mandated to support sector development.

Key areas with the potential to inform the CDB's fishery sector investment strategy include the following: developing regional and national level policy and enhancing implementation capacities, which directly impact sustainable resource management and the long-term viability of the sector, as well as climate-smart and mitigation strategies; developing aquaculture as a source of sustainable income and nutrition for local communities and a new source of sustainable economic revenue for the state; and improving value chain efficiencies and adding value to the artisanal fisheries sector through strategic and sustainable policies and initiatives.

Investments should be aimed at supporting the transformation of the island economies using the Blue Economy paradigm to develop an innovative ocean economic space. This paradigm shift presents new opportunities for the fisheries sector; it upholds the principles of environmental, economic and social resilience as well as sustainability. Although the fisheries sector policy and

strategy is part of the overall Agriculture Policy of CDB, it must also be viewed as an integral part of CDB's Blue Economy Paper and align with its vision of the way forward.

Annex 5: Horticulture in the Caribbean

Horticulture is an important and specific component of agriculture that can be a powerful catalyst for economic growth, overcoming poverty, enhancing food security and stimulating growth in all sectors of community and regional economies. High-value horticulture is consistently more profitable for small-scale growers than alternatives such as cereal or root crop production. Horticulture creates more jobs, produces higher incomes, sustains the socio-economic viability of rural communities, and can contribute to national economies through export-related activities. At the same time, it is more demanding in terms of technology, infrastructure, pre- and post-harvest management, finance and knowledge.

Most Caribbean countries are at an early stage of agricultural technology and the potential to increase productivity is substantial. Local initiatives in Caribbean horticulture need to focus on the diversification of smallholder cropping systems toward increased production, post-harvest handling, value-added processing, and marketing. There are many market niches waiting to be exploited, especially for creative enterprises if they can obtain technical assistance in the fields of market research, standard certification, packaging and product adaptation to the requirements of selected target markets and tourists visiting the region. These horticultural industries are highly differentiated across countries and across sub-sectors.

Annex 5 identifies current limitations to horticulture sector growth in the region and presents the opportunities and strategies to counteract these challenges and spur growth. Recommendations include supporting the clustering of smallholders based on a product of common interest or common infrastructure, improving the performance and sustainability of plant quarantine services, and supporting the development of national food safety strategies.

Annex 6: Livestock in the Caribbean region

Livestock production systems are transitioning in the Caribbean, driven by population growth, increasing demand, stricter quality and safety standards for animal source food, and increasing competition for land and water resources. Smallholders with crops and livestock are central in this progression, as livestock ownership forms part of rural livelihood strategies. Competition for feed resources in carbon-constrained environments implies that these systems will have to intensify to ensure an acceptable livelihood for its producers. However, enhancing the quality and quantity of feed, as one of the most important factors of animal production, should not be seen in isolation, but rather be assessed as part of the greater value chain, including all stakeholders.

The mixed crop-livestock systems dominant in Caribbean livestock production systems will continue to be critical to future food security due to increasing competition for land, driven by continued concerns about climate change, energy security, urban expansion and alternative income sources for smallholder farming households. Competition for water is also expected to grow as a result of changing patterns of livestock production and the demand for fodder.

Annex 6 highlights the importance of long-term strategies for the development of improved livestock production, including appropriate husbandry and management support for small-scale growers. Increased livestock production will depend ultimately on the adoption of appropriate technology,

improved support services, market access and infrastructural development to stimulate increased productivity.

Annex 7:
Mainstreaming nutrition into agriculture investment in the Caribbean region

Nutrition security and agriculture are intrinsically linked. Achieving a nutrition-sensitive food system requires interventions at all stages of the farm-to-fork chain, from inputs and production, to processing, retail and consumption. This encompasses adopting a nutrition lens in agricultural practices and policies to enable a conducive institutional environment and capacity for nutrition-sensitive agriculture. This annex identifies the multiple potential entry points for nutrition interventions that contribute to inclusivity, sustainability and effective nutrition, and mitigate against the double burden of malnutrition in BMCs.

Nutrition-sensitive agriculture and food systems contribute to improving health outcomes through the production of diverse, safe and nutrient-rich food, income generation (which facilitates access to health services), reduced contamination of water sources, and the application of labour-saving technologies.

Annex 7 presents potential strategies to improve food security and ensure access to healthy foods by all individuals and families through initiatives that ensure access to healthy and sustainable diets from appropriate and resilient food systems.

All of the abovementioned cross-cutting issues facing the agriculture and fisheries sector in the Caribbean are explored in detail in these seven thematic annexes to the **State of Agriculture in the Caribbean**. Together, they capture the synergies among sectors, revealing the complex challenges facing the region as well as the many opportunities for investments to promote growth, reduce poverty, and ensure sustainability.

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Annex 1

Climate change adaptation in the Caribbean region

Acronyms and abbreviations

ACS	Association of Caribbean States
AF	Adaptation Fund
BMCs	Borrowing Member Countries
CANARI	Caribbean Natural Resources Institute
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community Organization
CBF	Caribbean Biodiversity Fund
CBIT	Capacity Building Initiative for Transparency
CC	Climate Change
CCA	Climate Change Adaptation
CCCCC	Caribbean Community Climate Change Centre
CCCRA	CARIBSAVE Climate Change Risk Atlas
CCF	Climate Change Finance
CCM	Climate Change Mitigation
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDB	Caribbean Development Bank
CDB-CRS	Caribbean Development Bank Climate Resilience Strategy
CIF	Climate Investment Fund
CPACC	Caribbean Planning for Adaptation to Climate Change
CPUE	Catch Per Unit of Effort
CRI	Climate Risk Index
CRS	Creditor Reporting System (CRS)
DAC	Development Assistance Committee
DFIs	Development Finance Institutions
EIB	European Investment Bank
GCF	Green Climate Fund
GEF	Global Environment Facility
ICZM	Integrated Coastal Zone Management
IPCC	Intergovernmental Panel on Climate Change
LDCF	Least Developed Countries Fund
MDB	Multilateral Development Banks
NAP	National Adaptation Plan
NCs	National Communications
NDC	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Index
NDVI	Normalized Difference Vegetation Index
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
SCCF	Special Climate Change Fund
SEI	Stockholm Environment Institute
SIDS	Small Island Developing States
SIS	Small Island States
SLC	Sea Level Change
UNFCCC	United Nations Framework Convention on Climate Change

Definitions[1]

Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

Adaptive capacity/Readiness: The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Anthropogenic: Resulting from or produced by human beings.

Baseline scenario: The term baseline scenarios refers to scenarios that are based on the assumption that no mitigation policies or measures will be implemented beyond those that are already in force and/or are legislated or planned to be adopted. Baseline scenarios are not intended to be predictions of the future, but rather counterfactual constructions that can serve to highlight the level of emissions that would occur without further policy effort.

Climate change: Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate projection: A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases (GHGs) and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized.

Climate scenario: A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information, such as about the observed current climate.

Disaster risk reduction (DRR): Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development.

Early warning system: The set of technical, financial and institutional capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.

1 Definitions are from the IPCC (2018) Glossary of Terms, unless cited otherwise.

Exposure: The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.

Global Climate Risk Index: CRI is an index based on the most reliable available data on the impacts of extreme weather events and associated socioeconomic data. The Climate Risk Index thus indicates a level of exposure and vulnerability to extreme events which countries should see as a warning signal to prepare for more frequent or more severe events in the future (Eckstein, Hutfils, and Winges, 2018).

Hazard: The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Integrated Coastal Zone Management: ICZM is a dynamic, continuous and iterative process designed to promote the sustainable management of coastal zones. Over the long term, ICZM seeks to balance the benefits from economic development and human uses of the Coastal Zone, the benefits from protecting, preserving, and restoring Coastal Zones, the benefits from minimizing loss of human life and property, and the benefits from public access to and enjoyment of the Coastal Zone, all within the limits set by natural dynamics and carrying capacity (EU, 1999).

Land use and land-use change: Land-use change involves a change from one land-use category to another.

ND-GAIN Index: The Notre Dame-Global Adaptation Index (ND-GAIN) Country Index is a free, open source index that shows a country's current vulnerability to climate disruptions. It also assesses a country's readiness to leverage private and public sector investment for adaptive actions. ND-GAIN brings together over 74 variables to form 45 core indicators to measure vulnerability and readiness of 192 UN countries from 1995 to the present (ND-GAIN, 2015).

Sea level change (sea level rise/sea level fall): Sea level can change, both globally and locally (relative sea level change) due to (1) a change in ocean volume as a result of a change in the mass of water in the ocean; (2) changes in ocean volume as a result of changes in ocean water density; (3) changes in the shape of the ocean basins and changes in the Earth's gravitational and rotational fields; and (4) local subsidence or uplift of the land.

Vulnerability: The propensity or predisposition to be adversely affected.

Summary

The Caribbean is among the world's most vulnerable regions to the adverse impacts of climate change. The changing magnitude and frequency of extreme events pose a serious, long-term threat to communities and ecosystems in the Caribbean. Increasingly severe droughts, more intense hurricanes and sea level rise are among the impacts that have already been documented in the region, while projections expect current trends to continue during the course of this century. Climate change adaptation strategies are thus vital to ensuring sustainable development in the region, in particular in terms of agriculture and food production, natural resources and biodiversity, health, and tourism.

There are many drivers of vulnerability to climate change and natural hazards in the Caribbean:

- small size and/or complex topography along with high population density in coastal areas;
- near-exclusive reliance on climate-sensitive economic activities, such as agriculture (mostly monocultures of commodities) and tourism;
- dependence on rainfed agriculture as well as on coastal aquifers;
- overexploitation of natural resources and reduced biodiversity;
- high public debt;
- limited hazard forecasting capabilities; and
- incomplete mainstreaming of climate-related issues into policies and strategies.

Since the mid-1990s, the region has received support to increase the readiness of its countries, and to adapt to the current and forecasted negative impacts of climate change. Adaptation deficit seems to be decreasing in countries like Grenada, Guyana, Jamaica and Suriname. However, climate change adaptation challenges persist, and in some cases, exposure to climate-related hazards has increased, as is the case for the Bahamas, Belize, Haiti, Saint Lucia, and Saint Vincent and the Grenadines.

Over USD 1.4 billion has been allocated to support national and regional climate change mitigation and adaptation efforts since 2010; yet coordination and mainstreaming for adaptation initiatives have waned. Future investments in climate change adaptation in the region will require a more detailed understanding and national mapping of the above-mentioned drivers of vulnerability, including climate risks and ecosystem vulnerability. Based on current policies and active projects, the Caribbean Development Bank (CDB) has a strong comparative advantage in supporting the adaptation path of Borrowing Member Countries (BMCs), including the following priorities: (1) infrastructure (irrigation and water management, transport, access to energy, coastal protection); (2) climate-adaptive natural resource management and climate-smart approaches to value chain development and support; and (3) policy and planning (climate change strategic planning).

The adaptation priorities identified by BMCs are key to building the resilience of traditional sectors in the region, such as agriculture and fisheries. Strategic investments supporting adaptation to climate change also provide nutrition, gender equality and food security co-benefits. The investment priorities identified in this Annex to the Study on the State of Agriculture in the Caribbean will contribute in various forms to the guiding principles of CDB's revised Agriculture Policy and Strategy Paper, jointly prepared by FAO and CDB.

Introduction

Background information

Over the years, CDB has prioritized the development of the agriculture sector in its BMCs,[2] lending directly to governments and private enterprises, and indirectly to private enterprises through national Development Finance Institutions (DFIs). Through its Technical Assistance (TA) programmes, CDB provides financing to governments, national and regional agricultural support institutions, and non-governmental organizations to implement a wide range of activities that support agricultural development.

Most of CDB's Borrowing Member Countries have achieved key development milestones in the post-independence era, including relatively high human development indexes and middle-income status. Nonetheless, CDB's Strategic Plan 2015–2019 reveals that BMCs continue to face significant socioeconomic and environmental challenges. These include low and variable economic growth; unsustainable debt and weak fiscal management; high unemployment; high prevalence of non-communicable diseases; crime and increasing threats to citizen security; persistent and extreme poverty; food insecurity; environmental degradation; and vulnerability to the effects of climate change and natural hazards.

As part of its efforts to contribute to sustainable development and poverty reduction, CDB developed a transformative climate-resilient policy and investment financing strategy for its BMCs. The five-year Climate Resilience Strategy (CDB-CRS, 2012–2017) is aimed at ensuring climate change adaptation (CCA) mainstreaming within the institution, and supporting the most vulnerable and least developed BMCs in their efforts to implement urgent priority initiatives (CDB, 2012). The strategy identifies a number of constraints to climate change adaptation:

- Insufficient Research and Development (R&D) and poor technical capacities at the national level with consequent negative impacts on policy.
- Ineffective mainstreaming of information and low awareness.
- Limited interdisciplinary and multidisciplinary research, with specific gaps in relation to the socioeconomic impacts of climate variability and changes.
- Inadequate prioritization in addressing climate change actions, both at the regional and national levels.

The objectives of the 2012–2017 Climate Resilience Strategy are to (1) develop and operationalise a robust environmental sustainability risk framework, which explicitly includes climate resilience, for CDB's operations; and to (2) assist BMCs and regional institutions with the financing, design, and implementation of policies, strategies and investment programmes to address climate resilience and deliver on their sustainable development objectives.

The strategy, which is organized into two phases, is articulated as follows:

2 Anguilla, Antigua and Barbuda, Barbados, Belize, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, The Bahamas, Trinidad and Tobago, Turks and Caicos Islands.

Phase 1: 2012–2015

(a) Strengthen staff capacity by building an explicit internal climate risk framework for CDB's operations.

(b) Establish itself as an intermediator of climate finance and an implementing entity providing direct access and more sustainable funding levels to BMCs, using the global climate finance architecture.

(c) Strengthen the knowledge framework and capacity of regional institutions and BMCs to assess climate change risks.

(d) Support BMCs to design and implement appropriate policies and climate-resilient development programmes for financing by CDB and other development institutions.

Phase 2: 2016–017

(a) Scale up and replicate successful programmes initiated during Phase 1, with limited expansion into new operational areas.

(b) Place emphasis on the establishment of long-term sustainable levels of concessional financing and the use of more innovative approaches, mechanisms and instruments to support the full transition of BMCs to a more sustainable, low carbon development path.

The CDB's Climate Resilience Strategy for 2012–2017 has not yet been evaluated; therefore, it is not possible to assess whether or not the strategy reached its objectives.

Scope and objectives

The main objective of this Annex is to identify the challenges and complexities of climate change adaptation in the CDB's Borrowing Member Countries. The paper will look at adaptation from a holistic perspective, identifying key bottlenecks to adaptation along with linkages between adaptation and sustainable development at the local level, and the sectoral level – agriculture, infrastructure and water resource management, coastal zone and disaster management. The scope and objectives of CDB are reflected in the key climate change adaptation investments proposed in the paper, while the climate change impacts and vulnerability information presented will support the plans and priorities identified by BMCs as well as their development outcomes.

Methodology

The analysis and findings presented in this document are based on data and information gathered through (1) a literature review; (2) an FAO GeoSpatial analysis via FAO-Earth Map and Google Earth Pro;[3] (3) an analysis of the main climate change adaptation indexes (ND-GAIN and CRI); and (4) an analysis of nationally determined contributions (NDCs) and national communications (NC) to the United Nations Framework Convention on Climate Change (UNFCCC).

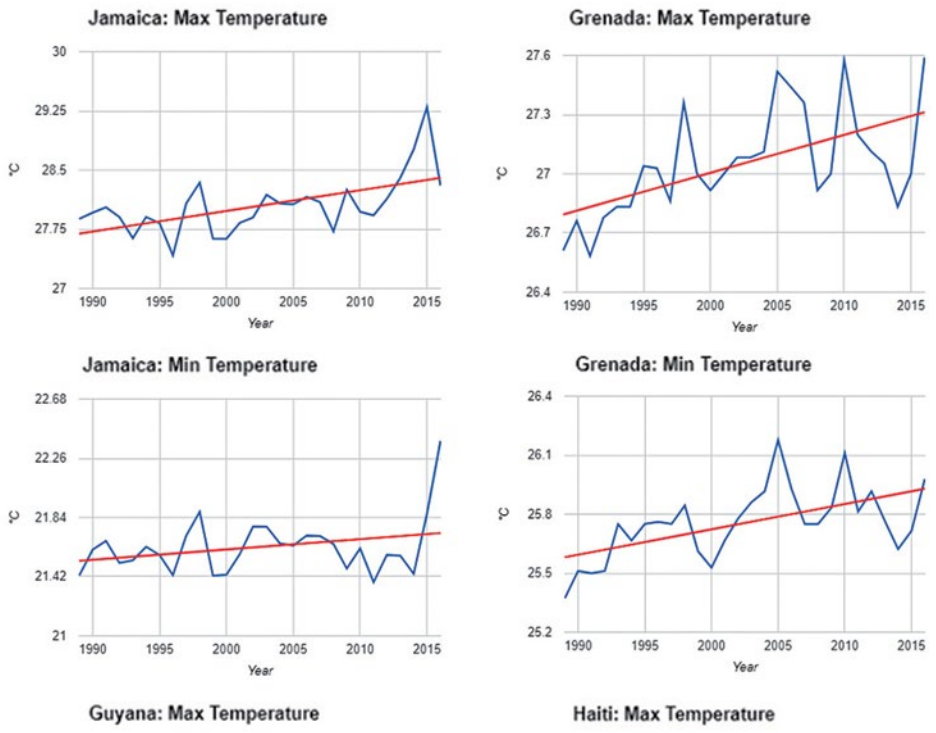
3 To better understand countries' climate change vulnerabilities, FAO has developed a new application that allows access to and elaboration of the main international databases on remote sensing and climatic data.

Current climate-related challenges for agriculture, fishery and aquaculture sectors in the region

Persistent threats

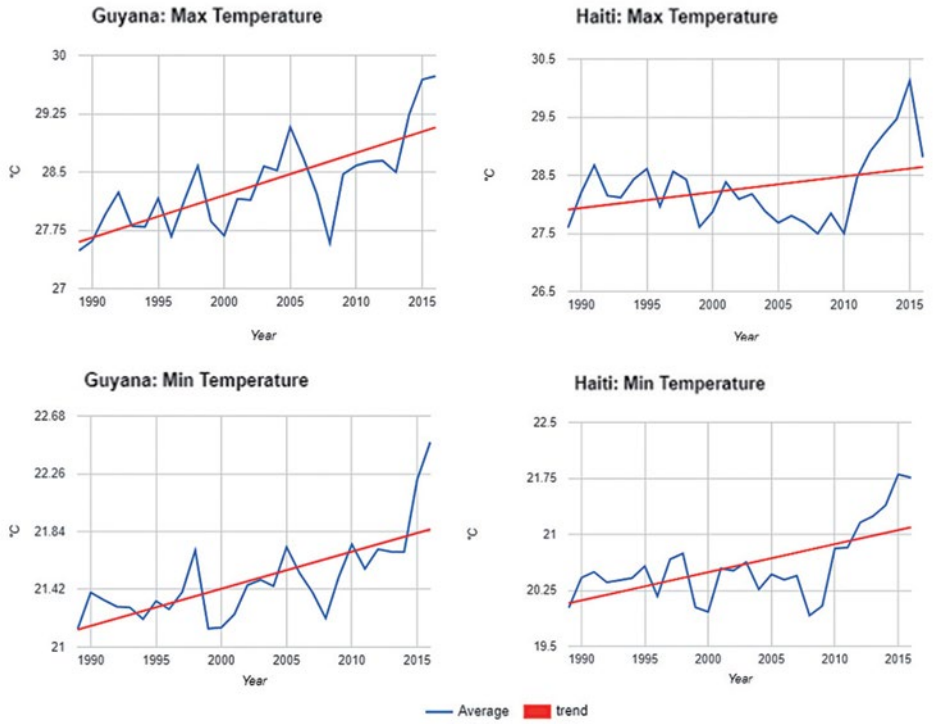
The Caribbean is among the world's most vulnerable regions to the adverse impacts of climate change. Air and ocean surface temperatures (Tandon, 2014; Taylor *et al.*, 2018)[4] show a constant increase, including higher frequency in temperature extremes across the region. The data[5] in Figure 1 from Jamaica, Grenada, Guyana, and Haiti show an upward trend in maximum and minimum temperature from 1989 to 2017.

Figure 1. Maximum and minimum temperature trends (1989–2017) in Jamaica, Grenada, Guyana, and Haiti.



4 Air temperatures: +0.19°C and + 0.28°C per decade of daily maximum and daily minimum temperature. Sea surface temperatures: +0.13 per decade since 1979.

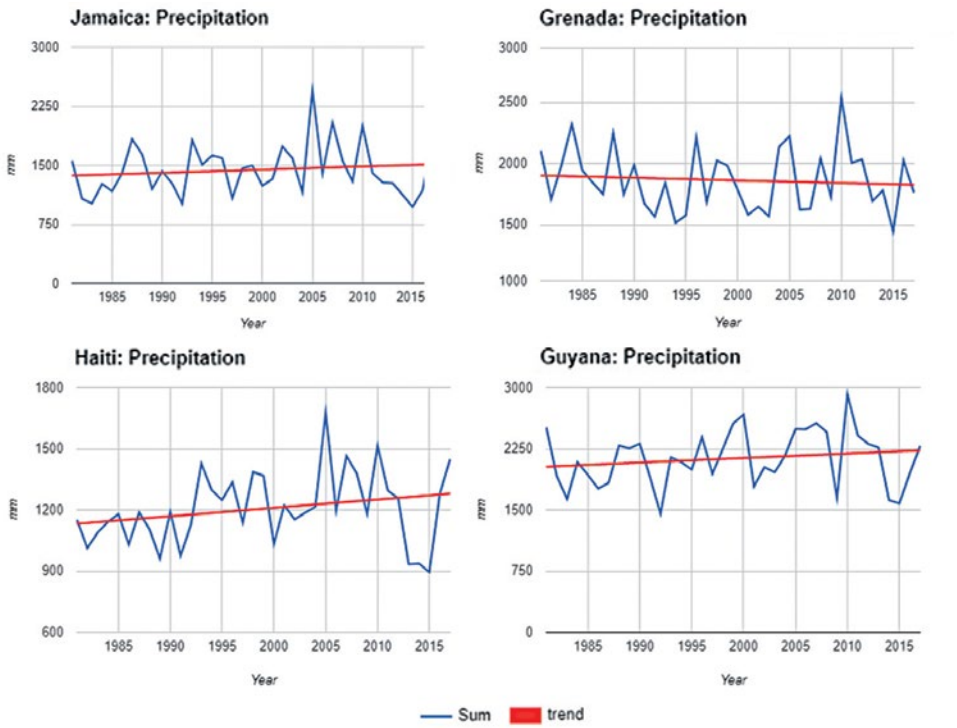
5 FAO Earth Map using Climate Hazards Group InfraRed Precipitation with Station data (version 2.0 final).



Source: Adapted from FAO, Earth Map data (2018).

Precipitation trends over the same time period are less linear and homogenous, mostly because of the region's diverse geography and topography. However, Figure 2 illustrates changes in precipitation patterns for Jamaica, Grenada, Haiti, and Guyana.

Figure 2. Precipitation trends (1989–2017) in Jamaica, Grenada, Haiti, and Guyana.



Source: Adapted from FAO, Earth Map data (2018).

Across the region, BMCs are becoming increasingly exposed to extreme events, such as droughts and more intense hurricanes, as well as sea level changes (Taylor *et al*, 2018).[6] Projections for the region expect current trends to continue during the course of the century.

Vulnerability, exposure and readiness in the region

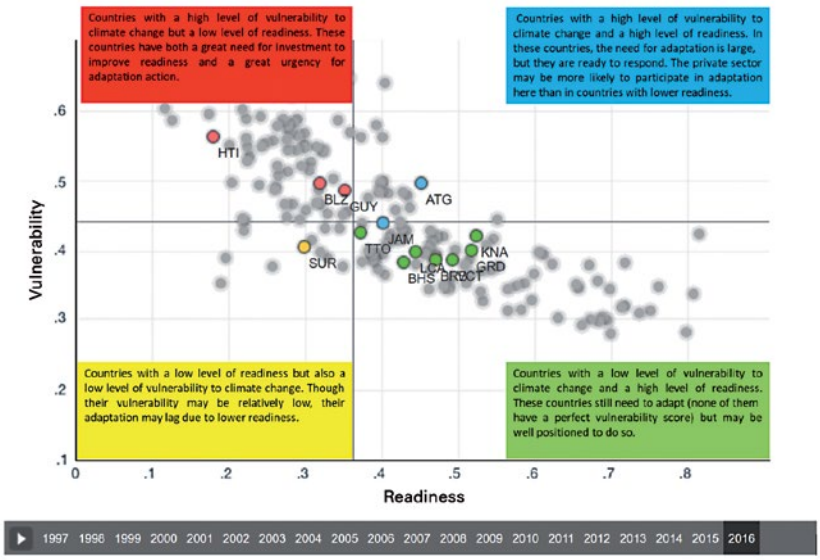
Climate change adaptation challenges and strategies should be considered in conjunction with the main factors driving climate change vulnerability in the Caribbean. These include:

- small size and/or complex topography along with high population density in coastal areas;
- near-exclusive reliance on climate-sensitive economic activities, such as agriculture (mostly monocultures of commodities) and tourism;
- dependence on rainfed agriculture as well as on coastal aquifers;
- overexploitation of natural resources and reduced biodiversity;
- high public debt;
- limited hazard forecasting capabilities; and
- incomplete mainstreaming of climate-related issues into policies and strategies.

Given the diverse environments, governance approaches and economies of BMCs, this document looks at vulnerability, readiness and risk exposure through the lens of internationally recognized indicators – such as the ND-GAIN Index and the Climate Risk Index (CRI) – to compare and present the vulnerability of each country, and identify spillover effects on identified sectors.

Figure 3 shows the ND-GAIN (vulnerability) and the CRI (exposure) indexes[7] of BMCs: Belize, Guyana, and Haiti still present both high levels of vulnerability and scarce readiness to adapt, whereas Antigua and Barbuda as well as Jamaica are slowly but steadily improving their ranking.

Figure 3. The ND-GAIN Matrix for selected BMCs and the CRI overall ranking.[8]



6 The average sea level change (1950–2009) is reported as equivalent to +1.7–1.9mm / yr.

7 Values and information on the vulnerability of BMCs are available in Appendix A.

8 The definition of country vulnerability is reported, verbatim, from the ND-GAIN. Details on the vulnerability of BMCs are available in Appendix A.

Country vulnerability is defined in Table 1, based on ND-GAIN and CRI indicators.

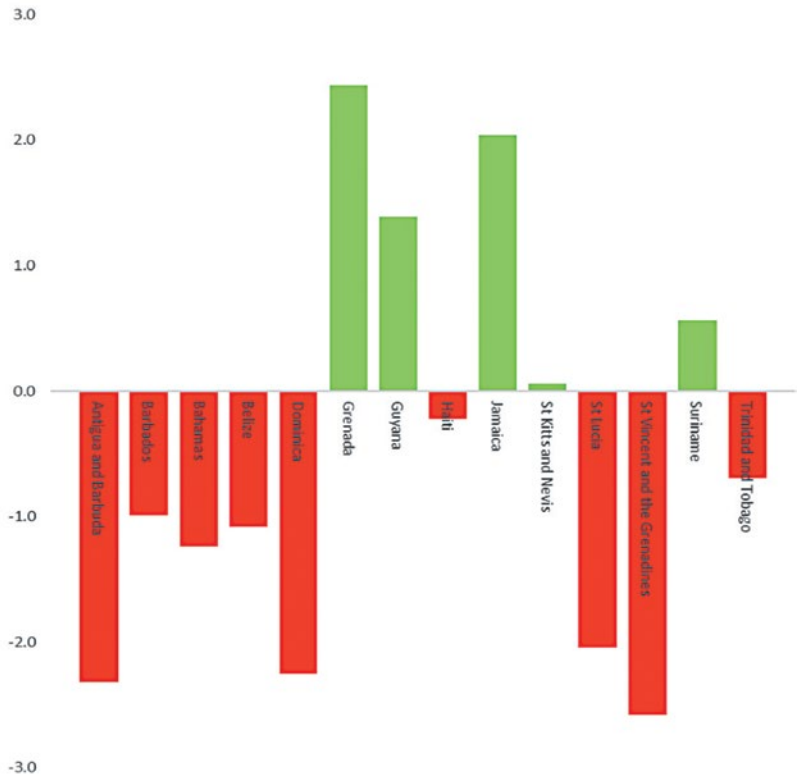
Table 1. 2018 ND-GAIN/CRI ranking for selected BMCs.

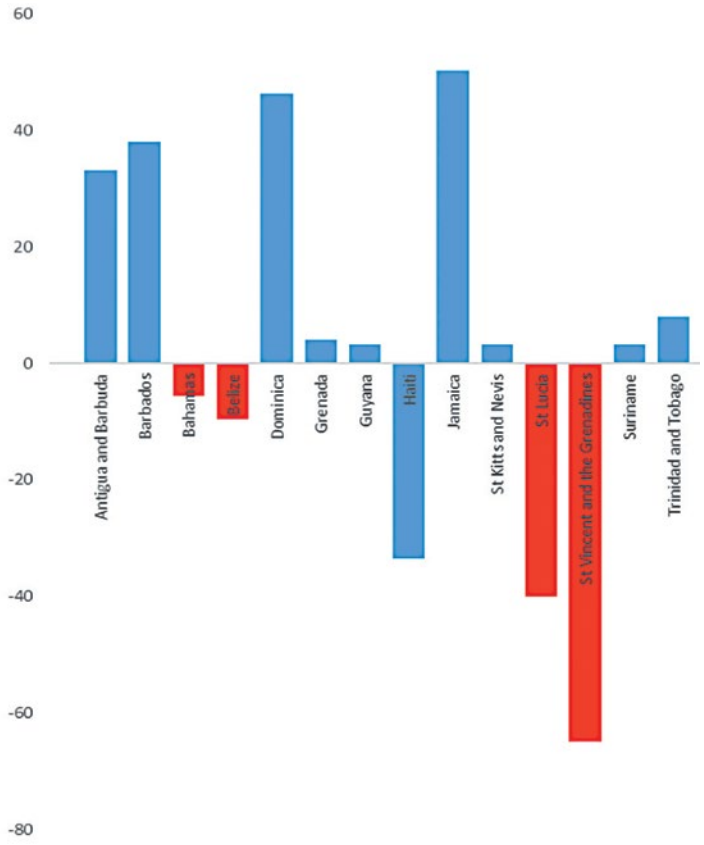
Country	These countries have both a great need for investment to improve readiness and a great urgency for adaptation action.	In these countries, the need for adaptation is large, but they are ready to respond.	Countries with a low level of readiness but also a low level of vulnerability to climate change. Though their vulnerability may be relatively low, their adaptation may lag due to lower readiness.	These countries still need to adapt (none of them have a perfect vulnerability score) but may be well positioned to do so.
Antigua and Barbuda				
Barbados				
Bahamas				CRI reports a worsening situation since 2010
Belize	CRI reports a worsening situation since 2010			
Dominica				
Grenada				
Guyana				
Haiti				
Jamaica				
St Kitts and Nevis				
St Lucia				CRI reports a worsening situation since 2010
St Vincent and the Grenadines				CRI reports a worsening situation since 2010
Suriname				
Trinidad and Tobago				

Source: Adapted from ND-GAIN (2018).

Figure 4 shows the inhomogeneity of BMCs in terms of their rankings (2010–2016) within the two indexes – NG-Gain and CRI. **Improvements** in the overall ranking for both indexes are reported for **Grenada**, **Guyana**, **Jamaica**, **Saint Kitts and Nevis,** and **Suriname**; however, **negative trends** for both vulnerability and exposure are visible in **Haiti**, **Saint Lucia**, and **Saint Vincent and the Grenadines**.

Figure 4. Variation within the NG-Gain (ND-GAIN, 2018) and CRI scores in BMCs (2010–2016).





Source: Adapted from Eckstein, Hutfils, and Winges (2018).

Overview of current climate change adaptation initiatives

Climate change adaptation experiences vary greatly in the Caribbean. Since the early 1990s, most if not all of the countries and territories in the region have been recipients of bilateral, multilateral and multi-bi investments. According to the Stockholm Environment Institute (SEI), which analysed climate finance[9] flows from 2010 to 2015,[10] the total investment in BMCs was equal to about USD 914 million (SEI, 2017). Over 80 percent of climate finance consisted of grants, of which 48 percent was invested in mitigation activities, 32 percent in adaptation, and 20 percent in cross-cutting activities (SEI, 2017).

However, the analysis performed by the SEI does not include projects which were approved after 2016, nor does it reflect new, multilateral donors, such as the Green Climate Fund (GCF), which invested over USD 111 million in the region in 2017/2018. Following a preliminary analysis of ongoing and planned projects and additional investments of up to USD 571 million, total climate-finance flows in BMCs amount to over USD 1.48 billion for the period 2010–2018. At the national level, 52 percent was invested in climate change adaptation (CCA) activities, 34 percent in climate change mitigation (CCM) activities, and 10 percent in cross-cutting activities between CCA and CCM. Regional investments consist of about 11 percent of the total volume allocated, with CCA absorbing about 60 percent of the total, and CCM and cross-cutting investments about 1 percent and 39 percent respectively.

Based on a combined analysis, SEI (2017) and FAO (2018a) find that about 80 percent of international climate finance comes from bilateral donors, and the rest from multi-bi funds, such as the Global Environment Facility (GEF)[11] and the Green Climate Fund. About 50 percent of bilateral and multi-bi climate finance is programmed through various multilateral development banks (MDBs), which work with recipient countries in the design and/or execution of projects: 25 percent through recipient government entities; 18 percent through undefined public sector, and 7 percent via the United Nations.

As shown in Figure 5, the first BMCs to receive grants and loans allocated for climate change between 2010 and 2018 were Guyana (31 percent); Haiti (17 percent); Antigua and Barbuda (8 percent); Jamaica (6 percent); and Grenada (5 percent).[12]

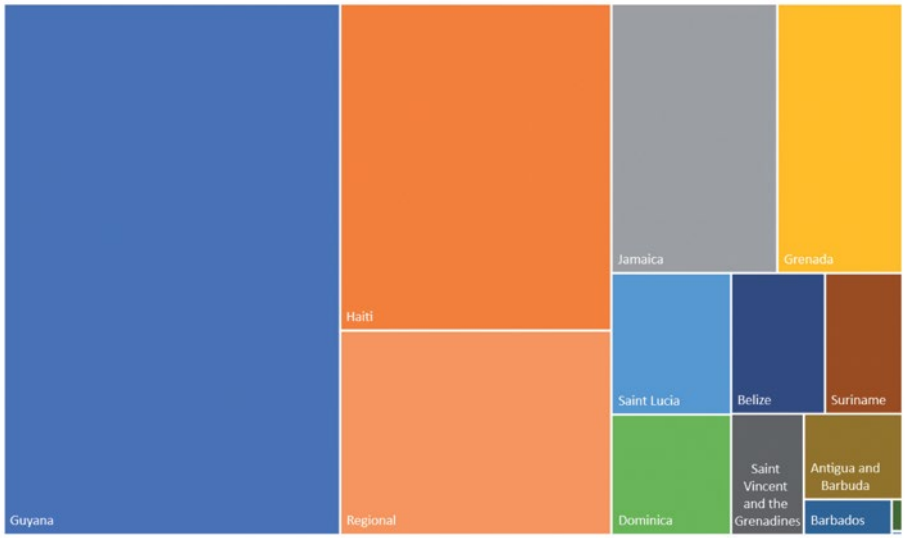
9 The term "climate finance" refers to international financial flows reported as official development assistance (ODA) that primarily target climate change (SEI, 2017).

10 Source of data from the OECD/ DAC /CRS.

11 Reported here as aggregate of the following funds: LDCF, SCCF, CBIT and GEF-Trust Fund, jointly managed by the GEF.

12 Details for Grenada, Guyana, Haiti and Jamaica are available in Appendix C.

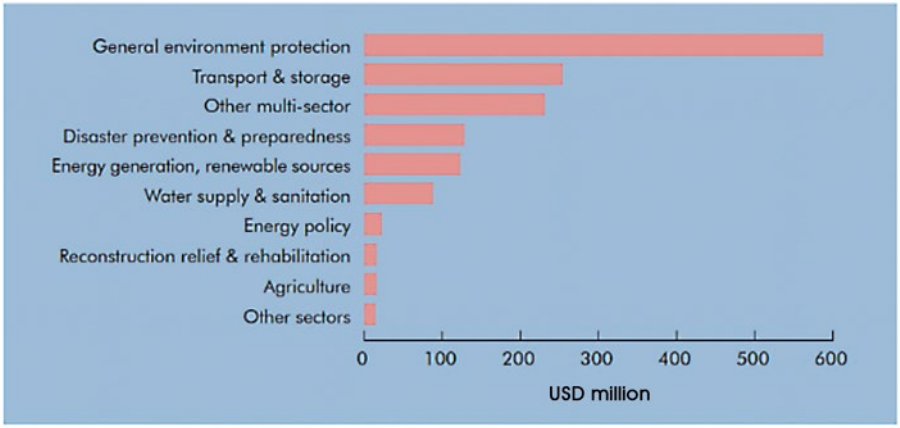
Figure 5. Distribution of climate finance in BMCs.



Sources: (SEI, 2017; FAO, 2018a).

As shown in Figure 6, climate finance was distributed across ten key sectors between 2010 and 2015. With the exception of funding for "general environment protection" in Guyana[13] (SEI, 2017), a large share of investments went into the transport and storage sector, and other multi-sectors.

Figure 6. Sectoral distribution of climate finance in the Caribbean, 2010–2015.



Source: SEI (2017).

Of the additional financial resources – USD 536 million – identified from 2016 to 2018, the largest share of reported funds is invested in climate-related, multi-topic projects, where climate change adaptation is addressed through a diverse set of actions. However, the SEI cautions:

The narrow range of sectors represented in the climate finance data […] suggests that countries may be finding it difficult to align the available climate funding with a wide range of other complementary

13 Forest protection.

development priorities. If so, this could be a missed opportunity and also leave some gaps in implementing country adaptation strategies (SEI, 2017, p.8).

Another important factor observed by the SEI, and partially confirmed for the period 2016–2018, is that often, allocation criteria are not fully coherent with identified regional and national priorities. This is particularly relevant to the agriculture and fishery sector in BMCs: Although both are at the core of several countries' economies and are reported in many key climate change adaptation documents, such as national action plans (NAPs) or nationally determined contributions (NDCs), both lack international climate finance.

Concerning the period analysed by SEI, it is not possible to disaggregate investments in the target sectors. The document only reports an aggregate value of around 10 percent and 13 percent. During the 2016–2018 period, the proportion of climate finance invested in agriculture, fisheries and aquaculture (aggregated) was about 17 percent, of which 14 percent was invested in agriculture, and 3 percent in fishery.[14] Most of these investments addressed the resilience of smallholders as well as crops and livestock (mostly via training), capacity development, institutional support to central and local authorities, and small on-farm/household investments, such as irrigation, machinery, and plants.

Of the ongoing projects, the two main actors in agriculture are the Inter-American Development Bank (IDB) and the International Fund for Agricultural Development (IFAD). For fisheries and aquaculture, the main partners are the Climate Investment Funds (CIF), the World Bank and the United States Agency for International Development (USAID). The Green Climate Fund (GCF) also operates in the region, mostly via regional and national institutions.

Most funds for climate financing – over 86 percent for the 2010–2018 period – are allocated via specific projects or programmes, while about 14 percent contribute to programmes and funds managed by international organizations. According to the SEI's analysis of climate finance disbursement ratio, only 39 percent of the funds identified were disbursed in 2017 (SEI, 2017). However, the reported percentage is significantly lower for climate finance than it is for the disbursement ratio of non-climate aid, which can reach as high as 95 percent (SEI, 2017).

The complexity of climate change adaptation, along with the lack of coordination and technical capacities, might suggest that there are specific challenges associated with the execution of climate projects or with the climate finance architecture, which may complicate delivery mechanisms to the point of being unrealisable.

Gender targeting is also lacking in the reviewed projects, even though it is considered a pillar of climate change adaptation by the United Nations Framework Convention on Climate Change (UNFCCC). Addressing gender equality is particularly important for adaptation strategies in certain sectors, such as agriculture and fisheries, where women constitute a considerable part of the workforce, but have limited access to finance, land, networks, information, and decision-making in organizations. The UNFCCC firmly upholds the notion that gender mainstreaming is key to ensuring the success of adaptation strategies.

Best practices and lessons learned

Understanding best practices and lessons learned in terms of climate action in the Caribbean is challenging, given the region's heterogeneity and variety of governance systems. Despite considerable

14 The reported amount does not include a large Green Climate Fund (GCF)/German Development Agency (GIZ) project on water management in Grenada. The amount planned for on-farm irrigation improvements could not be isolated due to limited budget information.

climate funding by different actors for adaptation initiatives in the region – over USD 1.2 billion – few evaluation reports are available (SEI, 2017).

Although the best and the worst performing countries – concerning vulnerability and exposure – received similar interventions, the main variables influencing performance cannot be determined without a proper analysis of key evaluation papers and country performance analysis.

However, during the past two decades, a number of strong regional initiatives have been launched. For example, the Caribbean Community Climate Change Centre (CCCCC), which opened in August 2005, has already executed several projects, established key regional tools, such as the CARIBSAVE Climate Change Risk Atlas (CCCRA), and engaged in several other regional programmes to ensure integrated coastal management and sustainable natural resource management. Climate change is also now part of the mandate of other key regional organizations: the Association of Caribbean States (ACS); the Caribbean Community (CARICOM), which started the Caribbean Planning for Adaptation to Climate Change (CPACC); the Caribbean Biodiversity Fund (CBF); the Caribbean Natural Resources Institute (CANARI); and the Caribbean Agricultural Research and Development Institute (CARDI). However, no single organization has the mandate to coordinate climate change adaptation and mitigation initiatives.

Despite the establishment of these and other regional organizations, coordination and synergies are lacking. Therefore, the diversity of adaptation results in the region may also be linked to a lack of funding and coordination among organizations, rather than weak projects. Likewise, at the national level, it is often unclear as to where institutional responsibilities lie. In Jamaica, for example, several different ministries work on climate change adaptation in the absence of a coordination mechanism or clear leadership, which may lead to mainstreaming bottlenecks, and obstruct initiatives.

While it is not possible to evaluate the success of individual projects, programmes, or strategies – including the CDB-CRS (2012–2017) – the following elements of adaptation processes and vulnerability can be reported for the region:

- ⬆ The Caribbean Community Climate Change Centre (CCCCC), the Central American Bank for Economic Integration (CABEI), and CDB[15] are now accredited with the GCF and/or the Adaptation Fund (AF).
- ⬆ 58 percent of CDB's active portfolio includes climate change (CDB, 2018), but only 4 percent seems invested in agriculture (i.e. Haiti).
- ⬆ 100 percent of the 14 BMCs analysed have either approved, or are in the process of developing or updating their respective National Adaptation Plans.
- ⬆ 100 percent of the BMCs analysed have submitted their Nationally Determined Contributions (NDCs) to the UNFCCC, and each includes adaptation among the priorities (UNFCCC, 2018a).
- ⬆ Climate change adaptation is recognised as a priority by all the existing regional organizations; it is integrated into regional strategies and into support actions for their clients.
- ⬇ Submission trends of National Communications (NCs) to the UNFCCC demonstrate that about 65 percent of countries analysed were either late or severely late in submitting their four-year reports, which include adaptation targets for both agriculture and fishery.
- ⬇ Only one BMC (Jamaica) has submitted the Biannual Update Report to the UNFCCC (UNFCCC, 2018b).

15 Through the accreditation, CDB can implement small projects (up to USD 205 million) in the region.

- Climate change adaptation tends to be approached through stand-alone projects, and is often disjointed from national investments, thus reducing long-term sustainability potential.
- Coordination of climate change adaptation issues at the regional and national level remains unclear, and is often underreported, which may lead to the dispersion of climate finance and unaccountability of results.
- Natural resources – land, water, energy – are increasingly subject to competition in the region, which puts pressure on agricultural land and ecosystems. In countries like Belize and Jamaica, in addition to "traditional" competitors, such as urbanization and tourism, new players are competing over resources, including the freshwater and marine aquaculture sectors.

This overview shows that, despite substantial climate finance invested in the region, the performance of BMCs varies as regards adaptation, disbursement ratios, and coherence between climate finance and national priorities. It can be assumed that: **(a)** Caribbean countries still require assistance and support in identifying and securing climate finance to address their climate change needs; **(b)** climate change adaptation requires national and international coordination to be effective and efficient; and **(c)** national priorities are not always the main driver of climate finance allocation.

Expected impacts on agriculture and climate change adaptation challenges

Climate change poses a significant threat to the agriculture sector in BMCs. The recorded and projected changes in climate variables may decrease the productivity of key crops, such as bananas, beans, sugar cane, cassava, maize, and rice. Climate change is also expected to have a negative impact on livestock production, reducing the availability of pasture, fodder and water, especially for large ruminants (ECLAC, 2014).

Erratic precipitation patterns may reduce the quantity and reliability of water resources, augment soil erosion, and damage key infrastructure, such as irrigation networks, drainage systems, roads, power distribution, markets, and others. Sea level changes (SLC) are expected to affect coastal aquifers, further reducing the availability of fresh water in areas where population density is high, and potentially increasing the risk of conflict over natural resource use.

Agriculture is sensitive to weather and climate conditions; therefore, variations in temperature can have a negative impact on the growing season of crops. Changing environmental conditions can also worsen the spread of disease and pests, thus affecting agricultural production. The increased intensity of tropical storms and hurricanes could also lead to severe losses, not only in terms of agriculture production, but also physical infrastructure, making agriculture less commercially viable.

Furthermore, sea level change is likely to affect lowland rice production. For example, in Guyana, part of the rice production fields are subject to tide-related floods, and are currently protected by dykes. According to the United States Department of Agriculture (USDA), sea intrusion – in combination with drought – in Guyana's Mahaica-Mahaicony-Abary area has affected the productivity of about 15 percent of the rice fields planted in 2016 (USDA, 2017).

Moreover, the cumulative impacts of climate change on transport and energy distribution are expected to negatively affect the region's agriculture sector (Torres and Tsimplis, 2013). Sea level changes, increased temperature and extreme weather events might severely affect mobility: (1) isolating agricultural areas; (2) blocking production and the marketing of products; (3) compromising food security (especially in Haiti); and (4) increasing country dependence on food imports. Seasonal and daily temperature increases will also affect electricity demands. As energy consumption increases for cooling and refrigeration, power shortages and the occurrence of blackouts will become more frequent.

Smallholders in BMCs are particularly vulnerable to the impacts of climate change. Ninety percent of the farms in the region are smaller than 2 hectares, while smallholders in rural areas depend on agriculture for their livelihoods (Graham, 2013).

The impacts of climate change will also affect rural populations. Increased migration away from rural areas may have spillover effects on the socioeconomic stability of countries and on coastal areas. For example, in Haiti, Jamaica and other Caribbean countries, agricultural land is being converted to non-agricultural uses such as housing at a rapid pace. At the same time, key ecosystems which are vital to climate change adaptation are increasingly overexploited, such as mangroves, coastal forests and coral reefs. Figure 7 and Figure 8 illustrate major, primary land-use changes in Jamaica and Haiti.

Figure 7. Land-use changes (agriculture to urban) in Caymans Blocks Irrigation Network, Jamaica.

Source: Adapted from Google Earth data (2005–2017).

In view of the above, agriculture in the region – particularly in Small Island States (SIS) and Small Island Developing States (SIDS) – will have to cope with both the **direct** and **indirect** negative impacts of climate change, and with increasing anthropogenic stressors, such urbanization and tourism. Given the negative trends in the contributions of agriculture to GDP in the region, urbanization and other land-use changes may slowly, but steadily reduce the availability of resources, such as water and land, for traditional and commercial agriculture.

Nevertheless, agriculture continues to play a vital role in the economies of BMCs. Therefore, investments in the sector, such as in livestock production, have the potential to not only spur sustainable growth, but to also ensure long-term climate change adaptation and, ultimately, food security. However, sustainable growth and climate change adaptation require investments in research and development, specialized human resources as well as strengthened public-private partnerships. For the agriculture sector to become adaptive and climate smart in terms of adaptation and mitigation, the following challenges must be addressed:

- Improve climate-smart planning and practices within value chains.
- Prevent the overexploitation of ecosystems, which are vital to climate change adaptation – forests, grasslands, coasts.
- Reduce competition over natural resources such as water and land among sectors.
- Strengthen infrastructure considering the projected impacts of climate change.

Expected impacts on fisheries and climate change adaptation challenges

Recent studies on climate change adaptation in the fishery sector (FAO, 2018a) confirm the high vulnerability of Caribbean fisheries to climate change. Reductions in fish and shellfish catches are expected, which will in turn impact on those working in the entire value chain. Food and nutrition security as well as the export trade will also be adversely affected by climate change (Tandon, 2014). The following are among the main, negative impacts of climate change on the fisheries sector in the Caribbean:

- Extensive coral bleaching, reducing habitats and coastal ecosystem productivity.
- Increased intensity of storms and sea level rise reducing the number of fishing days and impacting infrastructure, including landing sites, ports, markets and logistics.
- Sargassum influxes affecting fishery-related infrastructure and logistics, and potentially affecting catches due to the reduced productivity of coastal ecosystems such as reefs, seabed and mangroves.
- Water acidification.
- Hypoxia of coastal water.
- Fewer favourable habitats for fish nurseries and changes in the availability of high-value species (such as spiny lobster, conch, shrimp, and snapper) will reduce the catch per unit effort (CPUE) for both commercial and artisanal fisheries (FAO, 2018a).

An additional challenge for climate change adaptation in the region's fishery sector is the generally poor environmental performance of Small Island States and Small Developing Island States. According to the ND-GAIN and the CRI indexes, Haiti is considered the most vulnerable country in the region, as demonstrated by the negative performances in both vulnerability indexes (NG-GAIN, 2018; Eckstein, Hutfils, and Winges, 2018).

Multiple factors contribute to the country's vulnerability: demographic pressure, lack of environmental regulations or enforcement, limited sectorial investments, and land-use changes have led to the deterioration of coastal ecosystems and the near collapse of the coastal fishing sector. Figure 8 clearly shows how the abovementioned factors have not only changed Haiti's coast and the Port-au-Prince area in particular, but also the entire socioeconomic fabric of the country and its capacity to adapt to climate change.

Figure 8. Haiti, land cover and land-use change from 1967 to 2019. Views from Port-au-Prince and surrounding areas.

Source: map (1:12, 500 U.S. Army Map Service, 1967) available at the Perry-Castañeda Library - Map Collection from the University of Texas; Google Earth Pro.

Note: A short video is also available at: http://tiny.cc/73nfdz

For the fishery sector to become climate adaptive and climate smart in terms of adaptation and mitigation the following challenges need to be addressed:

- Improve climate-smart planning and practices within value chains.
- Prevent the overexploitation of coastal ecosystems, which are vital to climate change adaptation – mangroves, the seabed, coral reefs.
- Reduce competition over coastal resources among sectors.
- Strengthen infrastructure considering the projected impacts of climate change.
- Recognise the contribution of artisanal fishers and their role in planning and managing the sector.

Expected impacts on aquaculture and climate change adaptation challenges

The aquaculture sector is still marginal in the Caribbean; it is limited to a few countries – Belize, Guyana, Jamaica – and limited data is available to determine the country-specific challenges of BMCs. Nonetheless, FAO (2018) has identified numerous short-term, climate change impacts on aquaculture, including production and infrastructure losses as a result of extreme events, such as floods, and the increased risk of diseases, parasites and harmful algal blooms. Long-term impacts can include the reduced availability of seedlings from ecosystems as well as reduced precipitation, thus increasing competition for fresh water. Though often underestimated, the impacts of climate change on aquaculture may also adversely affect food safety and nutrition (FAO, 2018a), for example, through changes in the growth rates of pathogenic marine bacteria, or in the incidence of parasites and food-borne viruses.

The extent of climate change and its related impacts on aquaculture will depend on how exposed and vulnerable the socio-ecological systems are, as well as their capacity to plan and respond. Furthermore, given the high fragility of regional ecosystems and the dependence of local economies on ecosystem services, investing in freshwater and coastal aquaculture in the region might increase anthropogenic pressure, thus magnifying the impacts of climate change. When developing the sector, environmental and climate risk assessments are strongly recommended, in addition to effective biosecurity plans, which emphasize prevention and controls along the entire value chain.

Using satellite analysis, Figure 9 illustrates how aquaculture in countries like Belize and Jamaica seems to be competing with agriculture and ecosystems for space and resources. Such land-use changes should be included in a country's cost-benefit analysis to ensure sustainable growth pathways in the aquaculture sector.

Figure 9. Land-use changes in Jamaica due to pond construction.

Source: Author's analysis based on Google Earth Pro pictures (2003–2017).

Note: In addition to the loss of 280 ha of potentially good agricultural land, about 90 ha of coastal ecosystems (i.e. mangroves) have been permanently lost. For a time-lapse video of land-use change in Belize, see: https://earthengine.google.com/timelapse/#v=16.51124,-88.34403,10.628,latLng&t=0.12&ps=50&bt=19840101&et=20181231&startDwell=0&endDwell=0

On balance, the main sustainability and climate change adaptation challenges facing the aquaculture sector in BMCs correspond to those identified for both the fisheries and agriculture sectors. However, additional actions will be required:

- assessing the cost opportunity (financial, economic, climatic and environmental) of further developing the sector in the vulnerability context of BMCs;
- climate-proofing infrastructure related to the production and distribution of products – power and cold chain; and
- ensuring appropriate technical assistance for operators.

Adapting agriculture, fisheries and aquaculture in the region

Important steps have been taken at the regional level to produce climate data and forecasts as well as to attract new and innovative climate finance from multi-bi funds, such as the GCF. Nevertheless, some BMCs are still struggling to secure the enabling conditions needed for climate change adaptation. The CDB's 2012–2017 Climate Resilience Strategy continues to play a key role in

supporting BMCs with the approach to climate change adaptation as well as investments to ensure adaptation. The CDB Climate Resilience Strategy also reflects the priorities countries have identified (UNFCCC, 2018a, 2018b, 2018c) and communicated to the UNFCCC, as shown in Table 2.

Table 2. Countries' priorities[16] concerning climate change adaptation.

Priority Adaptation/Climate Proofing Topics	#	%
Infrastructure (production, mobility, electricity, Sea level rise)	14	100%
Planning and Policy	11	79%
Agriculture including food security and nutrition	7	50%
Natural Resource Management and Biodiversity	6	43%
Fishery	3	21%
DRR and Health	2	14%
Climate Insurance Schemes	2	14%
Aquaculture	0	0%

Source: Data adapted from NDCs.

Each target sector identified in Table 2 is subject to direct or indirect climate change adaptation challenges, especially in Belize, Guyana, and Haiti. An analysis of BMC priorities reveals the following challenges to ensuring climate change adaptation in agriculture and fisheries (including aquaculture): **(1)** incomplete climate change mainstreaming; and **(2)** lack of structured and effective coordination. As a result, BMCs generally lack strategic and climate-oriented territorial planning as well as the technical and financial means to ensure the climate proofing of infrastructure.

The CDB's Climate Resilience Strategy can help country and regional institutions to mobilize financing and to design and implement policies, strategies and investment programmes so that countries can address climate resilience and deliver on their sustainable development objectives (CDB, 2012). Many BMCs, such as Guyana and Haiti, urgently require tailored assistance to set their policies, strategies and investments.

Overall, many of the CDB's Climate Resilience Strategy (2012–2017) objectives have been reached, including points (a) and (b) in Phase 1 – internal mainstreaming of climate change, the Climate Investment Framework with the European Investment Bank (EIB), and accreditation with the Green Climate Fund (GCF) and the Adaptation Fund (AF). Further investments and dedicated tools are needed to strengthen the knowledge framework and capacity of regional institutions and BMCs to assess climate change risks (point c), and to support BMCs with the design and implementation of appropriate policies and climate-resilient development programmes for financing by CDB and other development institutions (point d).

Additionally, both points (c) and (d) can be enhanced with targeted investments in natural resource management (NRM) and integrated coastal zone management (ICZM), both of which are foreseen in the CDB-CRS (2012–2017). Investments in NRM and ICZM are integral to knowledge building and capacity development, which assist BMCs in the design and mainstreaming of climate risk management strategies in regional, national and sectorial policies.

As reported in the previous sections, most if not all of the highlighted vulnerability factors are determined by the combination of anthropogenic impacts and the intrinsic, biophysical characteristics of countries. The agriculture, fishery and aquaculture sectors are highly vulnerable to the impacts

16 A detailed account of priorities per country is available in Appendix B.

of climate change, as they largely depend on and influence the availability and quality of natural resources and ecosystem services. Similarly, biodiversity loss due to ecosystem disturbance or destruction has severe indirect impacts on ecosystem services. Yet, biodiversity and ecosystem health – such as mangroves, forests, and sand dunes – are essential to climate change adaptation and mitigation, and consequently to stability and economic growth in the region. This is clearly the case for countries such as Jamaica, where agriculture contributes about 7 percent to GDP, and to 20 percent of its labour force, whereas tourism contributes to about 30 percent of the GDP, employing about 35 percent of the total labour force.

As reported by the Caribbean Natural Resource Institute:

Threats from climate change cannot be viewed in isolation, but rather within the context of existing environmental pressures, such as habitat loss, deforestation, soil erosion, coastal pollution and overfishing. The cumulative and compounding impacts of climate change are now pushing many ecosystems to the point of collapse (e.g. coral reefs) or lowering their ability to recover from diseases, pests or invasive species. While the linkages between biodiversity, human well-being and economic activities, such as tourism, agriculture and fisheries, have been recognized by scientists for many years, they have often not been reflected in policy (Day, 2009, p. 3).

The severity and magnitude of the impacts of climate change on agriculture, fisheries and aquaculture will be determined by countries' ability to: (1) understand and map climate risks and opportunities; (2) correlate and plan value chains accordingly; (3) climate-proof infrastructure; and (4) apply an ecosystem-based approach to target sectors. In other words, a shift is needed from a paradigm based on exploitation to one where ecosystem and climate-reliant sectors are planned and managed sustainably in view of climate change and its impacts. Ecosystems in coastal and marine environments – forests (including mangroves), coral reefs and the seabed – also provide protection from extreme events, such as storms and hurricanes; consequently, their disappearance will not only increase the adaptation deficit of BMCs, but will also lower the productivity of value chains within the target sectors.

Based on the research presented, the following investments can support BMCs with climate change adaptation in target sectors, while providing additional and monitorable co-benefits in terms of food security and nutrition, gender equality, and youth empowerment.[17]

Agriculture

The following investment strategies have the potential to ensure climate change adaptation in the agriculture sector of BMCs:

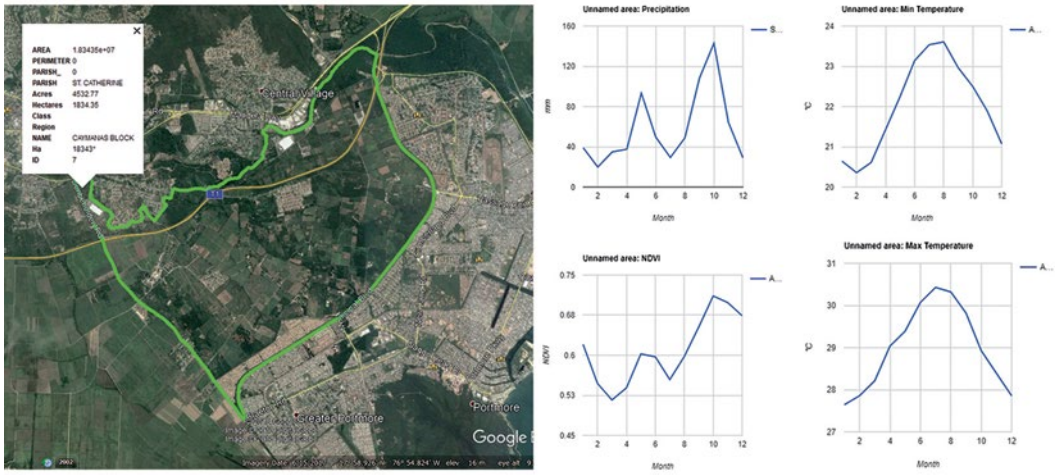
Climate-smart mapping and planning of sustainable value chains

The potential productivity and forecasting returns of investments can be estimated to a higher degree with the detailed mapping of temperature and precipitation in countries. Currently available climatic databases and country maps, such as FAO Earth Map, can be instrumental in supporting countries with strategic planning. Jamaica sets a good example: the state has shared pertinent information to enable detailed risk mapping for climate change adaptation in agriculture, thus facilitating the planning of adequate investments in production approaches (protected versus traditional) and infrastructure. Figure 10 shows how specific target areas can be downscaled to extract key agro-climatic data, such as temperature, precipitation and normalized difference vegetation index (NDVI). Knowing trends of

17 A detailed brief on Grenada, Guyana, Haiti and Jamaica is available in Appendix C.

such variables will allow stakeholders to invest accordingly and plan for production diversification. As previously illustrated in Figure 7, mapping will also indicate areas with potential land and resource conflicts, and allow planning accordingly.

Figure 10. Example of climate mapping for Jamaica (Cayman Block Irrigation Network).



Sources: Adapted from FAO Earth Map (2018b) data; Google Earth Pro.

Note: Temperatures report the monthly average MIN and MAX temperature for the period 1981–2017. NDVI reports the monthly average for the period 2001–2017.

Climate proofing value chain-related infrastructure

Agriculture is subject to both the direct and indirect impacts of climate change, which will affect value chains and operators. Investing in climate-proof infrastructure – in view of current climatic trends as well as projections – can improve the efficiency and effectiveness of value chains in the agriculture sector, while optimizing natural resource use and upgrading practices. Water reuse is also essential to sustainable irrigation practices; urban wastewater treatment plans, such as those found in Jamaica, reduce pressure on coastal freshwater aquifers, which are under anthropic (pollution and over pumping) and climatic pressure (sea level changes). Finally, decentralizing energy production via renewable energy will increase the resilience and adaptation capacity of value chains, thus reducing the risk of isolation, food insecurity and post-harvest losses.

Upgrading technologies and practices in target value chains

Precise climate trends as well as projections confirm that temperature and precipitation have changed across the region. Similarly, soil and water are less available and more subject to competition among sectors, such as agriculture and livestock versus tourism, aquaculture, and housing. Current agricultural technologies and practices may not be sufficient to guarantee the livelihoods and well-being of populations in BMCs. Consequently, investments in upgrading agriculture are needed to ensure the adaptation of the sector to climate change and the real market via diversification and innovation. Given the specific context of the region and the general scarcity of suitable agricultural land, investments will have to be diversified depending on the proximity of urban areas or key ecosystems. For example, investments in protected horticulture for commercial purposes with high inputs of technology may appeal to both smallholders and agriculture entrepreneurs near urban areas or key ecosystems. In more isolated rural areas, investing in climate-smart agriculture appears to be a viable option to increase resilience and rural employment as well as food and nutrition security.

Fisheries and aquaculture

The fishery sector in BMCs mostly consists of artisanal fishers. A precondition for climate change adaptation in the sector is an integrated and ecosystem-based coastal management approach, which is reflected in the following potential investment strategies.

Climate-smart mapping and planning of coastal resources

Investments should support countries in identifying vocational areas according to their exposure to climate change as well as to the presence of key ecosystems, such as mangroves and coral reefs. Novel approaches could be tested and eventually put into operation, such as the Coastal Hazard Wheel, developed by the United Nations Environment Programme (UNEP-DTU, 2018).

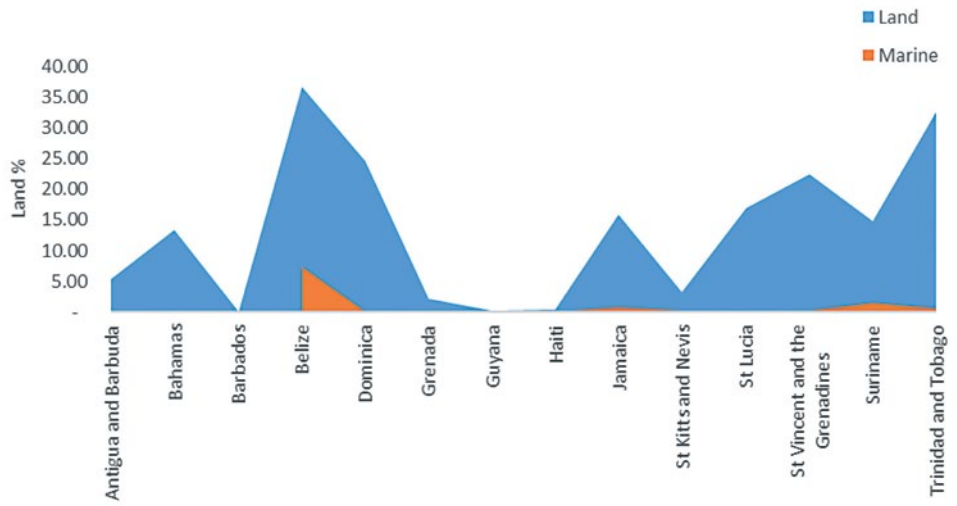
Protection, upgrade and relocation of ports, landing sites and other fishery-related infrastructure

As identified in the first phase of its Climate Resilience Strategy, CDB could support the protection or relocation of sensitive infrastructure (including access to power), which is vital to the functioning of the sector and would benefit both commercial and artisanal fishers.

Support the creation and enhancement of coastal and marine protected areas

The percentage of coastal and marine areas under protection or special management is very limited among BMCs, while their importance for fisheries and climate change is paramount. Figure 11 shows that, with the exception of Belize (7.4 percent of territorial waters protected), marine protected areas are virtually non-existent in the region.

Figure 11. Percentage of terrestrial and marine protected areas in the region according to the International Union for Conservation of Nature (IUCN)–Caribbean Protected Areas Gateway 2018.



Investing in protected areas will guarantee that nurseries and breading grounds for target species are adequately managed and protected. Ensuring the protection of key coastal and marine areas will also contribute to reducing country exposure to extreme weather events, and increasing the attractiveness of tourism destinations.

Conclusions

Great strides have been made over the past decade with regard to climate change adaptation in the Caribbean. However, many challenges still lie ahead. Climate change adaptation in BMCs can be supported through targeted investments in climate-smart agriculture and fishery sectors. This requires a sustainable and climate-oriented perspective along with a more structured and coordinated approach. The Caribbean Development Bank has all the necessary instruments to support climate change adaptation, and to have a primary role at both the regional and national level. Nevertheless, the high and rising costs associated with climate change adaptation may compel CDB to express its comparative advantage (1) with other institutions, such as IFAD, for investments to support agriculture and fisheries, and (2) with the World Bank concerning infrastructure investments. However, with GCF and AF accreditation, CDB will also be able to mobilize climate finance efficiently and have far-reaching impacts on BMCs across the region.

Specifically, the investments proposed in this Annex to the Study on the State of Agriculture in the Caribbean will enhance CDB's capacity to assist BMCs in their efforts to achieve climate change adaptation in key agricultural sectors: agriculture, fisheries and aquaculture. The abovementioned investment proposals are in line with CDB's Climate Resilience Strategy (2012–2017), and will support BMCs to ensure:

- improved spatial and environmental planning systems to better regulate and control development;
- more effective and efficient administration of physical planning and environmental management performance systems and processes;
- improved technical capacity for mainstreaming Environment, DRR and Climate Resilience in national development planning and investment finance programming, including the development of tools to better identify and prioritize natural hazards and climate risk vulnerabilities; and
- better arrangements and mechanisms to strengthen links and cooperation and collaborative arrangements between the public sector, private sector and civil society to finance and implement climate-resilient development initiatives (CDB, 2012, p. 13).

Additionally, the proposed investments will (1) support CDB in the identification of adaptation and mitigation needs of BMCs, and (2) ensure that identified value chains meet expectations in terms of their economic and financial returns as well as their climate and environmental relevance.

At the regional level, the proposed investments will contribute to creating the necessary conditions for a shift in the current risk mitigation approach to one of risk transfer, where climate-related insurance and the private sector may play increasing roles. The Caribbean Development Bank has already invested over USD 64 million in the Caribbean Catastrophe Risk Insurance Facility (CCRIF). Through investments, additional information is added to regional and national statistics, which allow for a better understanding of the relationship between impacts, damages, and payments.

Evidence-based climate change adaptation monitoring and evaluation to support CDB's investments in agriculture, fisheries and aquaculture

The indicators and means of verification presented in the CDB Climate Resilience Strategy (2012–2017) are still relevant to climate change adaptation today. Nonetheless, given the diversity of factors influencing climate change adaptation, and considering the inherent reliance of target sectors on ecosystem services, CDB may consider integrating their set of indicators with the following:

Goal level:

- Positive changes in the ND-GAIN vulnerability index of BMCs.
- Positive changes in the Climate Risk Index of BMCs.
- Investments made by BMCs in R&D and innovation related to climate change adaptation and the sustainable management of agriculture, fisheries and aquaculture.

Objective Level:

- Process-based indicators per sector of intervention (assessment, mapping, planning, climate proofing of value chains).
- Contribution of investments to mitigation as regards sequestration and avoided emissions.
- Contribution of investments to ecosystem-based management in BMCs.
- Total hectares of habitat restored and total number of hectares with ecosystem-based approaches (UNFCCC, 2013).
- Amount of surface water extracted for irrigation and number of monitored wells increasing groundwater efficiency in project sites (UNFCCC, 2013).
- Retention or increase in forest areas and proportion of inland, coastal and marine protected areas.

Given the nature of climate change adaptation and the diverse directions available in terms of objectives and related results, it is recommended that investments be made in evidence-based protocols to secure objective and transparent means of verification. Therefore, the following investments are recommended to ensure that climate change is efficiently and effectively mainstreamed in the monitoring and evaluation procedures of CDB:

- Support states in defining strong and detailed baselines related to agriculture, fisheries and aquaculture.
- Invest in GIS/Remote Sensing technology and human capacity to allow CDB to properly follow up investments and impacts of funded activities.
- Collaborate with national and regional initiatives, such as the Jamaica meteorological service and CARIBSAVE, to mainstream climate change adaptation, and to include updated climate risks and mapping in CDB's internal processes to understand and classify investments according to their climate risk and opportunity profiles.

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Appendix A

Vulnerability Brief for BMCs

Antigua and Barbuda

The country is on the road to responding effectively to climate change, though the need for adaptation and the **urgency to act are still pressing issues**. Antigua and Barbuda is the fifty-seventh most vulnerable country, and the sixty-ninth most ready country. The country's capacity to acquire and deploy agricultural technology appears to be decreasing. Water storage capacity is stable, though needs are growing.

Barbados

Adaptation challenges still exist, but **Barbados is well positioned to adapt**. Barbados is the fifty-first least vulnerable country and the fifty-seventh most ready country. The country's capacity to acquire and deploy agricultural technology does not appear to be constant and may be decreasing.

The Bahamas

The **Bahamas is well positioned to adapt,** despite adaptation challenges. The Bahamas is the forty-ninth least vulnerable country and the seventy-eighth most ready country. Cereals yields are slightly decreasing, food import dependency is increasing, and the country's capacity to acquire and deploy agricultural technology appears to be stagnating. The **CRI reports a worsening situation since 2010** (Eckstein, Hutfils, and Winges, 2018), which may suggest increased exposure to extreme events.

Belize

The country urgently requires both investments and innovation to improve readiness. Belize is the fifty-sixth most vulnerable country and the sixty-second least ready country. Cereals yields are slightly decreasing and the country's capacity to acquire and deploy agricultural technology appears to be stagnating. The **CRI reports a worsening situation since 2010** (Eckstein, Hutfils, and Winges, 2018), **and increased exposure to extreme events.**

Dominica

Adaptation challenges still exist, but **Dominica is well positioned to adapt**. Dominica is the seventy-sixth least vulnerable country and the thirty-ninth most ready country. Cereals yields are slightly decreasing, while the country's capacity to acquire and deploy agricultural technology and its engagement in international environmental conventions may be stagnating.

For Grenada, Guyana, Haiti, and Jamaica see Appendix C

Saint Kitts and Nevis

Adaptation challenges still exist, but **Saint Kitts and Nevis is well positioned to adapt**. Saint Kitts and Nevis is the eighty-fifth least vulnerable country, and the forty-fourth most ready country. The country's capacity to acquire and deploy agricultural technology appears to be decreasing, while engagement in international environmental conventions is stagnating.

Saint Lucia

Adaptation challenges still exist, but **Saint Lucia is well positioned to adapt**. Saint Lucia is the sixty-eighth least vulnerable country and the seventieth most ready country. Food import dependency is increasing, whereas the country's capacity to acquire and deploy agricultural technology appears to be decreasing. Additionally, the water storage capacity appears stable, though needs are growing. The **CRI (2018) reports a worsening situation since 2010, along with increased exposure to extreme events.**

Saint Vincent and the Grenadines

Adaptation challenges still exist, but **Saint Vincent and the Grenadines is well positioned to adapt**. It is the fifty-first least vulnerable country, and the fifty-first most ready country. While cereal yields are slightly decreasing, food import dependency is increasing. The **CRI (2018) reports a severe worsening situation since 2010, and increased exposure to extreme events.**

Suriname

Relative to other countries, Suriname's current vulnerabilities are manageable, though **improvements in readiness will help the country better adapt to future challenges**. Suriname is the seventy-fourth least vulnerable country and the fifty-second least ready country. Cereal yields are slightly decreasing and the country's capacity to acquire and deploy agricultural technology appears to be stagnating.

Trinidad and Tobago

Relative to other countries, Trinidad and Tobago's current vulnerabilities are manageable, but **improvements in readiness will help it better adapt to future challenges**. It is the eighty-ninth least vulnerable country and the eighty-first least ready country. Although the proportion of the total population living in rural areas is increasing, the country's capacity to acquire and deploy agricultural technology as well as the capacity to store water may be stagnating.

Appendix B

Identified Adaptation Priorities for BMCs

Antigua and Barbuda

Planning and policy: Ensure coastal and land risk assessment to assess risks and priorities related to climate variables and ecosystem management.

Infrastructure:

(a) Ensure 100 percent of the electricity supply in the water sector and other essential services (including health, food storage and emergency services) is generated through off-grid renewable sources (solar, wind, geothermal and biomass) to enhance resilience to extreme events.

(b) Improve buildings and infrastructure; prepare for extreme climate events, including drought, flooding and hurricanes.

(c) Increase seawater desalination capacity by 50 percent above 2015 levels.

(d) Protect waterways to reduce the risk of flooding and health impacts.

Climate insurance schemes: affordable insurance schemes for farmers, fishers, and residential and business owners to cope with losses resulting from climate variability.

The Bahamas

Planning and policy: Secure coastal and land risk assessment to assess risks and priorities related to climate variables and ecosystem management.

Agriculture: Formulate and implement strategies and measures that will help to enhance food security and sustainable food production mainly through diversification, protected agriculture and the technological upgrading of farming systems.

Infrastructure: Continue the trend of employing reverse osmosis facilities to provide access to potable water to adapt to loss of freshwater by saltwater intrusion and retrofitting water and sewage infrastructure. The latter can also have beneficial impacts on agriculture, providing additional water resources to a mainly rainfed sector.

Natural resource management and biodiversity: Adopt short, medium, and long-term measures to protect coastlines and increase the resilience of coastal ecosystems, enforcement of setbacks, and restoration of coastal wetlands. This activity will also have major positive impacts on the fishery sector and livelihoods.

Barbados

Planning and policy: Ensure coastal and land risk assessment to assess risks and priorities related to climate variables and ecosystem management and water resource management.

Infrastructure: Increase flood resilience of major infrastructure.

Belize

Planning and policy: Ensure the mainstreaming of climate change considerations throughout the sectors to enhance ecosystem resilience, the equitable distribution of tourism activities, and sustainable tourism development, at a local and national scale.

Agriculture: Address critical gaps in technological developments relevant to crop production – better soil management practices, diversification into drought-resistant crops and livestock, and protected farming. Actions should include land use, land topography and increasing the use of low-water irrigation systems.

Fisheries: Sustainable management of fisheries resources, and the conservation and preservation of fisheries resources and marine habitats to promote reef ecosystem resilience.

Infrastructure: Several of Belize's roads and bridges are vulnerable to seasonal flooding. Belize's waterways also become unnavigable during certain periods. Strengthening infrastructure is particularly important in urban areas and other areas that are critical to the country's productive sectors (tourism, agriculture, and ports).

Natural resource management and biodiversity: Enhance the protection and restoration of forest ecosystems and build the resilience of water catchment areas. Adopt and implement the Belize Integrated Coastal Zone Management Plan, which will ensure the responsible and sustainable use of Belize's coastal and marine resources in the face of climate change.

Dominica

Planning and policy: Ensure coastal and land risk assessment to assess risks and priorities related to climate variables and ecosystem management and water resource management. Use climate change risk assessments to enhance the climate resilience of water resources. Develop water inventories, forest and coastal resources management plans, community vulnerability mapping, and disaster risk and adaptation plans to reduce vulnerability.

Agriculture and fisheries: Promote food security through climate-resilient agricultural and fisheries development to build climate-resilient communities and strengthen the capacity to address climate change risks to food security associated with changing precipitation patterns.

Infrastructure: Establish community off-grid, mini-grid, or micro-grid, renewable energy electrical supply systems.

Disaster risk reduction: Establish early warning systems, multi-use disaster shelters (powered by renewable energy and backup biodiesel generators), and emergency preparedness training programmes in vulnerable communities.

For Grenada, Guyana, Haiti and Jamaica, see Appendix C

Saint Kitts and Nevis:

Infrastructure: Construction, rehabilitation and maintenance of conservancies and canals, coastal defences, water supply and sanitation.

Saint Lucia:

Planning and policy: Identify vulnerable priority areas and sectors and appropriate adaptation measures using available and appropriate information to support planning and climate risk mapping.

Agriculture: Food security and sustainable land management via diversification of crops, agroforestry and ecosystem rehabilitation.

Infrastructure: Climate proofing of infrastructure related to production and mobility. Water Resource Conservation and Management.

Natural resource management and biodiversity: Integrated Coastal Zone Management for Climate Resilience of ecosystems, infrastructure and livelihoods.

Saint Vincent and the Grenadines:

Agriculture and fisheries: Resilient Agriculture and fisheries to support small-scale farmers/fishers in coping with and adapting to the negative impacts of climate change.

Natural resource management and biodiversity: Integrated Coastal Zone Management for Climate Resilience of ecosystems, infrastructure and livelihoods.

Suriname:

Planning and policy: Vulnerability assessments and mainstreaming of climate change in social and productive sector strategies, such as agriculture development, social protection, and integrated coastal zone management.

Infrastructure: Installation of solar panel parks as well as micro-hydro power units in river systems; application of biomass-to-energy technology; installation of windmills; and implementation of waste-to-energy technology. Climate Proofing of infrastructure related to production and mobility. Water Resource Conservation and Management.

Trinidad and Tobago:

Planning and policy: Vulnerability assessments and mainstreaming of climate change in social and productive sector strategies.

Infrastructure: Installation of solar panel parks as well as micro-hydro power units in river systems; application of biomass-to-energy technology; installation of windmills; and implementation of waste-to-energy technology. Climate Proofing of infrastructure related to production and mobility. Water Resource Conservation and Management.

Appendix C

Analysis for selected countries

Figure a. ND-GAIN Profile of Guyana.

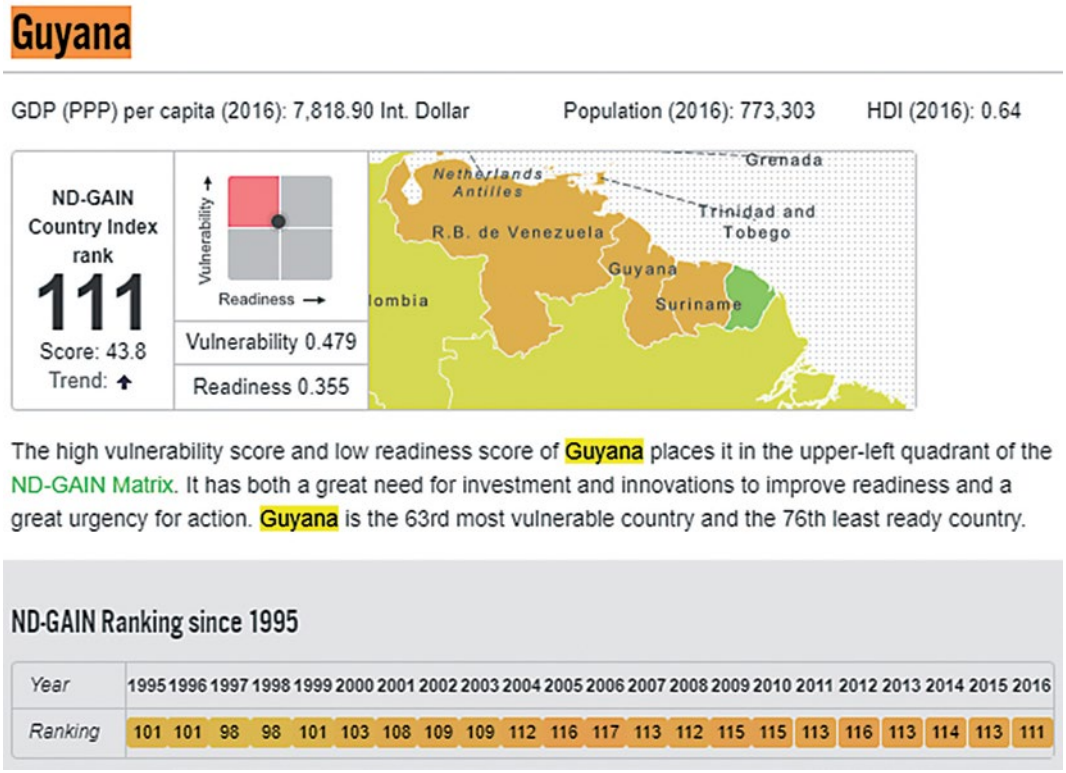

Figure b. Changes in the ND-GAIN and CRI Indexes for Guyana.

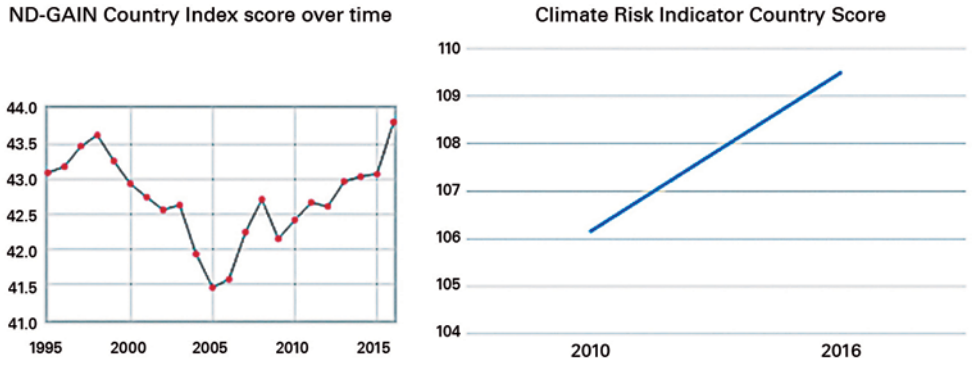

Figure c. Climate finance (2010–2018) allocated to Guyana.

Guyana	2010-2018	Agriculture	%	Fishery	%	Aquaculture	%
Climate Finance Invested	USD 463 540 000.00	USD 45 510 000.00	10%	USD -	0%	USD -	0%
Adaptation	USD 98 630 000.00	USD 29 540 000.00	65%	USD -	0%	USD -	0%
Mitigation	USD 361 560 000.00	USD -	0%	USD -	0%	USD -	0%
Cross-cutting	USD 3 350 000.00	USD 15 970 000.00	35%	USD -	0%	USD -	0%

Main climate change adaptation challenges. According to USAID (2013b), ND-GAIN (2017), FAO (2018a, 2018b) and UNFCCC (2018a), cereal yields are slightly decreasing and the country's capacity to climate proof and upgrade its transportation infrastructure appears to be stagnating. Overexploitation of natural resources and ecosystems is still a major concern despite the over USD 400 million invested in natural resource management in the period 2010–2015. Urban centres, ports, landing sites and markets are exposed to sea level changes. Climate change mainstreaming is also still incomplete and more integrated planning is required.

Main climate change priorities. *Planning and policy:* Formulate a land- and marine-use policy, along with accompanying regulations and building codes, and introduce an early-warning system. Enhance collection, analysis, distribution and use of data related to climate change and related topics. *Agriculture:* Develop and introduce crop varieties that are (1) flood resistant, (2) drought tolerant, and (3) disease resistant. Introduce new agricultural techniques, such as hydroponics and fertigation to sustain resilience as well as diversification. *Infrastructure:* Ensure the construction, rehabilitation and maintenance of conservancies and canals as well as coastal defences, water supply and sanitation. *Natural resource management and biodiversity:* Enhance integrated coastal zone management and impede deforestation (UNFCCC, 2018a, 2018b, 2018c).

Ongoing projects. There are at least eight projects currently ongoing, seven of which (10 percent of the total available climate finance 2010–2018) support the country in strengthening the resilience of the agriculture sector and its actors. The remaining projects target disaster risk reduction (DRR). There are no available evaluation reports; therefore, it is not possible to provide additional information on impacts, especially on projects related to natural resource management from 2010–2015. Ongoing projects in Guyana are, by and large, developed to support smallholders and rural households to cope with the negative impacts of climate change with upgraded technologies and practices. Most of the projects include awareness and institutional support. The Inter-American Development Bank (IDB) is one of the main actors in climate change adaptation of Guyana's agriculture sector, alongside bilateral donors.

Recommended subsectors of intervention. Given Guyana's positive improvements in both the CRI and NG-GAIN indexes, but poor natural resource management and environmental performance (over 175 000 hectares lost since 2000[18]), it is advisable to maintain investments in climate change adaptation via risk mitigation, including: (1) climate risk mapping and planning; (2) climate proofing of infrastructure (mobility, irrigation, drainage, sea level change protection, landing sites and electricity); (3) supporting land and coastal protected areas; and (4) providing institutional support to mainstream climate change adaptation in relevant policies and to enhance natural resource management. The International Fund for Agricultural Development (IFAD) would be the most suitable partner to work on climate change adaptation. Ideal co-financing sources include the European Investment Bank (EIB), the Global Environment Facility (GEF),the Adaptation Fund (AF), and the Green Climate Fund (GCF).

18 FAO Earth Map, 2018 analysing Hansen global forest change (2000–2017).

Figure d. Major forecasted impacts of identified investments on target sectors and themes in Guyana.

Guyana						
Impact / Investment	Food Security	Nutrition	Agriculture	Fishery	Aquaculture	Gender and Youth
Climate risk mapping and planning	Mapping climate risk and planning accordingly will allow investments in agriculture to factor in food security and relative requirements/needs		It will support both risk mitigation and derisking of the sector as well as enhance diversification of production and practices			It will improve employment opportunities in rural areas and will require new expertise
Climate proofing of infrastructure (mobility, irrigation, drainage, landing sites and energy)	It allows the introduction of new technologies in protected agriculture, increases the efficiency and effectiveness of the cold chain, improves access to information and access to markets, creates new employment opportunities, and secures artisanal fishery and related livelihoods					
Upgrade agriculture production techniques, support protected and soilless agriculture	It will increase productivity and allow crop diversification		It will strengthen horticultural production and maximize available resources with positive impacts also on CCM			It will improve employment opportunities in rural areas and will require new expertise
Support protected areas and integrated coastal management, and block deforestation	Enhancing the protection and resilience of forests will have positive impacts on all sectors and themes with specific impact on the productivity of artisanal fishery and tourism. Supporting NRM and reported ecosystems will also decrease exposure to extreme weather events (i.e. flash floods, floods, storms)					
Institutional support to mainstream CCA in relevant policies and to enhance NRM	Climate change is factored in all the relevant strategies and policy frameworks allowing effective and efficient readiness with transversal impacts on all the compartments of the society and economy of the country					

Figure e. ND-GAIN Profile of Grenada.

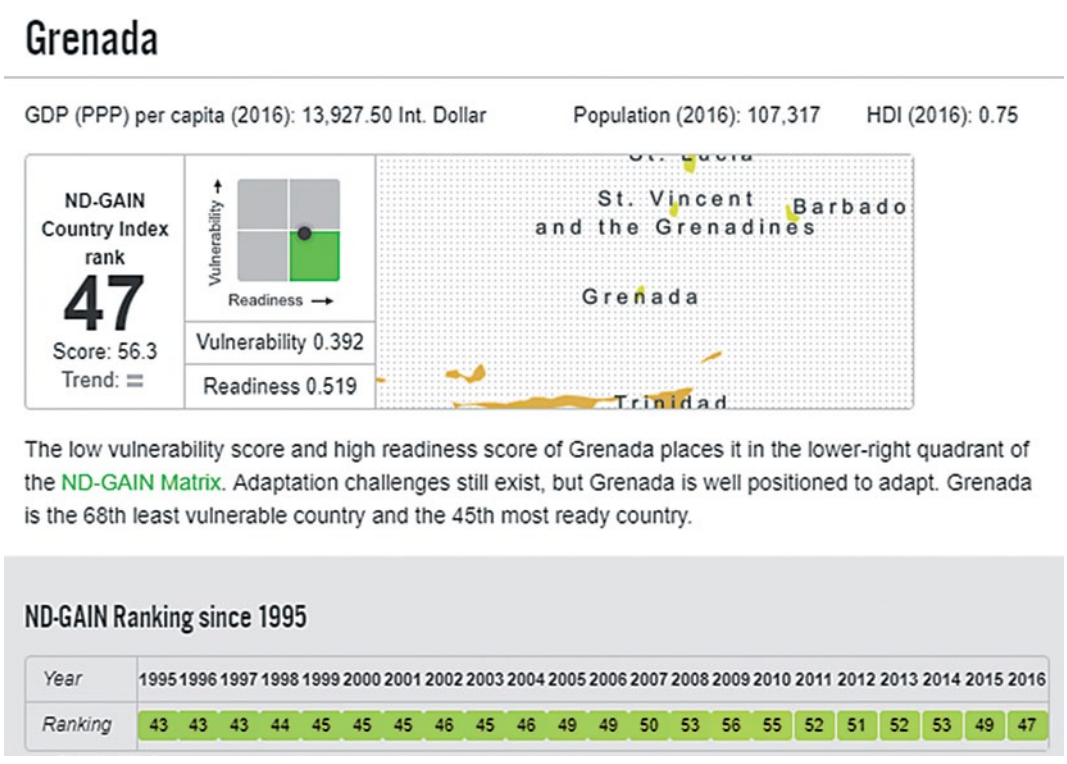

Figure f. Changes in the ND-GAIN and CRI Indexes for Grenada.

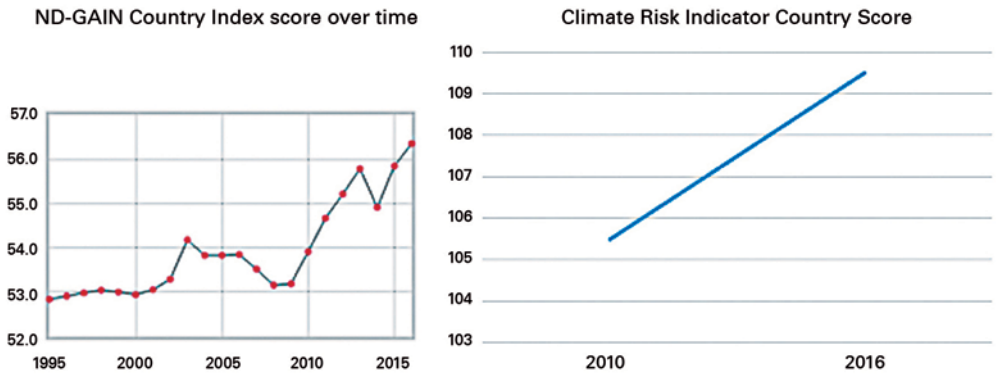

Figure g. Climate Finance (2010–2018) allocated to Grenada.

Grenada	2010-2018	Agriculture	%	Fishery	%	Aquaculture	%
Climate Finance Invested	USD 666 726 441.67	USD 15 659 775.00	23%	USD -	0%	USD -	0%
Adaptation	USD 665 656 441.67	USD 15 659 775.00	100%	USD -	0%	USD -	0%
Mitigation	USD 1 060 000.00	USD -	0%	USD -	0%	USD -	0%
Cross-cutting	USD 10 000.00	USD -	0%	USD -	0%	USD -	0%

Main climate change adaptation challenges. According to USAID (2017a), ND-GAIN (2017), FAO (2018) and UNFCCC (2018a-b), cereal yields are slightly decreasing and the country's capacity to acquire and deploy agricultural technology appears to be stagnating. Various sectors are increasingly competing over water and land resources, such as the tourism and urban sectors versus agriculture. Urban centres, ports, landing sites and markets are exposed to sea level change, with limited financial resources to address climate change adaptation and risk mitigation. Climate change adaptation mainstreaming is still incomplete and more integrated planning is required.

Main climate change priorities. *Planning and policy:* Formulate a land- and marine-use policy, along with accompanying regulations and building codes. *Infrastructure:* Improve caption, storage, distribution and conservation of water (including recycling from wastewater). *Natural resource management and biodiversity:* Build forest and coastal resilience, including coral restoration, mangrove rehabilitation, all with alternative livelihood implications (UNFCCC, 2018a, 2018b, 2018c).

Ongoing Projects. There are at least six projects currently ongoing, two of which (23 percent of the total available climate finance) support the country in strengthening the resilience of agricultural sectors and its actors by investing in resilience building. The GCF-funded project (about 66 percent of the total available climate finance) addresses water management, including irrigation (improvements of on-farm irrigation technology). The remaining projects target disaster risk prevention and management. There are no available evaluation reports; therefore, it is not possible to provide additional information on impacts.

Projects in Grenada related to the agriculture sector are mainly designed to help smallholders and rural households to cope with the negative impacts of climate change and to ensure the sustainable management of water resources. Most of the projects include awareness and institutional support. The main actors in climate change adaptation of Jamaica's agriculture sector include the World Bank,

IFAD and the German Corporation for International Cooperation (GIZ), while the main donors are bilateral donors and multi-bi funds, such as the GCF.

Recommended subsectors of intervention. Considering Grenada's positive improvements in both the CRI and NG-GAIN indexes, and national investments in R&D on climate change, it is advisable to maintain investments in climate change adaptation via risk mitigation and to explore the possibility of investing in risk transfer mechanisms, such as insurance. The following are potential risk mitigation investments: (1) climate risk mapping and planning; (2) climate proofing of infrastructure (irrigation, water catchment and recycling, and electricity); (3) supporting the creation of marine and coastal protected areas; and (4) providing institutional support to mainstream climate change adaptation in relevant policies and to enhance natural resource management. The most suitable partner to work on climate change adaptation in agriculture is IFAD, while ideal co-financing sources include: EIB**,** GEF, AF and GCF.

Figure h. Major forecasted impacts of identified investments on target sectors and themes.

Grenada						
Impact / Investment	Food Security	Nutrition	Agriculture	Fishery	Aquaculture	Gender and Youth
Climate risk mapping and planning	Mapping climate risk and planning will allow investments in agriculture to factor in food security and relative requirements/needs		It will support both risk mitigation and derisking of the sector as well as enhance production diversification and practices			It will improve employment opportunities in rural areas and will require new expertise
Climate proofing of infrastructure (irrigation, wastewater recycling for agriculture and electricity)	Increased efficiency and effectiveness of water management allow the introduction of new technologies in protected agriculture, increase the efficiency and effectiveness of the cold chain, improve access to information, create new employment opportunities, reduce land-use competition (urban/aquaculture/tourism vs agriculture), among others					
Support coastal and marine protected areas and support integrated coastal management	Enhancing the protection and resilience of key marine and coastal ecosystems will have positive impacts on all sectors, including the productivity of artisanal fishery and tourism. Supporting NRM and reported ecosystems can decrease the exposure of coastal infrastructure and the population to extreme weather events with long-term benefits for derisking mechanisms (e.g. insurance)					
Institutional support to mainstream CCA in relevant policies and to enhance NRM	Climate change is factored in all the relevant strategies and policy frameworks allowing effective and efficient readiness with transversal impacts on all the compartments of the society and economy of the country					

Figure i. ND-GAIN Profile of Haiti.

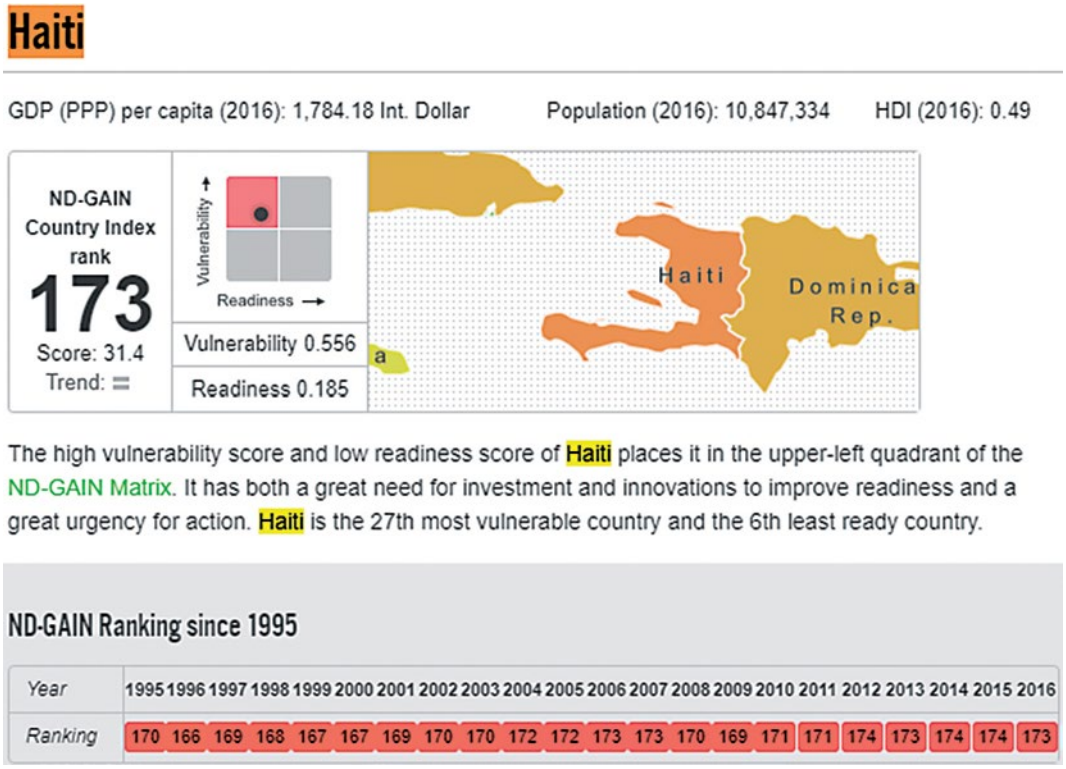

Figure j. Changes in the ND-GAIN and CRI Indexes for Haiti (negative values are those closer to zero).

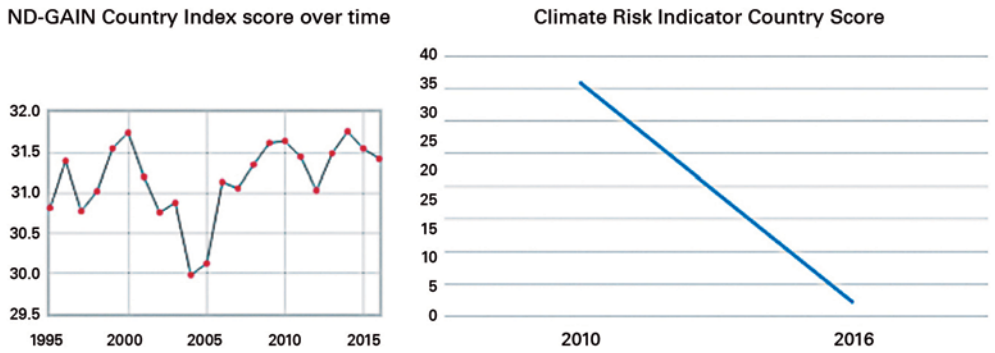

Figure k. Climate Finance (2010–2018) allocated to Haiti.

Haiti	2010-2018	Agriculture	%	Fishery	%	Aquaculture	%
Climate Finance Invested	USD 237 737 010.00	USD 14 500 000.00	6%	USD -	0%	USD -	0%
Adaptation	USD 121 947 010.00	USD 14 500 000.00	100%	USD -	0%	USD -	0%
Mitigation	USD 54 390 000.00	USD -	0%	USD -	0%	USD -	0%
Cross-cutting	USD 61 400 000.00	USD -	0%	USD -	0%	USD -	0%

Source: Adapted from SEI (2017) data.

Main climate change adaptation challenges. According to USAID (2013c, 2017a), ND-GAIN (2017), FAO (2018a, 2018b) and UNFCCC (2018a), the water storage capacity for irrigation appears stable, though needs are growing. Challenges include the weak governance of natural resources, rural population decline, severe instability, and a lack of clear climate change adaptation coordination and execution mechanisms. According to the data collected for the scope of this document, Haiti is the second beneficiary of climate change adaptation finance, but also the country with the lowest rankings since 1995: It is ranked the second most vulnerable country in the CRI (2018) Index.

Main climate change priorities. The main priorities for *planning and policy* include climate risk planning and mapping as well as the mainstreaming of climate change into national policies and strategies in all sectors. Priorities for *agriculture* include the adaptation of crops, the protection of crop genetic diversity, input management upgrade, and increases in technological inputs. For *natural resource* management and biodiversity, these include building coastal resilience, such as coral reef restoration and mangrove rehabilitation, with alternative livelihood implications (UNFCCC, 2018a, 2018b, 2018c).

Ongoing Projects. There are at least five projects currently ongoing or about to start, two of which (6 percent of the total available climate finance) support the country in strengthening the resilience of the agriculture sector and its actors. There are no available evaluation reports; therefore, it is not possible to provide additional information on impacts. Projects in Haiti in the agriculture sector are mainly developed to support smallholders and rural households to cope with the negative impacts of climate change. Most of the projects include awareness and institutional support. In all projects, upgrading agriculture practices and technologies is a priority to support the sector in adapting to climate change. The main actors in climate change adaptation of agriculture in Haiti are the IDB and IFAD, while the main donors include bilateral donors and multi-bi funds, such as the GEF. The most suitable partner to work on climate change adaptation in agriculture is IFAD.

Ideal co-financing sources include the GEF, AF, and GCF.

Recommended subsectors of intervention. In view of Haiti's instability, weak governance, and lack of national R&D investments in the agriculture sector and in climate change, it is advisable to avoid investments related to risk transfer, namely insurance, and to continue supporting risk mitigation and adaptation via: (1) Climate risk mapping and planning; (2) climate proofing of infrastructure (mobility and electricity); and (3) institutional support to mainstream climate change adaptation in relevant policies and to enhance natural resource management.

Figure I. Major forecasted impacts of identified investments on target sectors and themes.

<table>
<tr><th colspan="7">HAITI</th></tr>
<tr><th>Investment \ Impact</th><th>Food Security</th><th>Nutrition</th><th>Agriculture</th><th>Fishery</th><th>Aquaculture</th><th>Gender and Youth</th></tr>
<tr><td>Climate risk mapping and planning</td><td colspan="2">Mapping climate risk and planning accordingly will allow investments in agriculture to factor in food security and relative requirements/needs</td><td colspan="2">It will support both risk mitigation and derisking of the sector as well as enhance production diversification and practices</td><td>It will improve employment opportunities in rural areas and will require new expertise</td></tr>
<tr><td>Climate proofing of infrastructure (mobility and electricity)</td><td colspan="6">Improve access to markets, connectivity between different production centres, increase the efficiency and effectiveness of the cold chain, improve access to information, among others</td></tr>
<tr><td>Institutional support to mainstream CCA in relevant policies and to enhance NRM.</td><td colspan="6">Climate Change is factored in all the relevant strategies and policy frameworks allowing effective and efficient readiness with transversal impacts on all the compartments of the society and economy of the country</td></tr>
</table>

Figure m. ND-GAIN Profile of Jamaica.

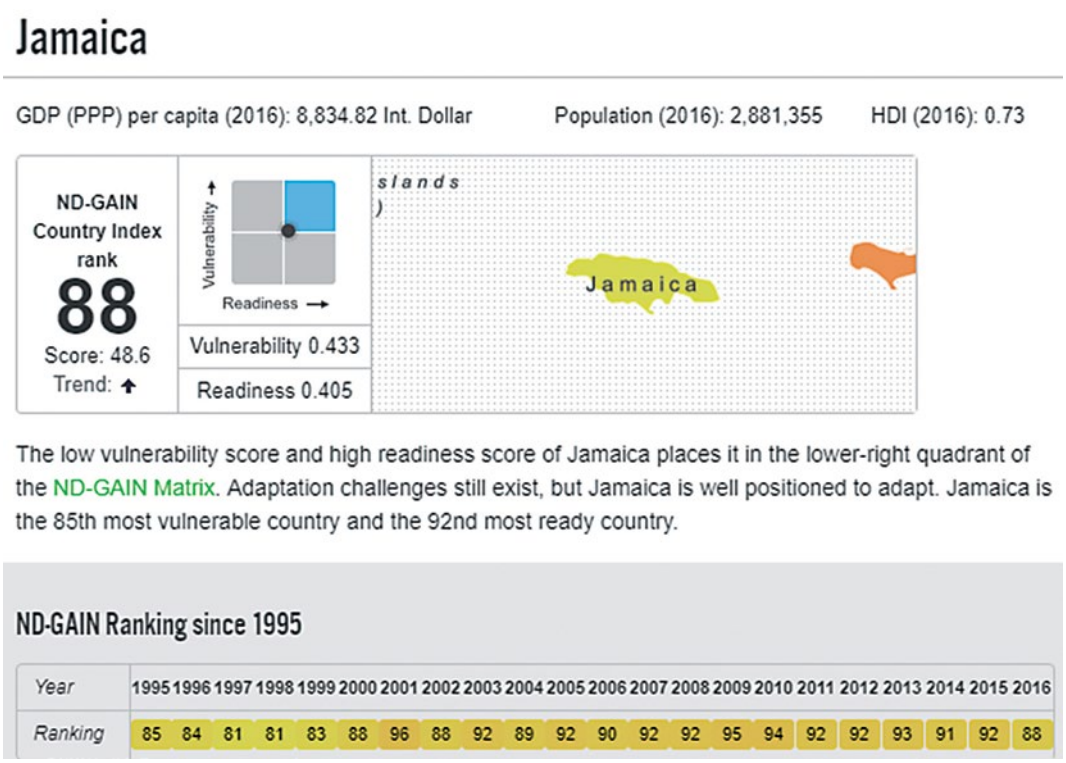

Figure n. Changes in the ND-GAIN and CRI Indexes for Jamaica (negative values are those closer to zero).

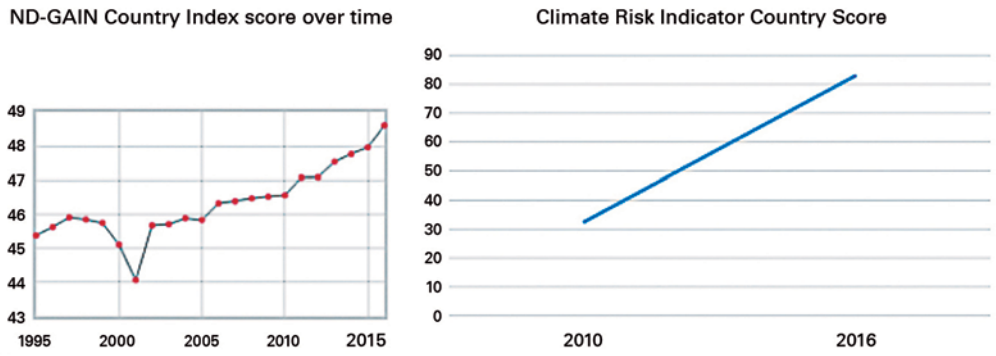

Figure o. Climate Finance (2010–2018) allocated to Jamaica.

Jamaica	2010-2018	Agriculture	%	Fishery	%	Aquaculture	%
Climate Finance Invested	USD 91 823 333.33	USD 16 100 000.00	18%	USD 13 133 333.33	14%	USD -	0%
Adaptation	USD 76 573 333.33	USD 16 100 000.00	100%	USD 13 133 333.33	100%	USD -	0%
Mitigation	USD 5 600 000.00	USD -	0%	USD -	0%	USD -	0%
Cross-cutting	USD 9 650 000.00	USD -	0%	USD -	0%	USD -	0%

Main climate change adaptation challenges. According to USAID (2017b), ND-GAIN (2017), FAO (2018a-b) and UNFCCC (2018a). Cereal yields are slightly decreasing and the country's capacity to climate proof and upgrade its transportation infrastructure appears to be stagnating. Overexploitation of natural resources and ecosystems is still a major concern. Urban centres, ports, landing sites and markets are exposed to sea level rise and storms. Climate change mainstreaming is also still incomplete and more integrated planning is required.

Main climate change priorities. *Planning and policy:* Mainstream climate change considerations into national policies and all types and levels of development planning, and build the country's capacity to develop and implement climate change adaptation and mitigation activities. Ensure climate-oriented planning and climate risk mapping. *Agriculture:* Connect farmers to available weather information and build the capacity of farmers and farmer organizations. Establish new pest management practices, provide grants to farmers to implement relevant climate resilience technologies in order to diversify productions, improve inputs of technologies, and plan according to climate variables. *Infrastructure:* Climate proofing of infrastructure (mobility, electricity, and irrigation) to increase efficiency, particularly for water, and increased resilience of agriculture, fishery and aquaculture (UNFCCC, 2018a, 2018b, 2018c).

Ongoing Projects. There are at least five projects currently ongoing, three of which (18 percent of the total available climate finance) support the country in strengthening the resilience of the agriculture sector and its actors by improving climate data and information management. These are cross-cutting projects, involving all sectors of the economy. Two other projects support the fishery sector in enhancing its resilience, (1) both directly via specific activities to support fishers with data, training and information on climate; and (2) indirectly by restoring key ecosystems, such as mangroves and coral reefs, which are crucial for the productivity of Jamaica's artisanal fishers. There are no available evaluation reports; therefore, additional information on impacts cannot be provided. Agriculture and fishery sector projects in Jamaica are mostly designed to support smallholders and rural households to cope with the negative impacts of climate change, and to improve ecosystem services – specifically the protection and conservation of biodiversity. Most of the projects include awareness and institutional support. The main actors in climate change adaptation of agriculture and fisheries in Jamaica are the World Bank, the United States Agency for International Development (USAID) and the GCF; the main donors are bilateral donors and multi-bi funds, such as the GCF. The World Bank would be the most suitable partner to work on climate change adaptation in agriculture, fisheries and aquaculture.

Recommended subsectors of intervention. Given Jamaica's positive improvements in both the CRI and ND-GAIN indexes, and in national investments in R&D in agriculture, fisheries, and aquaculture, as well as in climate change, it is advisable to maintain investments in climate change adaptation via risk mitigation, and to explore the possibility of investing in risk transfer mechanisms – namely insurance. Potential investments are in: (1) climate risk mapping and planning; (2) climate proofing of infrastructure (irrigation and electricity); (3) supporting the creation of marine and coastal protected areas; and (4) providing institutional support to mainstream climate change adaptation in relevant policies, and to enhance natural resource management.

Ideal co-financing sources include the EIB, GEF, AF and GCF.

Figure p. Major forecasted impacts of identified investments on target sectors and themes.

Jamaica						
Investment \ Impact	Food Security	Nutrition	Agriculture	Fishery	Aquaculture	Gender and Youth
Climate risk mapping and planning	Mapping climate risk and planning accordingly will allow investments in agriculture to factor in food security and relative requirements/needs		It will support both risk mitigation and derisking of the sector as well as enhance production diversification and practices			It will improve employment opportunities in rural areas and will require new expertise
Climate proofing of infrastructure (irrigation, wastewater recycling for agriculture and electricity)	Increased efficiency and effectiveness of water management allows the introduction of new technologies in protected agriculture, increases the efficiency and effectiveness of the cold chain, improves access to information, creates new employment opportunities, reduces land-use competition (urban/aquaculture/tourism vs agriculture),					
Create coastal and marine protected areas and support integrated coastal management	Enhancing the protection and resilience of key marine and coastal ecosystems (i.e. mangroves, seabed, coral reefs, upwelling areas) will have positive impacts on all sectors and themes with specific impact on productivity of artisanal fishery and tourism. Supporting NRM and reported ecosystems will also decrease the exposure of coastal					
Institutional support to mainstream CCA in relevant policies and to enhance NRM	Climate Change is factored in all the relevant strategies and policy frameworks, allowing effective and efficient readiness with transversal impacts on all the compartments of the society and economy of the country					

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Annex 2

Infrastructure and irrigation needs in the Caribbean region

Acronyms and abbreviations

ACS	Association of Caribbean States
AF	Adaptation Fund
APSP	Agricultural Policy and Strategy Paper
ASSP	Agricultural Support Services Project
BMCs	Borrowing Member Countries
CANARI	Caribbean Natural Resources Institute
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community Organization
CCCCC	Caribbean Community Climate Change Centre
CDB	Caribbean Development Bank
CDD	Community-Driven Development
CIAT	International Centre for Tropical Agriculture
COSOP	Country Strategic Opportunities Programme
CPF	Country Partnership Framework
CRU	Climatic Research Unit
CSA	Climate-Smart Agriculture
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practices
GIS	Geographic Information System
ICTs	Information and Communications Technologies
IDB	Inter-American Development Bank
IFAD	International Fund for Agricultural Development
IFI	International Financial Institution
IICA	Inter-American Institute for Cooperation on Agriculture
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resource Management
JFFLS	Junior Farmer Field and Life Schools
LIDAR	Light Detection and Ranging
NIDP	National Irrigation and Development Plans
NPV	Net Present Value
O&M	Operations and Maintenance
OFWM	On-Farm Water Management
RADA	Rural Agricultural Development Authority
SAEP	Climate Smart Agriculture and Rural Enterprise Programme
SDGs	Sustainable Development Goals
UEA	University of East Anglia
USAID	United States Agency for International Development
USD	United States Dollar
VCs	Value Chains
WHO	World Health Organization

1. Introduction

The overall objective of this report is to provide technical inputs to the Caribbean Development Bank's Revised Agricultural Policy and Strategy Paper (APSP), based on the results of the Study on the State of Agriculture in the Caribbean. This paper focuses on priorities and guidance for investments in infrastructure to foster sustainable value chain financing and development.

Key findings on opportunities for investments in infrastructure are drawn from the Study on the State of Agriculture in the Caribbean, prepared by CDB and the Food and Agriculture Organization of the United Nations (FAO). Resilient, climate-proof infrastructure, including irrigation and drainage, is essential to improving the productivity and competitiveness of the agricultural sector in the CDB's Borrowing Member Countries (BMCs); it enables farmers to comply with the demands from high-value chains in the domestic, regional and international tourism, processing and retail sectors.

2. Background, constraints and limitations related to infrastructure

At country level, the development of flexible and dynamic agricultural production systems is often constrained by complex factors, which contribute to the loss of competitiveness in international markets. These include: inadequate institutional support, limited incentives, a shortage of skilled human resources, weak market systems and linkages, poor capacity to respond to changes in international trading conditions, a high exposure to climate-induced risks, a lack of appropriate financing mechanisms, and deteriorated rural productive infrastructure.

As a result, the trend in agricultural growth has been declining, with BMCs becoming increasingly dependent on food imports, while income insecurity and unemployment have increased in rural areas. However, targeted investments in infrastructure can address the following limitations of the region's agriculture sector:

Low productivity

- Inability to adequately respond to growing local and regional demand for high-value produce from the tourism, processing, retailing and livestock sector.
- Low yields at the farm level and lack of infrastructure for production and processing to meet high-quality standards, which have hampered the development of domestic supply, despite the opportunities arising from the hospitality sector's demand.

Limited access to international and tourism markets

- High quality and safety standards restrict farmers' ability to enter potentially remunerative markets; information asymmetry regarding the standards required by buyers also obstructs access.

- Most hotels and restaurants in the region use a "preferred list" instead of binding contracts; therefore sales are not guaranteed even if the product is available.
- Smallholder farmers often lack transportation to deliver their products, which means it is less risky to sell at the community level, at a lower price, than renting a vehicle.

Commercial integration

- Maritime transport costs to Caribbean countries are significantly higher than to other regions. Transport costs account for nearly half the cost of imported produce, and thus strongly influence the price competitiveness of Caribbean farmers in the world.
- Food imports add up to almost three times the amount exported by BMCs.
- Low liner shipping connectivity, inefficiencies in port operations, and non-tariff barriers constrain the integration of agricultural products from BMCs into international trading systems.

Climate change and natural hazards

- Climate change and extreme events pose a major threat to agricultural development in BMCs, in both the short and the long term. Agriculture will be affected by increasing temperature, changing rainfall patterns, rising sea level, increased saltwater intrusion, more frequent and intense storms and cyclones as well as shifting agricultural seasonality.
- Net damage costs as a consequence of climate change are likely to be significant and to increase over time. Between 2000 and 2017, the region experienced 175 natural hazard events, with small islands in particular experiencing higher damage and losses as a percentage of GDP per annum.
- Global warming could lead to additional losses and damages as a percentage of GDP per annum for Caribbean states.
- Hurricanes and tropical storms not only damage critical infrastructure, but they also have a negative impact on livelihoods and well-being.

Infrastructure limitations

- Farmers have been constrained by a lack of both public infrastructure – such as irrigation, drainage, roads, energy availability – and private infrastructure, including greenhouses, on-farm irrigation, cold storage facilities, and post-processing facilities.

3. Opportunities for investments

The Study on the State of Agriculture in the Caribbean highlights the abovementioned limitations and constraints to the development of the agriculture sector in BMCs. The study concludes that the sector is currently unable to respond to rapidly growing demand for high-value produce from the regional tourism, processing, and retailing sector and from international markets. Despite the proximity – in terms of distance – to these high-value markets, the BMCs' agricultural sector remains unintegrated and constrained by high trade costs as well as stringent safety, quality, and volume requirements by these sectors. In particular, farmers are limited in their ability to tap into these

markets as a result of low productivity, inadequate irrigation and cold storage infrastructure, and a lack of knowledge regarding the standards required by buyers.

Investments in selected values chains, such as horticulture and livestock, as well as in trade and international value chains, can catalyze the expansion of agricultural production in BMCs. Investment priorities should include interventions aimed at increasing productivity and incomes from crop production, diversifying crops, and improving watershed management in vulnerable areas. This could include targeting niche markets and the production of alternative crops with a comparative advantage at the domestic or regional level. In addition, efforts need to be made to equip farmers with the skills needed to make them more competitive and able to respond to existing market opportunities and potentials.

Investing in specific infrastructure is a key factor in strengthening value chains; thus, interventions should be aligned with value chain development policies and programmes supporting local producers in their efforts to fulfil local and regional demand for high-value agri-food produce. This involves improving the environment in which farmers and agribusiness operate to enable them to meet this demand locally. Along with several complementary actions, such as ensuring macroeconomic stability and improving the investment climate, priority areas for investment include:

- **Public infrastructure,** such as water management investments, including irrigation and drainage, roads, energy distribution networks, port facilities, and more.
- **Private or value chain-specific investments,** such as extension and certification services, capacity building of farmer associations, and promoting strategic infrastructural investments – such as cold storage and transport and irrigation for certain sectors – to meet private sector standards.

Integrated value chain development programmes have the potential to directly assist farmers in specific high-potential value chains, while facilitating investments in private infrastructure or facilities. Different modalities are possible, but all require close collaboration with major companies in the respective value chains, such as suppliers to the tourism sector, hotel and restaurant chains, exporters, and processors. This could involve support to farmers, but might also involve assistance to agricultural input companies and agricultural services providers.

Investing in climate-proof infrastructure contributes to a more resilient agricultural sector. Decisive national and regional policy initiatives are needed to promote climate change adaptation and ensure the resilience of the agriculture sector to the impacts of climate change. Specifically, farmers need to increase their resilience to the expected above-average temperatures and below-average, dry-season rainfalls, which will lead to longer lasting drought periods and increase demand for water resources.

Investments are needed to create synergies between local agricultural production and the growing tourism sector. Currently, linkages are constrained by a lack of irrigation, inadequate cold storage facilities, low productivity, and asymmetry with regard to the food safety standards and information required by hotel and restaurant chains, cruise ships, and the yachting sector.

4. Description of potential areas for infrastructural investments

The Study on the State of Agriculture in the Caribbean concludes that both general and specific infrastructural investments are needed to support farmers in specific sectors. These investments will do the following:

- reduce trade costs, facilitating BMC integration in global value chains;
- enable producers in BMCs to comply with private and public standards in high-value markets (both domestic and export) as well as processing and retail sectors; and
- improve climate change resilience, to reduce the impact of weather-related shocks – in particular drought and excessive rainfall.

Priority areas for investments can be determined by identifying the sectors which significantly contribute to the BMCs' socio-economic development, and the sectors which have different competitive advantages. For example, international imports can be substituted with local production and with imports from other BMCs; demands from the tourism industry can be increasingly met by local producers.

Therefore, the CDB´s agricultural sector interventions are likely to be concentrated – both in number and value – in Grenada, Guyana, Haiti and Jamaica, considering the importance of the agriculture sector to their socio-economic development.[1]

A number of critical potential areas for infrastructural investments have been identified to support the development of the agriculture sector in BMCs. For example, across BMCs, adequate water management infrastructure is scarce; yet, irrigation and drainage infrastructure is necessary for farmers to be able to deliver fresh vegetables and fruits during the dry season, which precedes and overlaps with the relatively high demand generated by the main tourist season. The following are examples of infrastructural investments for improved water management:

- **Rehabilitation, improvement, and modernization** of existing irrigation schemes, including off-farm and collective systems.
- **Water harvesting structures** (from rainwater and surface water runoff), which can increase water availability.
- **On-farm irrigation technology,** such as drip irrigation systems, which allows for more precise and efficient water application.
- **Investments in expansion of irrigation,** as none of the BMCs currently exceed their total renewable water resources for agriculture. Thus, a moderate increase in irrigation infrastructure and water use can be carried out without structurally compromising water resources – although there may be shortages at the sub-regional level.
- **Drainage systems** to enhance crop production, control storm and water tables, and improve or maintain climate resilience and access to markets in the programme area.
- **Clean water and sanitation** to ensure access to basic social infrastructure and services, such as reliable, clean and safe water and sanitation facilities, which are key to improving the well-

1 Grenada, Guyana, Haiti and Jamaica are the four focus countries in the report on State of Agriculture in the Caribbean.

being and welfare of Caribbean citizens, and to enhancing health and educational outcomes, especially among women and children. In 2017, the percentage of the population with access to improved water sources was 95 percent and 92 percent for urban and rural areas, respectively. Nonetheless, progress regarding improved access to sanitation services is lagging, especially in rural areas (86.5 percent).[2]

Infrastructural upgrades with regard to agricultural production and post-harvest processing will enable compliance with emerging agri-food standards and prevent food loss. These include greenhouses, certified pack-houses, cold storage facilities, slaughterhouses, and laboratory testing facilities.

The clustering of greenhouse producers provides greater control of quality and crop production schedules, which consequently attracts larger traders who are often connected to higher value markets, such as supermarkets.

Accompanying post-harvest infrastructure – such as cold rooms and pack-houses – serving multiple growers increases efficiencies and reduces post-harvest losses through better management of post-harvest handling of fresh produce.

Investing in transportation and markets, such as farm access roads and public markets, will help drive agricultural sector output in BMCs.

Similarly, investments in energy distribution networks, grids and renewable energy in particular, will enhance the sustainability and cost effectiveness of irrigation systems, pack-houses, cold storage facilities as well as processing and aquaculture facilities.

Moreover, the use of solar energy is an important step in upgrading and greening the fisheries value chain and improving its efficiencies. By focusing on alternative energies and limiting its dependency on traditional systems, the fisheries sector will be able to restore its operations more quickly and efficiently, and thus improve sector resilience and reduce the vulnerability of its stakeholders.

Maritime transport infrastructure is also a key consideration for investment opportunities. Low liner shipping connectivity and inefficient port operations are key drivers of the high trade costs experienced by the BMCs. Although maritime transport infrastructure was not explicitly mentioned as a priority during the latest consultations with counterparts,[3] shipment times and delays are inherently linked to a country's trade potential in global agri-food value chains.

Investments in port infrastructure can improve the efficiency of ports – such as container handling capacity, time to (un)load containers, and waiting times – and ultimately, liner shipping connectivity. Infrastructural investment includes both "hardware" (including improved berth length, storage capacities, maximum draft, and port facilities), and "software" (such as technical assistance for port operations). Climate-proofing key infrastructure in ports, shipyards and boat dry-docks can also offers an important risk mitigation measure to strengthen infrastructure, minimize damage and protect property. It is also important to highlight that interventions in BMC port facilities are likely to be multipurpose rather than specifically connected to operations for the agricultural sector.

In addition to infrastructural investments, complementary "software" interventions should be developed to ensure the sustainable and effective use of infrastructure, including the following:

- **Integrated water resource management (IWRM),** which focuses on (1) maximizing economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems;

2 CDB, *Development Effectiveness Review* (2017), p.10.

3 FAO preparation mission – September 2018.

(2) supporting capacity building of the institutions that govern how the water is used, and how the infrastructure is operated and maintained; and (3) developing institutional measures that guarantee the avoidance of over-exploitation beyond sustainable water extraction rates.

- **The climate-smart agriculture (CSA) approach,** which helps countries to sustainably increase agricultural productivity and incomes, adapt and build resilience to climate change, and potentially reduce or remove greenhouse gas emissions. An example is the development of crop varieties better adapted to the expected effects of climate change.
- **Productive technical assistance,** including adequate irrigation technology for smallholders, and agricultural practices that promote soil and water conservation and improve farm risk management. Exemplary options for improved soil management include permanent crop cover, reduced forms of tillage and land preparation – such as ripping or planting ditches – as well as intercropping with legumes.
- **Technical assistance aimed at improving the efficiency of port operations** to reduce trade costs experienced by the BMCs.

5. Overview of past and ongoing infrastructural investment experiences

Though CDB's agriculture portfolio is relatively small, agriculture and its related activities are among CDB's strategic focus areas, given the sector's direct links to poverty reduction and promoting sustainable agriculture – Sustainable Developments Goals (SDGs) 1 and 2.[4] Through past and ongoing country-specific interventions, CDB has continued to assist BMCs as they strive to overcome challenges in agricultural sector development.

Specifically, CDB supports measures aimed at improving the productivity and sustainability of agriculture and rural enterprises so as to enhance the region's food and nutrition security, and alleviate poverty.

This section is aimed at identifying the sectoral interventions developed by international and financial institutions (IFIs) in response to government requests. It explores the alignment of interventions with IFI programmes and strategic frameworks, such as the World Bank Group's CPF (Country Partnership Framework), the International Fund for Agricultural Development (IFAD) COSOP (Country Strategic Opportunities Programme), the European Commission's Country Strategy Papers, and the Inter-American Development Bank's (IDB) country and regional information.

Appendix 1, at the end of this document, offers a summary of investment experiences – including infrastructural investments by other major development partners – in the four focus countries of the Study on the State of Agriculture in the Caribbean: Grenada, Guyana, Haiti, and Jamaica.

4 For more information on SDGs, see: https://sustainabledevelopment.un.org/sdgs

The following conclusions are based on the evaluation of the implementation of various past and ongoing projects:

- Agricultural development projects have seen mixed results.
- Technical solutions are necessary, but not sufficient for project success.
- Strengthening institutional projects require more focus on planning and implementation capacity.
- The primary risk of failure is the potential lack of markets for the increased production, especially for vegetables.
- Markets (and market access) are critical to project success, including farm to market roads, availability of credit, and good extension services.

6. Infrastructure development needs and requirements for value chains in selected countries

Building resilient infrastructure is essential to increasing inclusive and sustainable growth, expanding employment, reducing poverty, and minimizing the cost and impact of natural hazards. Infrastructure development needs and requirements for value chains in BMCs are linked to SDG 9 – build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.

Infrastructural investments related to selected value chains (VCs) could explicitly take the following four cross-cutting issues into account, as they are in line with CDBs' recent policies and operational strategies: (1) gender and youth; (2) nutrition; (3) fisheries and aquaculture; and (4) climate change adaptation.

Recommendations from the four sector reports on these issues are as follows:

The gender and youth report[5]

For public infrastructure, including water management, post-harvest processing, transport, markets, energy, and ports, CDB will support strategies that address gender disparities in accessing rural infrastructure services, by promoting**:**

- equitable participation in infrastructure planning and siting, and decision-making, such as in clusters, producer organizations, or community groups;
- gender-equitable employment opportunities in infrastructure construction or maintenance; and
- training and equitable participation in water user groups and operations and management committees.

With regard to water, CDB will also support rural water and sanitation infrastructure, which can reduce time spent fetching water (in particular in Guyana and Haiti), lower the incidence of water-borne diseases, and improve nutrition at the household level.

5 See Annex 3 (Gender and Youth).

For private infrastructure, including on-farm irrigation, renewable energy, greenhouses, post-harvesting facilities (packing houses, cold storage, storage, equipment facilities), and slaughterhouses, CDB will ensure the following:

- Infrastructure choice – at producer organization or cluster level – will be based on its potential to contribute to gender-equitable business creation, access to markets and employment.
- On-farm infrastructure is appropriate to women's needs, both as producers and as household managers, including facilities such as rainwater harvesting reservoirs, biogas units replacing firewood, improved stoves or solar ovens, simple wind turbines, livestock pens, and simple food processors.
- Infrastructure associated with farms for youth training purposes (such as school gardens and Junior Farmer Field and Life Schools [JFFLS]), youth groups or women's groups are prioritized.

The nutrition report[6]

The Caribbean Development Bank can play a pivotal role in offering nutrition-sensitive investments to its BMCs. Through the sustainable development of the agriculture sector, BMCs can achieve better nutrition and food security along with the increased availability, affordability, and consumption of diverse, safe, and nutritious foods.

The following is a list of possible entry points for intervention in the food value chain:

1. **Food production –** diversification and sustainable intensification of agricultural production
2. **Food handling, storage, and processing –** nutrition-sensitive, post-harvest handling, storage and processing
3. **Food trade and marketing**
4. **Consumer demand –** encourage nutritional food choices and behavioural change through education and communication strategies

Fisheries and aquaculture report[7]

The upgrading of technologies should focus on improving efficiencies, reducing waste and greening the various activities along the sector value chains. Recommendations for upgrading fisheries technologies, value chain infrastructure, and standards include:

- **Increasing the use of solar energy**, which is critical to upgrading and greening the fisheries value chain and improving its efficiencies.
- **Improving the efficiency of markets and storage facilities,** which strengthen the sector's capacity to 'bounce-back' faster following natural disasters.
- **Climate-proofing infrastructure,** which has become increasingly important in the face of intensifying climate-related risk. Investments are needed to improve existing infrastructure, and to create new facilities to protect key public and private assets, such as ports, shipyards and boat dry docks. Securing insurance for investments is also imperative in the sector.
- **Modernising and climate-proofing coastal infrastructure** as well as infrastructure along the entire value chain, such as storage, processing, and marketing.

Climate change adaptation in the Caribbean region report[8]

6 See Annex 7 (Mainstreaming nutrition in the agricultural sector).

7 See Annex 4 (Fisheries policy and investment strategy).

8 See Annex 1 (Climate Change adaptation in the Caribbean region).

The main priorities related to infrastructure and climate change adaptation are as follows:

- Meet electricity demand in the water sector and other essential services (including health, food storage and emergency services) through off-grid renewable sources (solar, wind, geothermal, biomass) to enhance resilience to extreme events.
- Upgrade and prepare infrastructure for extreme climate events, such as flooding and hurricanes.
- Establish reverse osmosis facilities throughout the region to provide access to potable water and to adapt to loss of freshwater by saltwater intrusion.
- Reinforce roads and bridges to reduce vulnerability to seasonal floods.
- Build, rehabilitate and maintain conservancies and canals, sea defences as well as water and sanitation infrastructure.
- Reduce the vulnerability of roads and bridges to seasonal floods.

Specific recommendations for infrastructure proposals are shown in Table 1. Potential areas for infrastructural investments are grouped according to the type of investment they represent (public/private), and how they relate to cross-cutting issues, such as the needs of youth and women along the VCs, environmental sustainability, nutrition, functions of food systems, and good governance.

Table 1. Proposed investments in infrastructure: Selected VCs, operational instruments, and cross-cutting issues

Proposed Investments in Infrastructure	Selected VCs			Operational instruments		Cross-Cutting Issues			
	Horti culture	Lives tock	Fishery Aqua culture	Public	Private	Climate Change	Nutrition functions Food Systems	Gender equality	Govern ance
Water management infrastructure						Environmental Sustainability - Increase Resiliance	food production	Gender equality and empowerment of youth and vulnerable groups along the VCs	Good Governance, Building Capacity and Improving Institutional Effectiveness
Modernization of Existing Irrigated Schemes									
Investments in expansion of irrigation									
On-farm irrigation technology									
Drainage systems									
Water harvesting structures									
Waste Water Reuse									
Clean Water and Sanitation									
Productive / Post-harvest / processing infrastructure							food handling, storage and processing		
Greenhouses									
Packing-houses									
Cold storage									
Slaughterhouses									
Laboratory/testing facilities									
Energy									
Distributions networks									
Renewable Energy (Mix sources)									
Solar Energy									
Transport and Markets Investments							food trade and marketing;		
Roads									
Public market									
Investments in port infrastructure									
Berth length									
Storage capacities									
Maximum draft									
Other port facilities									
Shipyards strengthened									
Boat dry-docks									
Technical Assistance							consumer demand and preferences		
Integrated water resource management									
Climate smart agriculture									
Productive Technical Assistance									
Integrated Coastal Management									
Natural Resources Management									
Education, Comunication Campaign									

Methodological approach to identify potential infrastructure investments

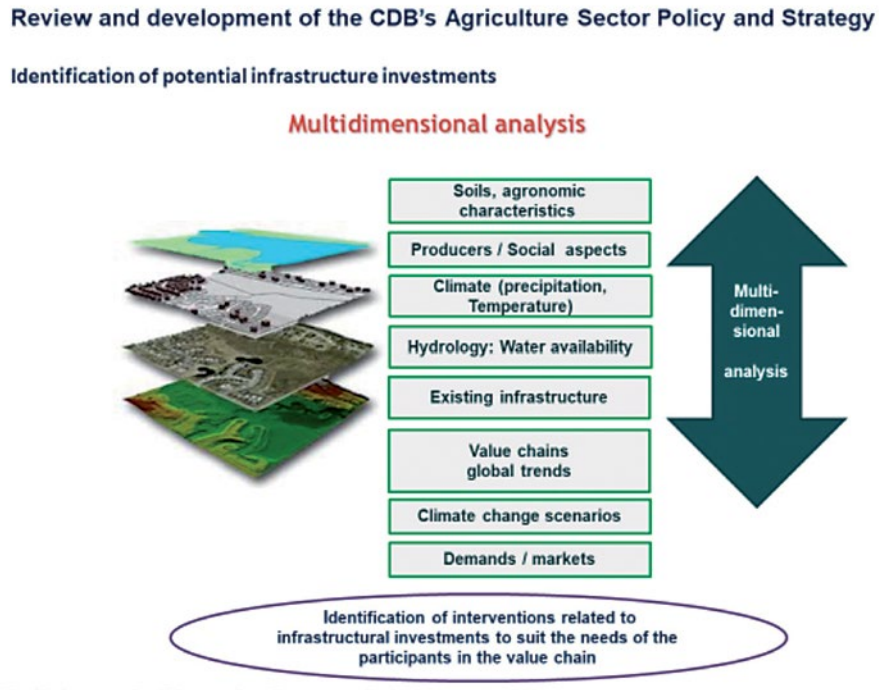
For the identification of potential infrastructure investments required to (1) increase productivity, (2) reduce trade costs, and (3) meet regional and international demands for the selected regional value chains, a multidimensional approach has been proposed. It is based on the mapping and interaction between different dimensions and variables.

The following list is a summary of the main dimensions and layers proposed for use in identifying potential infrastructure investments, depending on the information available in each priority country.

- Land terrain model
- Land use – geographical location of VCs and producers
- Value chains, potential production, yields, trends and opportunities
- Natural resources (surface water availability, aquifer characteristics and vulnerability, water management units)
- Climatic data – climate change risks (such as the impacts of projected drought periods and projected changes in temperature
- Existing infrastructure, irrigation, energy, and roads
- Location and characteristics of markets
- Demands from internal and external markets

Figure 1 and Figure 2 present a detailed scheme of the proposed approach for the mapping and interaction among different dimensions and variables.

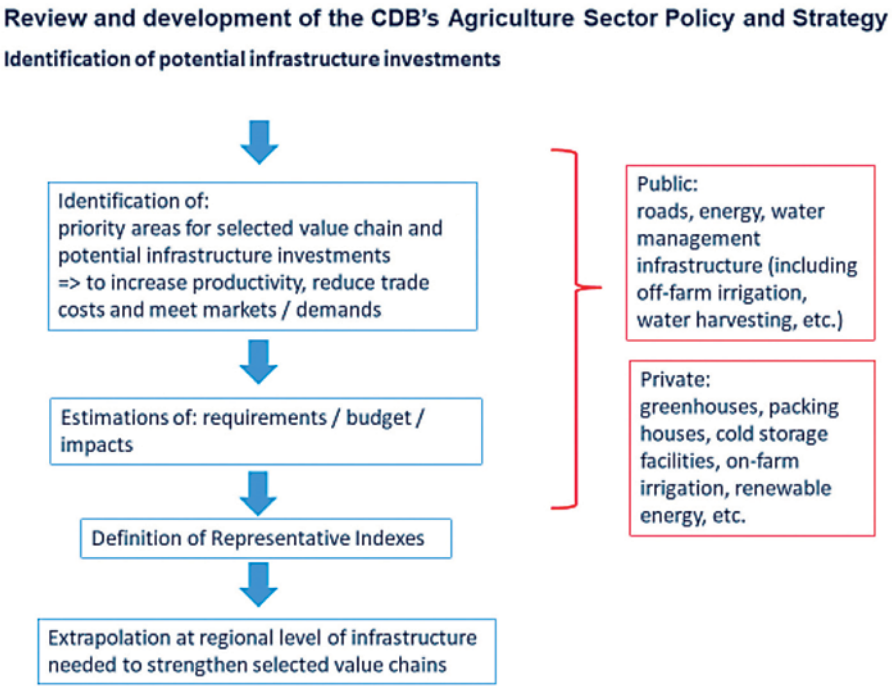
Figure 1. Multidimensional analysis of potential infrastructure investments.



- Based on the overlaying interactions among specific dimensions (layers), various tailored infrastructural investments can be identified to suit the needs of value chains.

- The results of this multidimensional analysis provide key information to support the development of potential scenarios for strategic investments in the four priority countries.
- Investment scenarios (including specific requirements, estimated investments and corresponding impacts) will provide information to develop a potential portfolio of actions, priority areas, and investments to be considered by the CDB.
- Based on this analysis for the priority countries, specific representative indexes can be defined to extrapolate results and investment estimations at subregional level.

Figure 2. Identification of priority areas for potential infrastructure investments.



7. Main considerations and assumptions for each type of infrastructure

Investment support to climate proof national infrastructure is the first priority in the region. Resilient infrastructure is needed to mitigate the effects of climate change, such as flooding or localized water shortages caused by extreme weather events. Both the cost and impact of natural hazards can be reduced by improving existing infrastructure and creating new facilities to protect key public and private assets.

Therefore, mainstreaming climate change considerations into water resources management and decision-making processes is vital to enhancing institutional capacities and ensuring resilient infrastructure.

7.1 Water management infrastructure

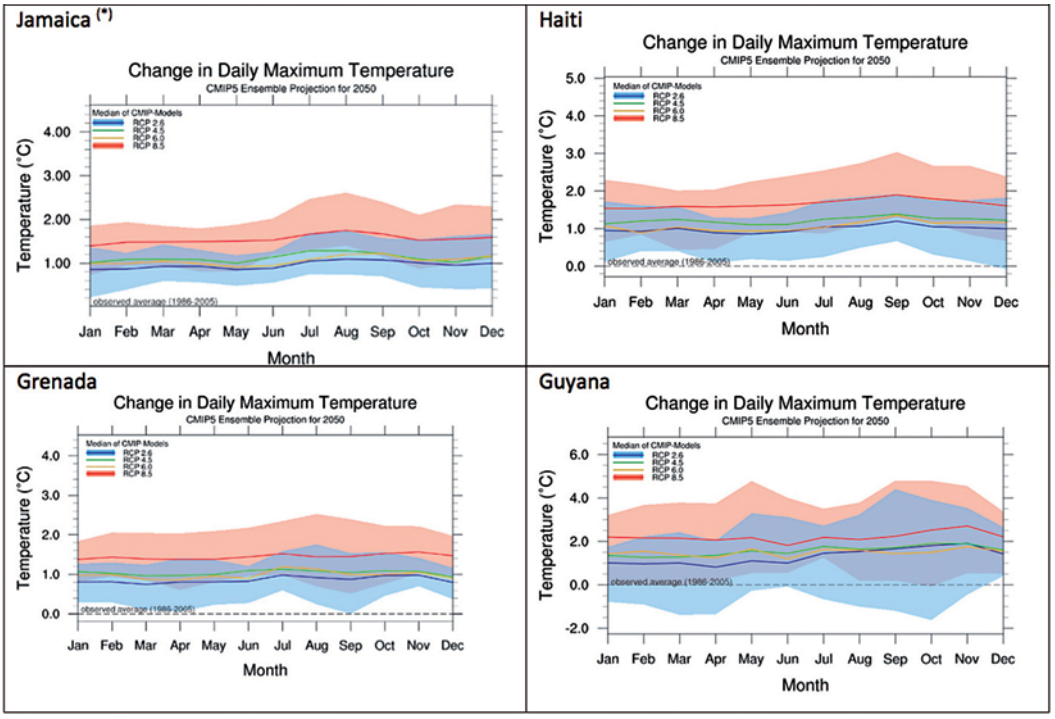
7.1.1 Climate change impacts on water infrastructure

The water sector in BMCs is susceptible to multiple risks associated with climate change and climate variability, include changing rainfall levels and patterns, rising temperatures, and more intense hurricanes. In fact, the region's water supply is expected to be directly affected by changing weather and climate conditions, and exacerbated by demographic and economic changes.

Variations in temperature and precipitation are among the main challenges of climate change, which threaten agricultural production in the Caribbean. **Annual mean temperatures across the Caribbean have increased** over the last century, while **average rainfall has decreased.** Figure 3 illustrates a range of possible changes in average temperatures for the four priority countries – Grenada, Guyana, Haiti, and Jamaica.

Figure 3. The expected changes in temperatures and rainfall for the four priority countries: Jamaica, Haiti, Grenada, and Guyana.

Changes in thermal environment – projected temperature[9]



Source: The World Bank Climate Change Knowledge Portal.

NOTE: (*) According to "State of the Jamaican Climate Report 2012, 6-15," between 1960 and 2006, the average temperature in Jamaica increased by 0.27°C per decade. Records also show an increase in the number of very warm days and nights. In addition, climate models project an increase in mean temperature of between 0.3°C and 1.3°C by the 2030s.[10] This figure coincides with the graph above.

According to the aforementioned results, a global warming target of 1.2°C to 1.5°C will still have significant negative impacts on Caribbean islands. In comparison to the present, the Caribbean will be warmer, with longer warm spells and longer hot and dry spells, and will experience moderate to extreme drought.

9 The World Bank Climate Change Knowledge Portal: http://sdwebx.worldbank.org/climateportal

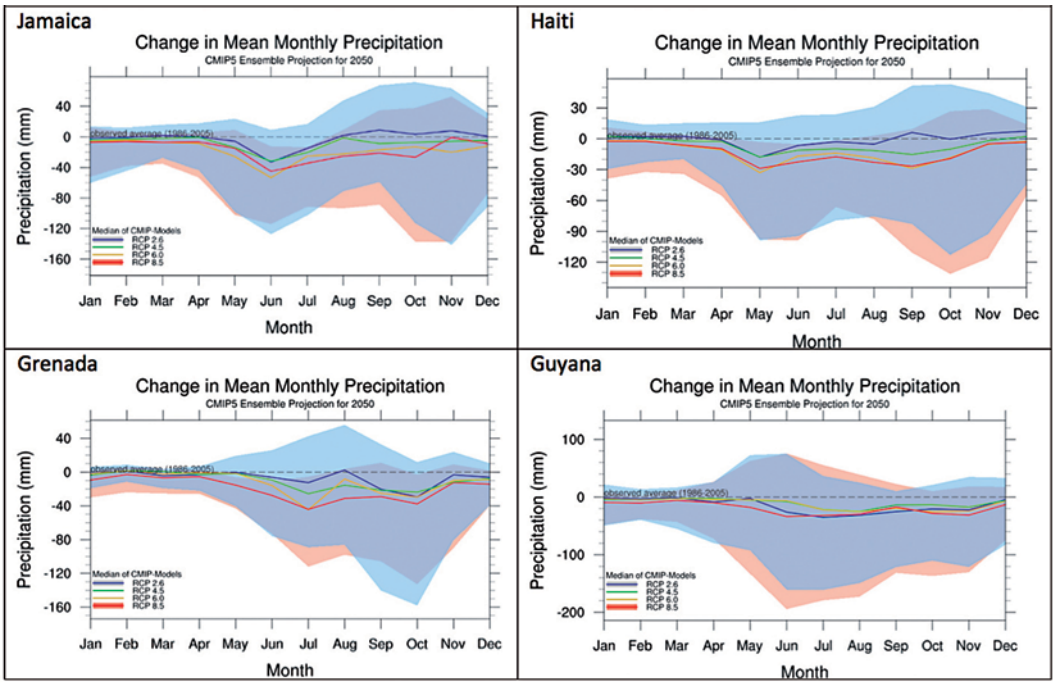
10 *State of the Jamaican Climate Report* (2012), pp. 6-15.

A projected decline in overall precipitation levels, together with increased variability in rainfall, suggests risk of more frequent droughts.

Figure 4 shows projected changes in monthly mean precipitation per month by 2050 compared to the reference period (1986–2005). Positive values indicate that monthly rainfall will likely increase compared to the baseline, and vice versa. The shaded area represents the range between the tenth and the ninetieth percentile of all climate projections. A projected decline in overall precipitation levels, together with increased variability in rainfall, suggests risk of more frequent droughts.[11]

Figure 4. Change in mean monthly precipitation for Jamaica, Haiti, Grenada, and Guyana – 2050 projections.

Precipitation – Water availability [12]



Source: The World Bank Climate Change Knowledge Portal.

Historical monthly temperature and rainfall

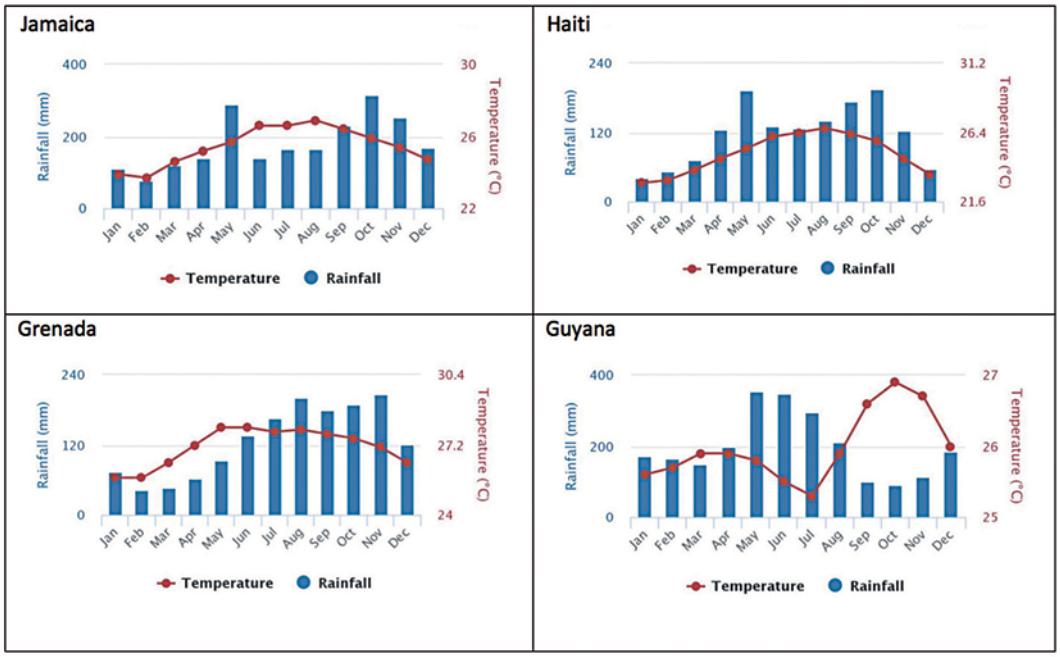
Figure 5 shows historical average monthly temperature and rainfall for Jamaica, Haiti, Grenada and Guyana during the 1991–2015 time period.

11 Note that none of these projections take into account the possible effect of changes in the pattern of tropical cyclones on rainfall.

12 The World Bank Climate Change Knowledge Portal (http://sdwebx.worldbank.org/climateportal) projected change in monthly mean precipitation per month by 2050 compared to the reference period (1986–2005) under all RCPs of CIMP5 ensemble modelling.

Figure 5. Mean historical monthly temperature and rainfall for Jamaica, Haiti, Grenada and Guyana during the time period 1991–2015.

Average Monthly Temperature and Rainfall[13]



Source: The World Bank Climate Change Knowledge Portal.

7.1.2 Analysis of impacts of expected water balances and climate conditions

The expected above-average temperatures and dry-season rainfalls, which will result in longer lasting drought periods, can lead to increased demand for water. In addition, the main changes in precipitation figures demonstrate a relevant reduction in precipitation during dry periods, which coincides with the higher projected changes in temperatures.

Comparative analysis of impact indicators

A summary of the more relevant indicators and key hydrologic drivers[14] for the four priority countries are shown in Table 2.

13 The dataset was produced by the Climatic Research Unit (CRU) of University of East Anglia (UEA) and is available on the World Bank Climate Change Knowledge Portal: http://sdwebx.worldbank.org/climateportal

14 Climate Change Knowledge Portal by the World Bank Water Anchor: http://sdwebx.worldbank.org/climateportal/index.cfm?page=water_indicators&Lat=18.109581&Lng=-77.297508&ThisRegion=Latin%20America&ThisCCode=JAM

Table 2. Indicators and key hydrologic drivers for the four priority countries

	Jamaica	Haiti	Grenada	Guyana
Negative hydrologic balance period	**May September**	**May September**	**January June**	**January June**
Change in maximum temperature (° C)	1.4	1.3	1.1	1.9
Change in mean monthly precipitation (mm)	-35	-25	-20	-18
Annual PET in percentage change	3.16	3.24	3.20	4.44
Mean annual irrigation deficit in percentage change	13.19	14.38	14.55	18.46
Annual precipitation in percentage change	-3.31	-2.81	-2.81	-1.90
Mean temperature in absolute change	1.11	1.13	1.13	1.59
Drought indicator in percentage change	-6.66	-5.20	-5.20	-3.16

Source: The World Bank Climate Change Knowledge Portal.

Considering the analysis presented above, investments in infrastructure (such as irrigation and rain-water harvesting systems, drainage, and on-farm irrigation) will promote the adoption of more efficient water management and conservation measures, and are key to addressing changing rainfall patterns. Specifically, water-related practices and investments, which are intended to address longer drought periods, will enable production planning to target higher prices in the dry season.

The link with the hospitality sector, where the vast majority of hotels are small- and medium-sized, could be significantly improved if farmers had irrigation schemes and access to technical support to increase yields and the quality of produce, and to tap into the domestic market.

Efficient water management and conservation measures are also needed to address expected production losses as a result of climate change. The economic benefits of irrigation projects are estimated using the increase in net farm income under future conditions with the project as compared to future conditions without the project.

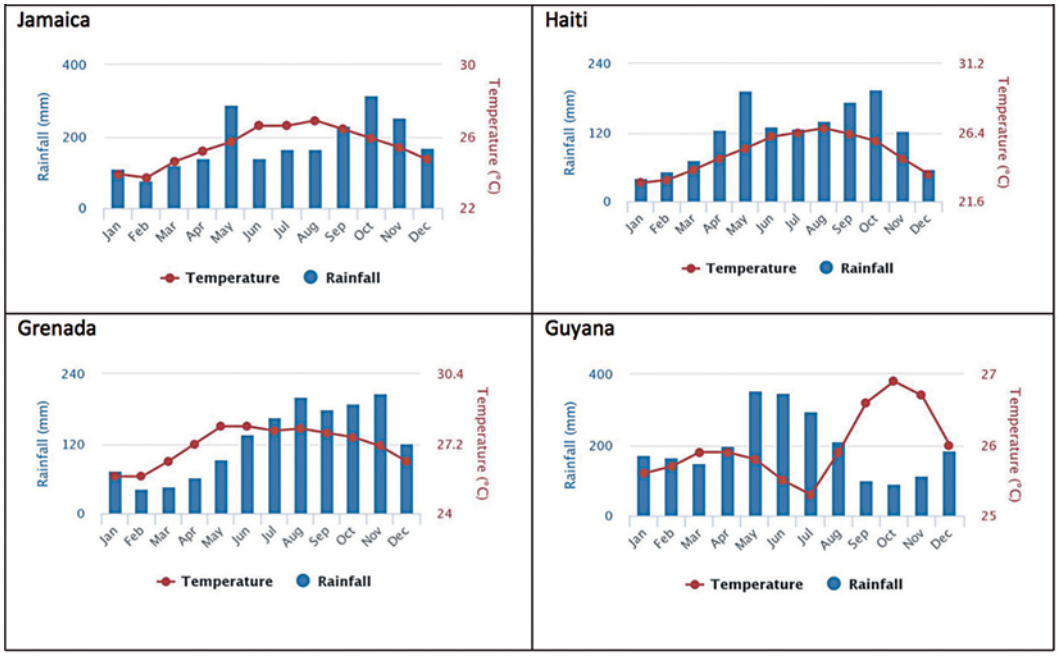
Table 3 shows estimated expected production losses due to future climate change scenarios in the four focus countries: Grenada, Guyana, Haiti, and Jamaica. Expected production losses in scenarios without projects in the islands are approximately 16 to 17 percent, while in Guyana (similar to other Continental States) the expected losses account for approximately 22 percent. A detailed analysis can be found in Appendix B – Climate change impacts and indicators for the priority countries.

Table 3. Potential production losses due to climate change

Production loses due to extreme events (%)	**Jamaica**	**Haiti**	**Grenada**	**Guyana**
Due to increase of evapotranspiration	97%	97%	97%	96%
Due to increase of water availability	87%	86%	85%	82%
Potential production losses	**16%**	**17%**	**17%**	**22%**

Figure 6. Average monthly temperature and rainfall for Jamaica, Haiti, Grenada, and Guyana.

Average monthly temperature and rainfall[15]



Sources: The World Bank Climate Change Knowledge Portal.

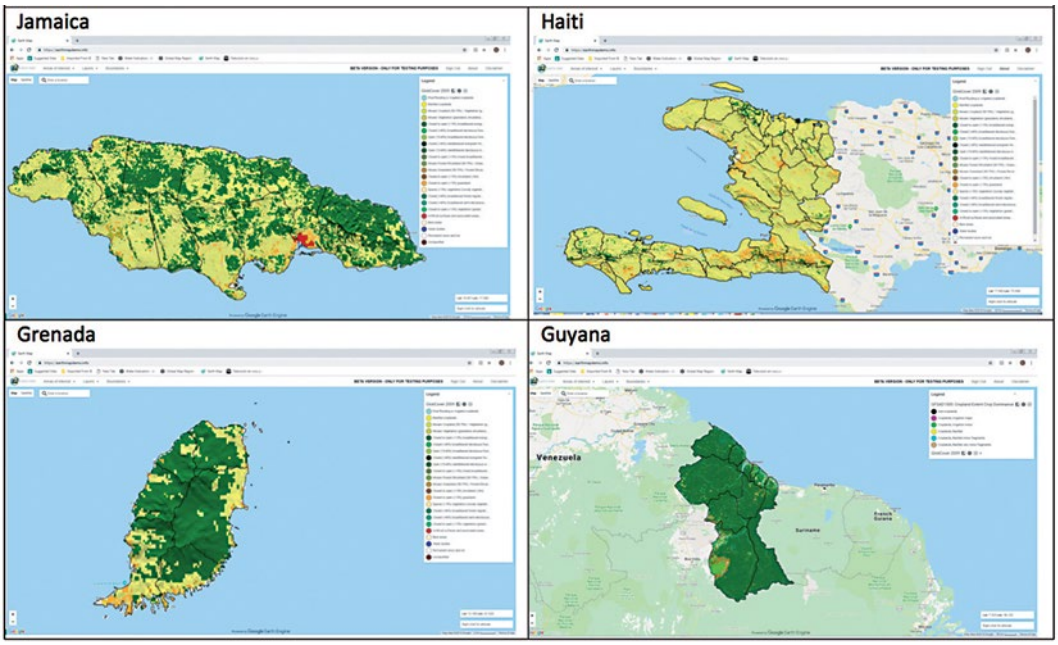
7.1.3 Identification of priority areas for investments in water resources management

Priority areas for investment in water resources management can be identified using the following, basic information, such as the land terrain model, topographical information, and land use, including the geographical location of VCs and producers as well as data related to value chains, potential production, yields, trends and opportunities. Figure 7 illustrates the potential application of land and soil maps to locate specific value chains.

15 The World Bank Climate Change Knowledge Portal: http://sdwebx.worldbank.org/climateportal The dataset was produced by the Climatic Research Unit (CRU) of University of East Anglia (UEA).

Figure 7. Land and soil map to identify the location of value chains in Jamaica, Haiti, Grenada, and Guyana.

Land/Soil Map Use – Location of Value Chain[16]

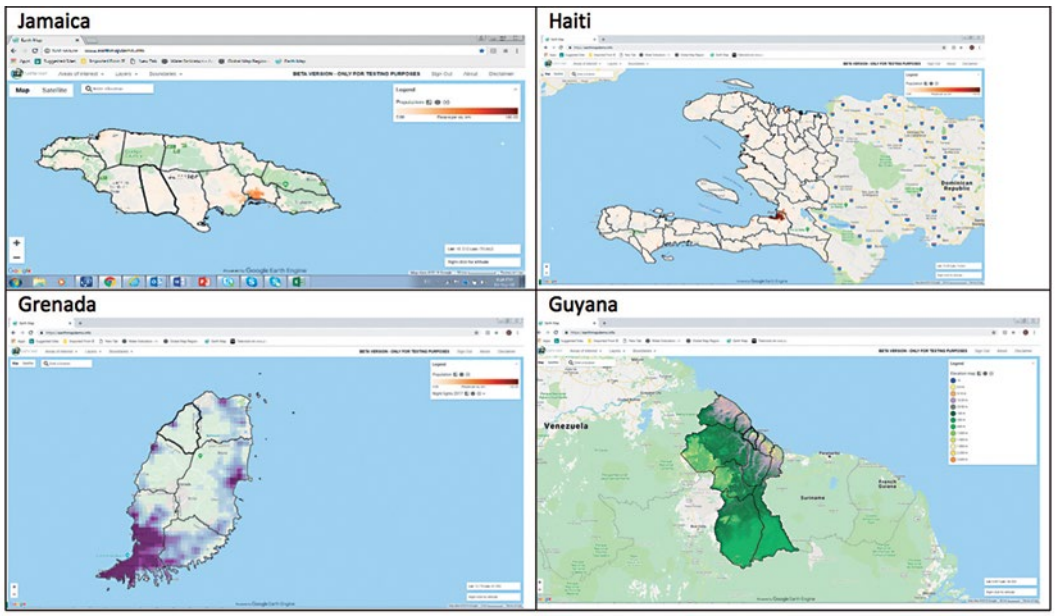


Source: EarthMap. See: https://earthmap.org/

Population maps including the distribution and number of potential beneficiaries are relevant to define indicators related to impacts and benefits.

Figure 8. Population maps for Jamaica, Haiti, Grenada, and Guyana.

Population



Source: EarthMap. See https://earthmap.org/

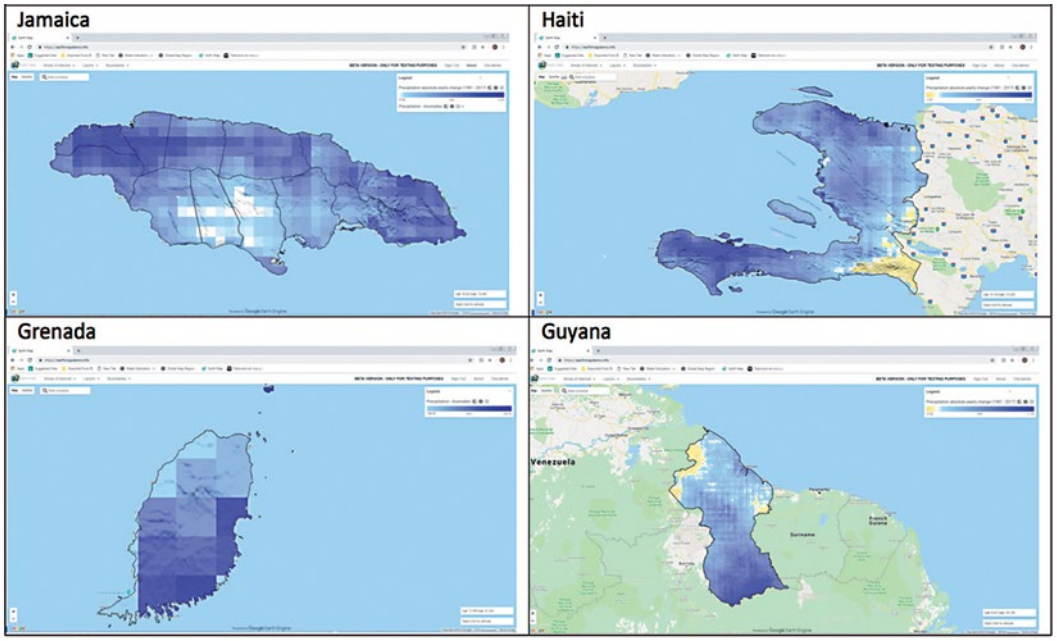
16 https://earthmapdemo.info/

It is important to evaluate how the climate in the Caribbean has varied and changed in the past. The monthly mean historical rainfall and temperature data can be mapped to show the baseline climate and seasonality by month, for specific years, and for rainfall and temperature.

In order to identify priority territories for investments, an assessment of the expected impacts regarding rainfall reductions and temperature increases and their anomalies should be developed. Figure 9 illustrates trends in precipitation changes (1981–2017) for the four priority countries, through a precipitation map.

Figure 9. Precipitation map: Trends of precipitation changes (1981–2017) for the four priority countries.

Precipitation absolute yearly change (Rainfall (mm)[17]



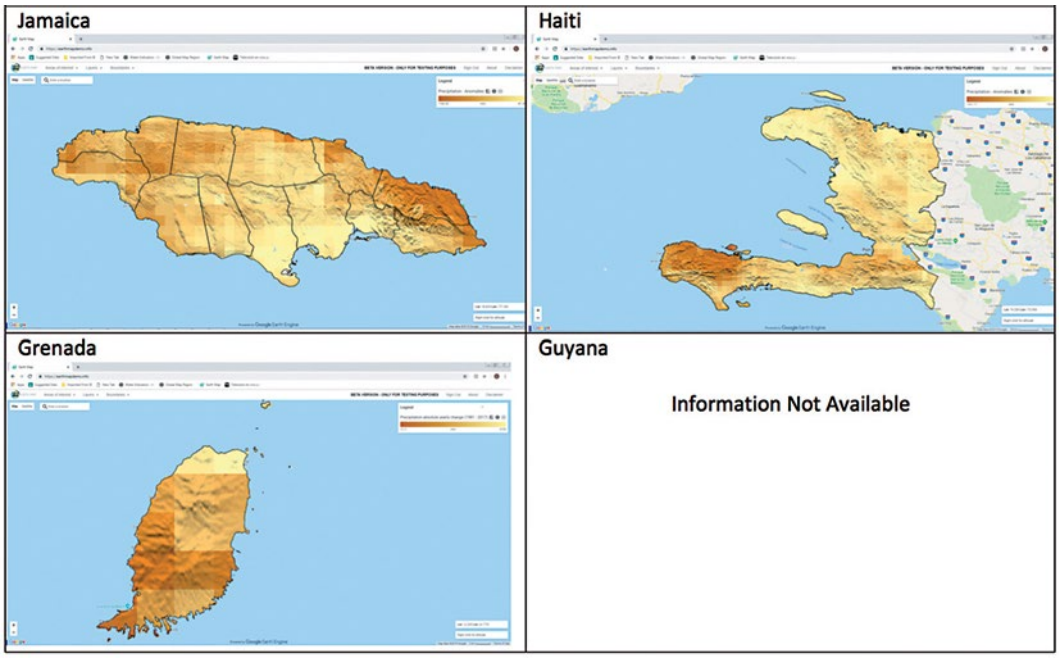
Source: EarthMap. See https://earthmap.org/

The anomalies map shows the percentage deviation (per pixel) between 2013 and 2017 and the average for the whole region between 1981 and 2017.

17 https://earthmapdemo.info/ The 'Precipitation' product is derived from processing Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS v2) grids at 5-day temporal resolution to generate total annual precipitation analysis for the period 1981 to present.

Figure 10. Anomalies map showing percentage deviation (per pixel) between 2013 and 2017 and the average for the whole region between 1981 and 2017.

Precipitation Anomalies[18]



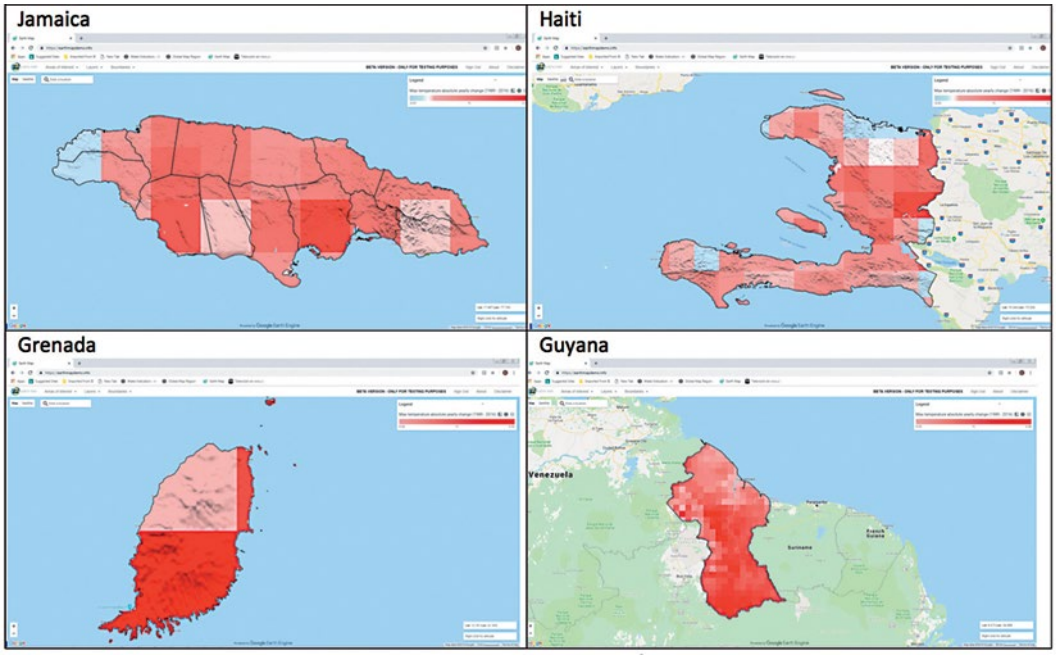
Sources: EarthMap. See: https://earthmap.org/

It is expected that higher temperatures will increase evapotranspiration, while reduced annual rainfall will have a negative impact on agriculture. Non-irrigated subsistence farming is particularly vulnerable to droughts, pests and diseases.

18 https://earthmapdemo.info/ The Precipitation Anomalies product is derived from processing the European Centre for Medium-Range Weather Forecasts (ECMWF) from 1981.

Figure 11. Precipitation anomalies for Jamaica, Haiti, Grenada, and Guyana.

Precipitation anomalies[19]



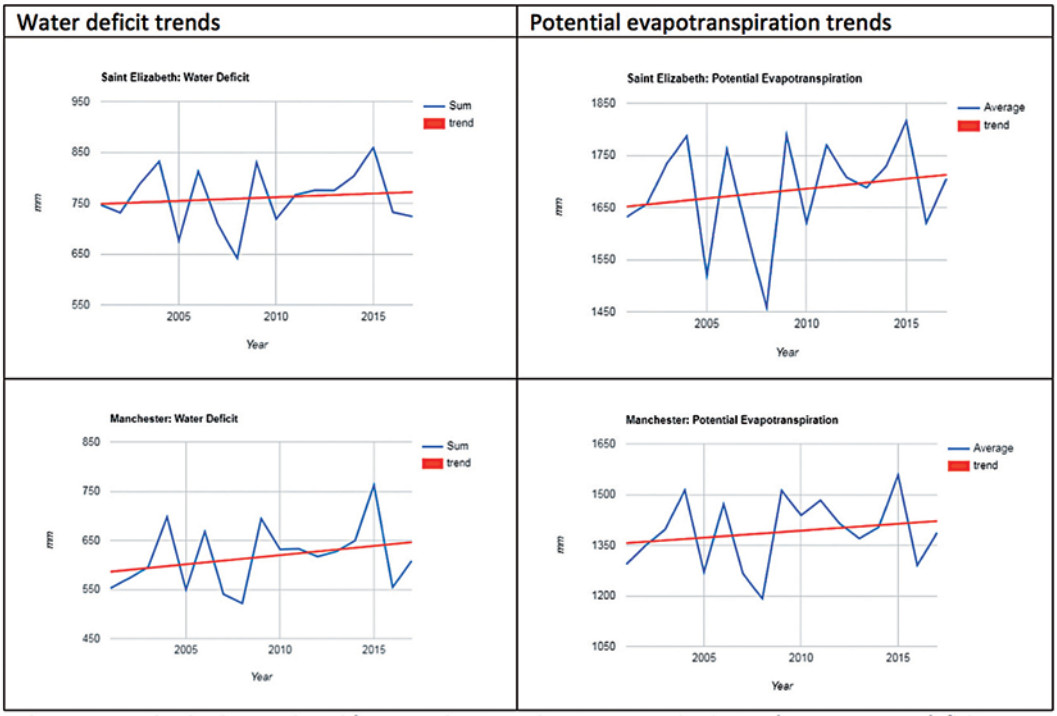
Source: EarthMap. See: https://earthmap.org/

The overlay analysis to identify priority areas for water-related investments, is based on the co-occurrence of areas that present greater precipitation anomalies and greater expected temperature increases. This analysis identified the territories with greater increases in evapotranspiration and greater projected water deficits. In addition, an overlay with the information on the shape of the population permits an analysis of the number of existing and potential producers in the selected priority territories.

In Jamaica for example, the parishes with the most irrigated areas, greatest projected water deficits and largest number of producers are Saint Elizabeth, Manchester and Clarendon (see Figure 12).

19 The Max. Temp. anomalies are calculated by building an image with the average of the Max. Temp. values for the region of interest for the whole period (1989–2017) and comparing it to the average Max. Temp. value (per pixel) of the year 2013–2017. The anomalies map shows the percentage deviation (per pixel) between 2013–2017 and the average for the whole region 1989–2017. See: https://earthmapdemo.info/

Figure 12. Territories in Jamaica with greater increases in evapotranspiration and greater water deficits.



Source: EarthMap. See: https://earthmap.org/

A similar analysis applied to Haiti, Grenada and Guyana identifies the following preliminary priority areas for investments:

- Haiti: Centre and Artibonite Departments
- Grenada: Saint George's
- Guyana: Mazaruni/Left Bank, Essequibo River, and Cuyuni districts

A more detailed analysis can be found in Appendix B – Climate change impacts and indicators for the priority countries.

7.1.4 Modernization of existing irrigated schemes

Modernizing or rehabilitating existing irrigation leads to actions that rationalize water use and incentivise productivity per hectare. Examples include:

- lining earthen channels with concrete;
- using closed pipes for water conveyance instead of open channels;
- applying sprinkler and drip irrigation methods instead of surface methods;
- measuring water flow at various locations throughout a system for better water management; and
- implementing water storage facilities close to irrigated areas.

Economic benefits of irrigation projects

Increases in net farm income due to investment in irrigation (under future conditions with the project as compared to future conditions without the project) are the result of the following:

- increases in the amount of cropped area, shifts in cropping patterns to more highly value crops, increases in the intensity of cropping patterns and livestock production, as well as higher yields;
- rehabilitation projects, which reduce water losses, thereby allowing the saved water to be used to increase crop production;
- economic benefits in the form of savings in annual operations and maintenance (O&M) costs, which are provided by some of the proposed rehabilitation projects; and
- reduced potential production losses in future scenarios.

Table 4 is a summary of irrigation typologies, investments and indicators for the projects that have been included in the National Irrigation Development Master Plan.[20]

Table 4. Irrigation typologies, investments and indicators for projects included in the National Irrigation Development Master Plan

Project	Description	Area (ha)	Farmers	Const. Cost (USD million)	Cost/ ha (USD)	Cost/ Beneficiary (USD/Prod)
Major Irrigation	Interdisciplinary approach to include engineering, farmer participation, extension and marketing; emphasis on cost recovery.	5 762	3 080	35.21	5 699	11 468
N.I.C. Irrigation	Focus is on improved service, improved delivery efficiencies, lower O&M costs, improved on-farm water management (OFWM), provision of on-farm equipment, recovery of full O&M costs.	3 009	615	12.66	6 596	24 821
Private Irrigation	Focus on introducing new technologies, training and improved management. The key is improved efficiencies through improved OFWM. For sugar cane with surface irrigation, this includes night storage, land grading, and improved furrows.	1 527	23	3.24	2 198	
Small Scale Irrigation	Irrigation systems < 400 ha: Interdisciplinary approach for engineering, farmer participation, extension and marketing. System designed for turnover to farmers. Establishing farmer groups (water user associations – WUA) to operate systems is a critical component.	4 279	2 709	19.03	4 627	7 666
Storage Irrigation		5 125	500	30.1	4 712	
Grand Total		**19 702**	**6 927**	**100.24**	**5 088**	**14 471**

Source: National Irrigation Development Master Plan – Government of Jamaica.

20 National Irrigation Development Plan and preparation of an irrigation Investment Project – Government of Jamaica (February 1998).

- The proposed National Irrigation and Development Plans (NIDP) projects have an estimated investment cost of USD 106 million, an annual incremental O&M cost of USD 12 million, and a net present value (NPV) of USD 99 million.
- Capital investment costs per hectare range from USD 1 700 for rehabilitation, USD 4 400 for small-scale irrigation, and up to USD 5 000 for major irrigation, depending on the characteristic and magnitude of the investment. The average investment is 5 100 USD per hectare.
- Once all projects have been implemented, NIDP will generate an average increase of USD 55 million in annual income to farm families, and USD 23 million in wages to farm labour contribution.
- The projects provide an increase in direct agricultural employment, amounting to an annual increase of over 10 100 persons per year. Most of the labour will be provided by the 6 928 farm families who directly benefit from the plan; though some will be provided by hired labour.

7.1.5 Investments in expansion of irrigation

Expansion in irrigation depends on water availability and soil quality. To identify the potential of soils and lands, an assessment of Geographic Information System (GIS) information related to land use, and land categories has been proposed. This overlay analysis to identify irrigable areas, is based on the co-occurrence of areas categorized as I, II, and III, and are areas currently used for agriculture or considered as croplands according to GIS Analysis.

- Land Category I: Lands which may be irrigated with all common methods of irrigation.
- Land Category II: Lands which are suitable for irrigation with sprinkler and micro-irrigation methods.
- Land III: Land with generally steep slopes and thin soils, which are productive with careful management of the limitations. Slopes greater than 10 percent could be considered to identify potential irrigable lands primarily in the hills to help increase the incomes of small farmers.

The results of the overlay analysis for Jamaica identified 90 800 hectares of land categories I and II, (category III amounts to 97 000 ha or approximately 9 percent of the Island).

- The incremental increase in new irrigated areas resulting from the implementation of the National Irrigation and Development Plan is 7 200 hectares.
- The total annual increase in production is USD 132.5 million, of which USD 62.9 million (47 percent) is from vegetable crops.
- The construction investment per beneficiary farm family is USD 13 000.
- Table 5 outlines the increases in irrigated area, production, and value of production from the projects for selected value chains.[21]

21 National Irrigation and Development Plan – Government of Jamaica (Plan Table E-8).

Table 5. Estimated crop production increases after full implementation of NIDP, Jamaica

Crop	Area increase	Production Kilotonnes	Gross value USD Million	Estimated production tonnes/ha	USD/ha
Vegetable	4 164	99.5	62.9	23.90	15 106
Mango	371	1.9	1.6	5.12	4 313
Papaya	128	1.8	2.3	14.06	17 969
Sugar Cane	4 483	99.5	62.9	22.19	14 031
Banana	2 296	44.2	31.9	19.25	13 894
Pasture, Misc	2 259	0	0.7	0.00	310
Fish	1 257	10.7	22.6	8.51	17 979

Source: Jamaica – National Irrigation and Drainage Plan

7.1.6 On-farm irrigation technology

In addition to off-farm improvements of irrigation, on-farm irrigation investments using sprinkler and drip irrigation methods instead of surface methods are effective instruments to improve water use efficiency and to increase the productivity and yields at farm level, especially for horticulture.

- Required investments range from USD 1 500 to USD 3 000 per hectare, depending on the irrigation methods, crop type and spacing, among others.
- Improved application efficiencies range from an average of existing furrow efficiencies of 45 to 55, to an improved efficiency of 70 to 80 percent for sprinklers, 80 to 85 percent for micro-sprinklers, and 85 to 90 percent for drip irrigation.
- Estimated impacts on yield and production increases vary from 15 to 45 percent, depending on the agriculture crop considered.

For irrigation with surface methods, it is also important to consider possible actions to improve efficiency. These include: uniform size and spacing; proper length which is appropriate to the soil infiltration rate; water holding capacity of the soil in the crop root zone; land grading to proper slopes to minimize the amount of surface runoff; and controllable water supply by means of siphon tubes from a constructed supply channel or gated pipe at the upper end of the furrows. Improved on-farm irrigation can be achieved through investments ranging from USD 200 to USD 1 000 per hectare, depending on the geometry of the plots, characteristic of the soils, irrigation methods, crop type and spacing, and more. Improved application efficiencies range from an average of existing furrow efficiencies of 45 to 55 percent to an improved efficiency of 60 to 70 percent (improve surface irrigation). With improved water use and irrigation efficiency, yield and production increases range from 10 to 20 percent depending on the agriculture crop considered.

7.1.7 Flood water control and drainage systems

Flood water control

Throughout the years, BMCs have experienced the vast destruction of property and infrastructure as a result of heavy rainfall and flooding. Many factors contribute to infrastructural losses and damage, including the lack of integrated and forward planning for adequate drainage networks, and the insufficient maintenance of existing drains and gullies.

These potential changes in Jamaica's climate will likely have an impact on[22] the flooding regimes, as the increase in the frequency of high intensity rainfall events and hurricanes will likely increase the frequency of landslides and floods.

While changes in the frequency and intensity of tropical cyclones in the future are hard to predict,[23] several studies conclude that cyclones are likely to become more intense in the Caribbean region in the future, bringing heavier precipitation and stronger winds.

Agricultural drainage

The implementation of planned surface drainage on irrigated lands contributes to eliminating the excessive duration of ponding, and to directing excess surface run-off to a safe outlet. No detailed data is available to estimate potential areas of lands with waterlogging issues, salinity or degraded land. Nevertheless, data on existing surface irrigated schemes show that approximately 30 percent of the irrigated land could potentially present drainage issues.

- Estimated investments in drainage range from USD 300 per hectare (for main drainage collector channels), USD 500 – 1 000 per hectare (including open on-farm drainage systems), and estimated USD 2 500 per hectare (considering on-farm drainage pipes).
- Estimated productive benefits would range from an increase of 10 percent to 80 percent of the production of the affected areas following interventions for adequate drainage systems.

7.1.8 Water harvesting structures

Over the past two decades, the frequency and intensity of drought conditions have risen significantly, and below average rainfall levels across the islands have resulted in more frequent water restrictions for domestic and agricultural uses. Water harvesting structures are intended to address longer drought periods, thereby enabling production planning to target higher prices in the dry season. Specifically, the construction of reservoirs and micro-dams for the storage of seasonal, monthly and weekly water flows can support and supplement peak irrigation requirements for small areas.

Table 6 presents the potential number of water harvesting projects in priority parishes and territories for the four focus countries.

22 Development of a National Water Sector Adaptation Strategy to Address Climate Change in Jamaica (2009).

23 IPCC Fourth Assessment Report. Regional Climate Projections, Small Islands, Tropical Cyclones (2007); Peilke (2005); and Webster (2005).

Table 6. Potential number of water harvesting projects

Country	Jamaica		Haiti		Grenada		Guyana	
Territories	Saint Elizabeth	Manchester	Centre	Artibonite	Saint George's	Saint David	Mazaruni	Cuyuni
Rainfed croplands (ha)	1 521	2 326	6 596	8 906	186	189	5 966	2 282
Area (ha) < slope 10%	55 731	25 292	123 174	189 841	1 206	642	1 757 700	791 975
Potential beneficiaries	1 006	4 649	5 729	10 578	136	628	14	3
Number of Families	201	930	1 146	2 116	27	126	3	1
Potential No. Projects	11	47	58	106	2	7	1	1

Source: Analysis based on EarthMap. See: https://earthmap.org/

A more detailed analysis for the identification of the number of projects can be found in Appendix B – Climate change impacts and indicators for the priority countries.

In Jamaica, due to the absence of a reliable supply of irrigation water in some areas, a proposed solution was the conversion of mined-out pits to water catchment ponds, and to provide farmers with access to lands around these ponds. These investments enabled production during the dry season: two production cycles of horticulture products, mainly vegetables; three productive cycles under greenhouse production systems. The cost for the pond design and site preparation was JMD 3.02 million per site,[24] which is equivalent to USD 25 000 per site.

7.1.9 Wastewater reuse

Wastewater that is properly treated at sewage treatment plants may be safe for activities such as irrigation and some industrial processes.

Treated effluent could be an alternative source of water where it is safe and economical, especially in agricultural areas close or adjacent to urban areas, where shifting from extensive to intensive agricultural production and protected agriculture (horticulture) could be a good alternative.

7.1.10 Clean water and sanitation

Access to basic social infrastructure and services in rural areas, such as reliable, clean and safe water and sanitation facilities, is key to improving the well-being and welfare of Caribbean citizens and enhancing health and educational outcomes, especially among women and children.

Investments in water and sanitation have (a) strengthened the governance and management arrangements of the sector aimed at providing efficient service delivery; and (b) enhanced the quality of life of rural households through the provision of a safe and reliable water supply as well as upgraded or installed water systems.

The following are potential solutions to ensure clean water and sanitation in rural areas:

24 See: www.jsif.org/search/node/greenhouses

Increased rainwater harvesting for households in areas with adequate rainfall and where groundwater and surface sources are inadequate.

- Promote the rehabilitation and maintenance of community catchment tanks, where municipal corporations, local authorities, or communities themselves wish to take on the responsibility of maintaining these systems.
- Water supply from rainwater harvesting should be treated or filtered to meet World Health Organization (WHO) standards before it is consumed.

Improvement or construction of local government or municipal corporation systems to provide potable water in rural areas using entombed springs, rainwater catchments and wayside tanks.

Construction of sewerage facilities operated by the institutional or private sector, including some small sewage systems or using package plants, which are associated with housing developments in various locations.

The disposal of the sewage generated, in the remainder of the population is by means of various types of on-site systems such as septic tanks, soak-away pits, tile fields, pit latrines or other systems operated by private entities.

7.2 Productive and post-harvest processing infrastructure

Productive and post-harvest processing infrastructure will enable compliance with emerging agri-food standards. Infrastructural upgrades include greenhouses, certified pack-houses, cold storage, slaughterhouses as well as laboratory and testing facilities.

Investments in greenhouses are aimed at supporting sustainable livelihoods in recipient communities, while contributing to the improved production and supply of fruits, herbs and vegetables. The development of greenhouse clusters can also help pool the production capacity of local farmers, thereby improving their earnings and marketing powers.

For capital investments in Jamaica, under the JSIF/JBI Water Harvesting Cluster Greenhouse Project,[25] farmers were provided with 160 greenhouses (20 at each site) at a total cost of J$208 million (USD 190 000 per cluster of 20 producers; from USD 9 700 to USD 12 500 per greenhouse). Productive and post-harvest investment covers: (1) the provision of plastics, shade cloths and lumber for each greenhouse; (2) fertigation and storage drums for each greenhouse; (3) drip irrigation systems; (4) pesticide storage facilities at each site; (5) food storage facilities at each site; (6) bathroom facilities at each site; and (7) training for farmers in business management, greenhouse production, water management, and marketing support.

Clustering greenhouse producers provides greater control of quality and crop production schedules, which consequently attracts larger traders who are often connected to higher value markets, such as supermarkets. Greenhouses enable three productive cycles.

Accompanying **post-harvest infrastructure**, such as cold rooms and pack-houses serving multiple growers, increases efficiencies and reduces post-harvest losses through better management of post-harvest handling of fresh produce.

25 See: www.jsif.org/search/node/greenhouses

The Caribbean Development Bank can facilitate and support post-harvest handling operations through building a good infrastructural support base, including efficient cold chain infrastructure and storage to maintain the quality of produce and prevent food loss and waste.

For the identification of required investments, specific information for each specific value chain is needed to define the scope of the potential proposals, including data related to the location of producers and production, standards and market requirements, the planning of market demands, location of markets, and more.

7.3 Investments in affordable and clean energy

Energy efficiency is among the most promising initiatives for reducing greenhouse gas emissions, energy costs, and for seeing improvements in operational efficiencies in the provision of public water supply and irrigation services.

Investments involving energy could complement investments in irrigation systems, such as pack-houses, cold storage, processing and aquaculture facilities, thus increasing sustainability and cost effectiveness. Improving resilience can also include the investment in alternative energies that can support key value chain hubs and reduce their dependency on national power grids.

However, the high cost of energy is still an area of concern for BMCs, as this impacts on, among other things, private sector development and competitiveness. Rebalancing the energy mix to include natural energy resources – such as solar, wind and geothermal power – offers a sustainable, long-term solution.

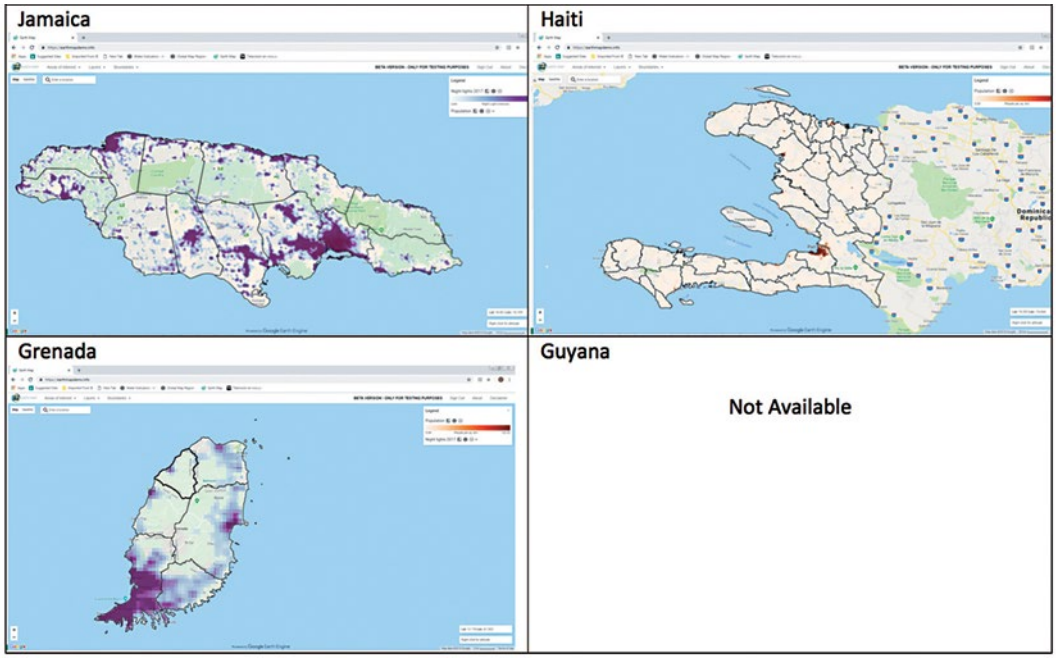
The use of solar energy is an important step in upgrading and greening the value chains, and improving their efficiencies. By focusing on alternative energies and limiting its dependency on traditional systems, the agricultural sector will be able to restore its operations more quickly and efficiently, and thus improve sector resilience and reduce the vulnerability of its stakeholders.

7.4 Transport and market investments

Road projects aim at enhancing the movement of persons as well as goods and agricultural products and trade, while road rehabilitation projects facilitate transportation linkages from rural areas to markets and basic social services.

Transport and market investments should include the rehabilitation, upgrade, or construction of roads. The investments should also include complementary drainage works to ensure transit during rainy seasons and bridges exposed to seasonal flood events.

Figure 13. Identification of transport and market investments. Market locations[26]



Source: EarthMap. See: https://earthmap.org/

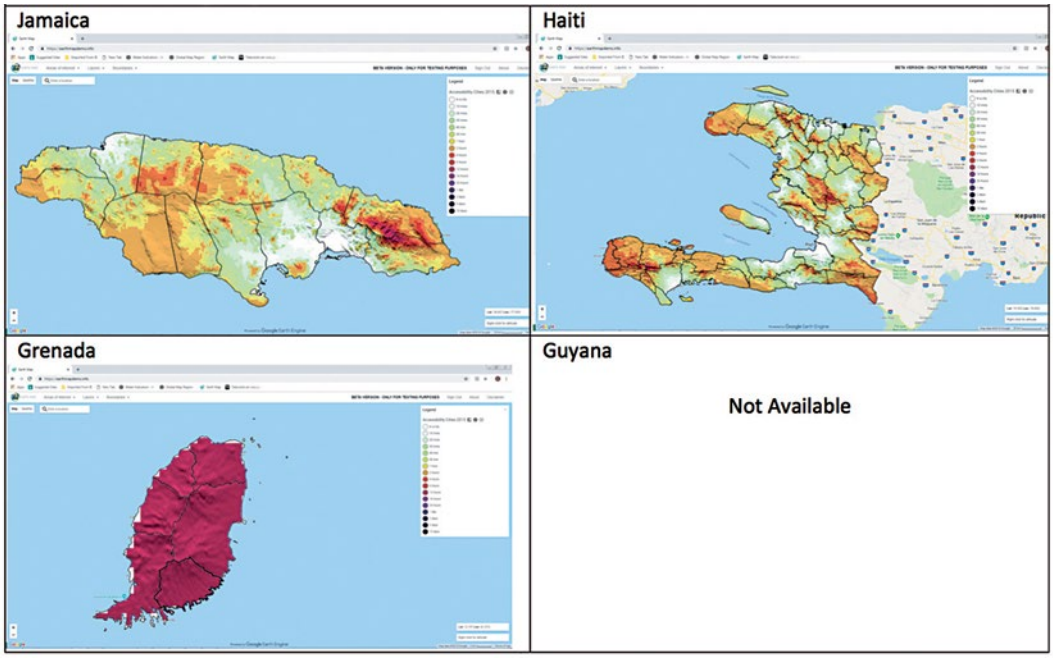
Investments in road rehabilitation projects, which facilitate transportation links from rural areas to markets, have a positive impact on small farmers in beneficiary communities, reducing travel time to markets as well as vehicle operating costs.

The global accessibility map is used to identify potential investments in roads that can significantly reduce trade costs and lead to better integration with markets.

26 The maximum temperature anomalies are calculated by building an image with the average of the Max. Temp. values for the region of interest for the whole period (1989–2017) and comparing it to the average Max. Temp. value (per pixel) of the year 2013–2017. The anomalies map shows the percentage deviation (per pixel) between 2013 and 2017, and the average for the whole region during the 1989–2017 period. https://earthmapdemo.info/

Figure 14. Global accessibility maps for Jamaica, Haiti and Grenada.

Global accessibility maps[27]



Source: EarthMap. See: https://earthmap.org/

Figure 14 shows the global accessibility map which enumerates land-based travel time to the nearest densely-populated area. Densely-populated areas are defined as contiguous areas with 1 500 or more inhabitants per square kilometre, or with a population centre of at least 50 000 inhabitants.

Based on this information, it is possible to identify priority areas for investments in the rehabilitation or upgrade of rural roads and drainage systems. This can improve or maintain rural area (and value chain) access to the location of demands (from cities, supermarkets, the hotel and restaurant industry, ports, and so on), both in extreme weather events, such as heavy rainfall, and in normal conditions.

The areas of interventions will be selected based on the potential number of beneficiary farmers, current production, and the potential to increase agricultural production and incomes. The scope for reducing transportation costs and for promoting improved linkages to markets will also be considered.

It should be noted that no relevant problems with regard to transportation times to domestic urban markets are found for Jamaica and Grenada.

On the whole, potential investments should be focused on secondary roads, feeders, and farm access.

27 https://earthmapdemo.info/

Table 7. Global land cover areas, Jamaica and Grenada

GlobCover 2009 – Area (ha)	Jamaica Parishes – Area (ha)				Grenada Parishes – Area (ha)			
Class name	Saint Elizabeth	Manchester	Clarendon	Saint Catherine	Saint George's	Saint David	Saint Andrew's	Saint Patrick's
Croplands	1 521	6 118	10 837	8 527	186	189	219	26
Percentage of Croplands	1.3%	7.4%	9.1%	7.4%	2.8%	3.9%	2.3%	0.6%
Density (people per ha cropland	30.4	7.0	3.3	4.8	5.3	2.8	4.0	12.2
Families per ha of cropland	6.09	1.41	0.65	0.96	1.05	0.57	0.79	2.43
Estimated number of lots	9 256	8 604	7 054	8 214	197	107	173	64

Source: Analysis based on EarthMap: https://earthmap.org/

The same analysis and figures on Haiti conclude that in some territories, it can take more than 8 hours to reach the nearest domestic urban markets by transit.

The analysis suggests that potential investments could be selected based on the number of beneficiaries in a specific parish´s location and for a specific value chain.

Table 8. Global land cover areas – Haiti

GlobCover 2009 –Area (ha)	Parishes – Areas (ha)								
Variable / Parish	Anse-D'Ainault	Jeremie	Corail	Chardonnieres	Coteaux	Mole Saint Nicolas	Dessalines	Valliere	Belle Anse
Croplands	4 575	8 623	10 995	5 489	585	12 496	1 344	16	11 785
Percentage of croplands	14.1%	10.7%	14.1%	14.4%	3.3%	11.3%	1.2%	0.0%	15.1%
Density (people per ha cropland	4.3	5.5	2.7	2.8	18.5	4.2	62.9	864.1	2.7
Families per ha of cropland	0.85	1.09	0.55	0.55	3.71	0.84	12.57	172.82	0.54
Estimated number of lots	3 897	9 434	6 018	3 030	2 170	10 553	16 892	2 850	6 306
Regularly flooded or waterlogged soil	-	-	-	-	-	-	982	-	-

Source: Analysis based on EarthMap. See: https://earthmap.org/

The estimated reduction of travel operational costs is considered in the economic evaluation (Map of Roads EIRRs)[28] for the different value chains located in these areas. This overlay analysis to identify areas with accessibility restrictions, is based on co-occurrence of areas with greater transport time to the near markets.

Since 2015, CDB has supported[29] the reconstruction and rehabilitation of 182 km of primary, secondary and other roads. Built or upgraded in urban and rural areas, these roads increase the movement of goods and improve access to services in BMCs. Investments in transport can therefore play an important role in ensuring the overall success of CDB's priority area investments.

8. Recommendations on new investment proposals

8.1 General recommendations on new investment proposals

In new investment proposals, it is recommended that CDB should:

- Create an enabling environment to achieve long-term impact, which requires a coherent package of policies and investments, including: agriculture policies; subsidies; taxation laws; investments in infrastructure to promote healthy foods; financial incentives and disincentives for businesses, including for food loss and waste prevention and reduction; education campaigns aimed at the population; and other measures.
- Invest in inclusive infrastructure to address the needs of youth and women along the value chains.
- Explore possible partnerships within CDB as well as with other international financial institutions and development partners who are active in the region.
- Identify synergies among institutions, such as the Inter-American Institute for Cooperation on Agriculture (IICA), the Caribbean Community Climate Change Centre (CCCCC), the International Centre for Tropical Agriculture (CIAT), and the Caribbean Agricultural Research and Development Institute (CARDI).
- Implement community-driven development (CDD) initiatives, based on the success of the Jamaica Social Investment Fund, which would support improvements in rural infrastructure and rural income generation.
- Provide opportunities for small- and medium-size farmers to access markets through different points in the value chains, ensuring food quality through internationally certified systems and promoting investments in profitable agricultural enterprises.

28 Economic evaluation and the determination of the evolution of the state of the road, are normally made with the HDM4 model: Highway Development and Management, version 1.3, accepted worldwide for the preparation of economic evaluations of road projects, financed by International financial Institutions (IDB, IBRD, World Bank, etc.).

29 CDB, *Development Effectiveness Review* (2017).

- Improve relevant public infrastructure, such as laboratories and slaughterhouse; harmonizing the Good Agricultural Practices (GAP) protocol and traceability systems, including building human resources, training and management capacity related to the adoption and application of GAPs and traceability.

The menu of technologies should be designed so as to enhance agricultural productivity while contributing to climate change adaptation without damaging the environment. The following are some examples:

- Small-scale irrigation equipment – pumps, micro-irrigation equipment, wells, boreholes, water-tanks, and rainwater catchments
- Agricultural equipment – animal and motorized traction, agricultural tools for pruning, weeding, plowing, and harvesting
- Farm-level post-harvest equipment – storage, drying tools, processing tools, cane mills, and grain mills

Sustainable agricultural practices include agroforestry systems, silvopastoral systems, and sustainable soil and water management techniques (water retention, erosion control practices, fertility restoration, etc.).

8.2 Involving the private sector

The private sector, which is among the CDB's main priorities, is an essential pillar in building competitive economies with the capacity to support sustainable growth (SDG 8), while contributing to poverty reduction. The following recommendations can help CDB support the development of the private sector and private sector operations:

- Increase access to affordable finance, which is crucial for doing business.
- Form partnerships within CDB, based on different instruments, such as providing extension services to farmers on CSA practices and on improving marketing links as well as matching grant financing schemes for individual farmers or groups to promote the adoption of CSA practices and technologies.
- Involve prospective beneficiaries in the choice of the technology menus in order to assess their interest for these technologies.
- Strengthen the supply chain through the direct support of farmers and investments in cold chain infrastructure, transportation, and safe packaging, which would also help reduce food loss.
- Promote public–private partnerships as a means of enhancing overall governance and sustainable investments.

In addition to creating multi-stakeholder platforms that cut across sector silos and offer holistic and comprehensive solutions to development challenges, CDB should target its support towards innovative public–private partnerships. These partnerships should complement public and private sector strengths in delivering results-based policy, supporting research and research-informed practices, as well as collaborating on improving governance capacity along the value chains – from stock management to trade and food security enablers.

In Jamaica, the private sector is involved in the water sector through the provision of piped water supply, piped sewerage services, and irrigation services. In many cases, private sector involvement has been effective at increasing the speed of development and delivering essential services to Jamaicans. In other cases, there have been problems, because this development has come at the

expense of other Government of Jamaica objectives. For example, some private service providers engage in so-called "cherry picking" – providing piped water and sewerage services only in areas where it is economically viable, resulting in gaps in service provision. To prevent "cherry picking," private service providers will be required to serve adjoining low-income communities, and be charged a fee to ensure universal access.[30]

8.3 Specific sectoral recommendations

Water Resources Projects:

- Strengthen the monitoring and evaluation capabilities for the identification of water catchment sites to improve natural resource management and climate change adaptation, including the preparation and implementation of a LIDAR[31] /satellite survey.
- Ensure that private participation in the water sector transforms decision-making and accountability by aligning the interests of all parties, government and private, with the public interest.
- Support management information systems, such as the establishment of real-time measurements and reporting of rainfall and soil moisture, and use that information to prepare a daily advisory on water needs for specific types of crops in specific areas. Develop information and communications technologies (ICTs) through the development of specific apps, which are accessible to producers. Improve data on water balances for the distribution systems.
- Improve socio-economic information about consumers and the types of crops that are being grown.
- Establish an effective monitoring programme to ensure long-term planning, along with the development of plans and programmes to combat the effects of drought conditions, in particular for vulnerable communities and the agricultural sector.

Technical Assistance

- Strengthen agricultural innovation and extension by financing the establishment of agricultural centres and contributing to local and regional development, including technology transfer, demonstration and training.
- Support compliance with sanitary and phytosanitary standards. Review and update standards and codes related to products destined for export markets as well as local markets (both current and potential).
- Provide technical assistance to cover at least one agricultural cycle in order to provide information about the proper use and implementation of the new technologies as well as to accompany farmers during the production process.
- Design new technological packages directly related to the results of applied agricultural research, while considering the diversity of climates and social contexts in which they will be implemented.

30 CDB, *Development Effectiveness Review* (2017).

31 LIDAR – Light Detection and Ranging – is a remote sensing method used to examine the surface of the Earth.

9. Suggested monitoring and evaluation targets

Proposed monitoring and evaluation targets related to infrastructural investments are as follows:

Agriculture Extension and Research

- Technologies demonstrated in the project areas (number)
- Targeted clients satisfied with agricultural services (percentage)
- Clients who have adopted an improved agricultural technology promoted by the project (number)
- Targeted clients who are members of an association (percentage)
- Food and nutritional requirements of the population significantly met by local production as evidenced by continuous reduction in imports of basic foods

Irrigation and Drainage

- Area provided with irrigation and drainage services (ha)
- Water users provided with new or improved irrigation and drainage services (number)
- Operational water user associations created and/or strengthened (number)
- Agricultural irrigated land (percentage of total agricultural land)

Renewable Energy

- Generation capacity of renewable energy (other than hydropower) constructed under the project (megawatts [MW])
- People/community provided with electricity connections with access to electricity under the project (Energy – Off-grid [#])
- Renewable energy consumption (percentage of total final energy consumption)
- Investment in energy with private participation (current USD)

Private Capital Mobilized

- Private capital mobilized (USD)
- Energy/Irrigation Services / water services

Roads

- Rural roads constructed (km)
- Rural roads rehabilitated (km)
- Roads in good and fair condition as a share of total classified roads (percentage)
- Share of rural population with access to an all-season road (proportion) (Number of people with access to an all-season road)
- Average time from rural areas to specific domestic markets (hours)

Water Supply

- People provided with access to "improved water sources" under the project (number)
- Improved community water points constructed or rehabilitated under the project (number)
- New piped household water connections as a result of the project intervention (number)
- Water utilities that the project is supporting (number)

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Appendix A

Overview of past and ongoing infrastructural investment experiences

A.1 CDB Strategy and interventions in the region

The CDB's Strategic Plan has been focused on support for investment to enhance mainly (a) water resource development and to (b) improve transportation, including roads. These investments are geared towards addressing the infrastructure deficit in an effort to improve the prospects for growth and employment and reduce the negative impact on access to goods and services.

- Improved climate-resilient and socially-inclusive infrastructure and institutions in the transport, water and sanitation, governance, education sectors
- Strengthened capacities at the regional, national and community levels for disaster risk reduction, preparedness and management to natural hazards and the effects of climate change
- Enhanced capacity of communities to sustain their livelihoods
- Improved food security and increased resilience of agricultural productivity

A summary of the main activities involving investments in infrastructure are:

- Transport – primary, secondary and other roads built or upgraded (Km)
- Installed water capacity – including rural areas (cubic metres / day)
- Water supply lines installed or upgraded – including rural areas
- Water – households with access to improved sanitation and water supply, including in rural areas

These projects have enhanced the movement of persons as well as goods and materials, which have benefitted key areas in the respective countries, including agriculture and trade.

A.2 Jamaica's investment experiences:

National Strategic Framework

The Strategic Agricultural Sector Plan designed by the Government, as part of a national 2030 development vision, identifies the following priority areas that build directly from the Agricultural Support Services Project (ASSP) and justifies the continued support of the Bank: (1) developing an agricultural information system to improve decision-making both at the policy level as well as at the farm level, particularly to help small- and medium-scale farmers with relevant production and market information; (2) strengthening farmers' organizations in the context of agricultural value chains and the need to effectively link producers and consumers; (3) ensuring the adoption of food quality standards in terms of animal health, plant health and food safety as a requirement to access markets; and (4) developing financial mechanisms to support business plans and initiatives that will improve productivity and market access conditions for small- and medium-size producers.

The World Bank

The World Bank support, which is aligned with the government's Socio-economic Policy Framework, has three main pillars: (1) accelerating inclusive economic growth; (2) improving human development and opportunity; and (3) crime prevention and reduction. The active sector portfolio is mainly focused on the implementation of the Jamaica Disaster Vulnerability Reduction Project – to enhance Jamaica's resilience to disaster and climate risk – and the Jamaica Foundations for Competitiveness and Growth project – to strengthen the business environment in Jamaica for private-sector investment.

The objective of the Disaster Vulnerability Reduction Project is to enhance Jamaica's resilience to disaster and climate risk. It Includes the retrofitting or construction of key assets given that the infrastructure sector is one of the most severely impacted after a major disaster event. The sub-components and activities to be financed under this component are: (1) retrofitting, construction and/or rehabilitation of national and sub-national priority infrastructure (bridges and urban drainage); and (2) retrofitting, construction and/or rehabilitation of critical public facilities (schools and fire stations).

Inter-American Development Bank (IDB)

This organisation currently supports the development of irrigation system rehabilitation. The IDB is also currently supporting the Agricultural Support Services Project (ASSP II). This project is aimed at strengthening the capacity of the Rural Agricultural Development Authority (RADA) to provide extension services, improving laboratory facilities for quality control (HACCAP and EUROGAP), and funding for the development of high-value products by entrepreneurs.

The National Irrigation Development Program (LO- 1562/OC-JA), together with a CDB programme, seeks to address one of the main constraints of the Jamaican agricultural sector by strengthening management capacities in the National Irrigation Commission and promoting the adoption of sustainable financing mechanisms. This project is still in execution.

The European Union

The European Union supports the Banana and the Sugar Support Programme, which among other things, is looking to pilot diversification activities and alternative income generating activities for smallholder banana producers. The European Union also has a new budget support proposal focused on the forestry sector.

The United States Agency for International Development (USAID)

The USAID strategy for Jamaica is very similar to that of the World Bank, and has five basic objectives: (1) increased trade effectiveness; (2) natural asset management; (3) improved health status; (4) improved education status; and (5) improved security. Three programmes focus on the rural sector: (1) Ridge to Reef, designed to test socially acceptable watershed management practices; (2) Coastal Water Improvement (I and II), which is aimed at improving environment management by local communities in economically important areas; and (3) Environmental Audits for Sustainable Tourism, which promotes improved environmental management practices in tourism and manufacturing industries. USAID, together with the Government of Jamaica and the International Atomic Energy Agency (IAEA) is also supporting the Screwworm eradication project.

A.3 Guyana investment experiences:

(a) Inter-American Development Bank (IDB)

The IDB has supported the country in the modernization of the sector through operations. Two operations in particular helped the Government to implement a Low Carbon Development Strategy, which included support for the agricultural sector: 1558/SF-GY improved the competitiveness

of the agricultural sector through investment in drainage and irrigation systems; 1929/BL-GY focused on non-traditional agricultural exports, including aquaculture, fruits and vegetables, and livestock.

The final evaluation of projects indicates: (1) substantial progress has been made in the design of animal health, as well as plant health and food safety systems (including inspection systems, laboratories and procedures); (2) transfer of technology for the livestock subsector was successful; (3) direct support to farmers through clusters in specific value chains facilitated the implementation of business plans; and (4) improvement of productive infrastructure, such as irrigation and drainage (I&D) systems and laboratories. Nevertheless, the same evaluation report also highlights: (1) the lack of critical data and gaps in information systems, which resulted in weak baseline data and difficulties to measure results; and (2) the need to build on the outcomes, such as the implementation of agricultural health and food safety systems.

The Agricultural Competitiveness Programme, which provides technical assistance, will be offered on a competitive basis to eligible beneficiaries to support the conformation of marketing organizations and to expand the services supplied by them, including the improvement of storage facilities and compliance with labelling and packaging requirements.

The International Fund for Agriculture and Development (IFAD)

Rural Development: Hinterland Environmentally Sustainable Agricultural Development Project
The project supports the resilience of rural families and indigenous people by promoting the links between economic diversification, productive transformation, environmental protection and family nutrition. The project identifies products that enable small farmers' inclusion in markets. This, in turn, increases local demand for services and labour and strengthens the entire rural economy.

A.4 Haiti investment experiences:

(a) Inter-American Development Bank with cofinancing from the IFAD Agricultural and Agroforestry Technological Innovation Programme – PITAG: The general objectives of the programme are to increase agricultural income and food security for smallholder farmers in selected areas of Haiti. The specific objectives are to increase agricultural productivity and improve the use of natural capital through the adoption of sustainable technologies. It is a Technology Transfer Programme to Small Farmers, to support the adoption of innovative, profitable and sustainable agricultural technologies that will improve long-term farm profitability, and generate positive environmental externalities. The technology menu may include: small irrigation equipment, harvest and post-harvest equipment as well as the application of sustainable agricultural practices (agroforestry systems, and sustainable soil and water management techniques).

(b) The International Fund for Agricultural Development (IFAD): Agricultural Development: Small Irrigation and Market Access Development Project in the Nippes and Goavienne Region – co-financing Inter-American Institute for Cooperation on Agriculture. This project supports local organizations working on irrigation schemes and watershed management in the Nippes and Goavienne region of Haiti. The project aims at (1) increasing agricultural production sustainably through efficient water management and the consolidation of both collective and individual irrigated agriculture, 2) improving the value of irrigated agriculture production, and (3) increasing farmers' access to markets and financial services.

(c) World Bank: Haiti Rural Accessibility & Resilience Project

The objectives of the Rural Accessibility and Resilience Project for Haiti are to (1) increase all-weather road access in selected sub-regions, and (2) improve the resilience of selected segments of the road network.

A.5 Grenada investment experiences:

(a) IFAD with co-Financing from the Caribbean Development Bank: Agricultural Development – Climate Smart Agriculture and Rural Enterprise Programme (SAEP).

The objective is to increase the sustainability of small farmers through the adoption of CSA practices: (1) providing extension services to farmers on CSA practices and improving marketing links; (2) matching grant financing schemes for individual farmers and/or groups to promote the adoption of CSA practices and technologies; and (3) rehabilitating rural roads and drainage systems to improve and/or maintain access to markets in extreme weather events, such as heavy rainfall.

(b) World Bank: Third Programmatic Resilience Building Development Policy Credit.

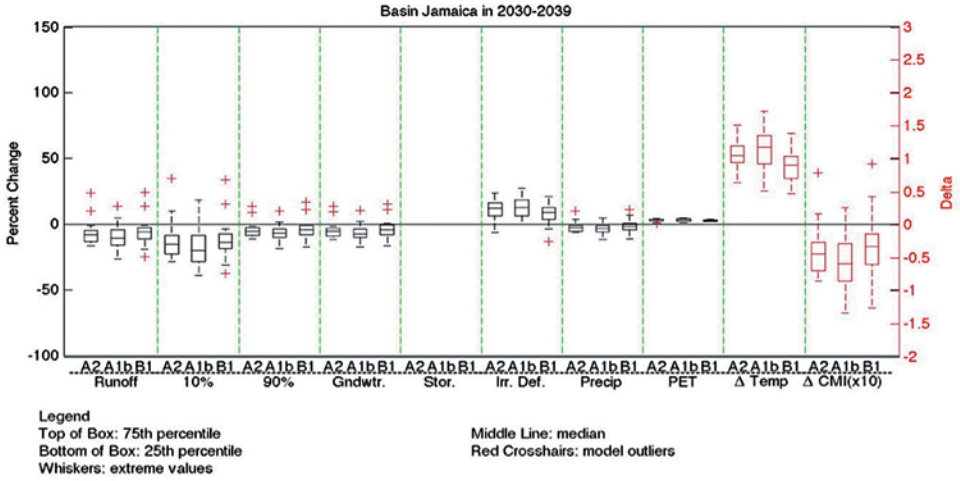
The development objective of the Third Programmatic Resilience-Building Development Policy Credit Project for Grenada was to support Grenada in implementing a programme of policy and institutional reforms to (1) improve the investment climate and competitiveness, (2) improve public resource management, and (3) enhance resilience against natural disasters.

Appendix B

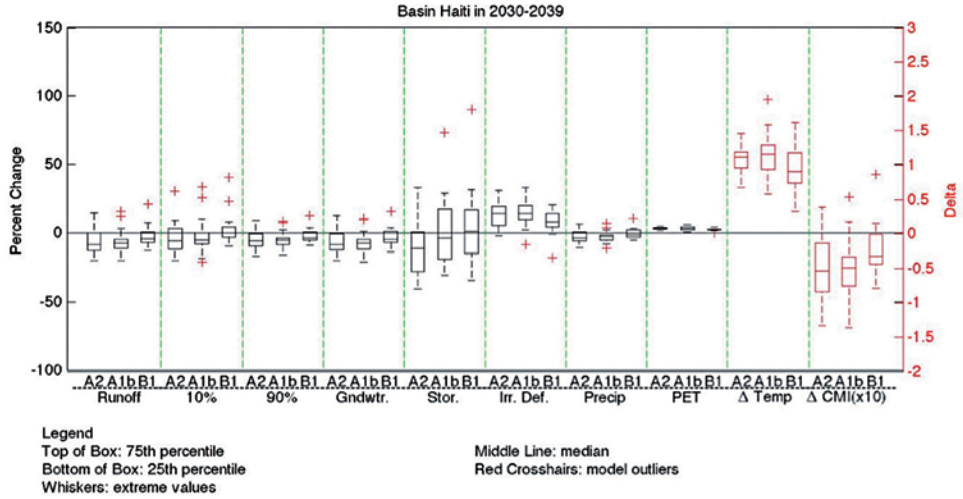
Climate change impacts and indicators for the priority countries

Figure 15. Changes in different climatic and hydrology indicators under different scenarios

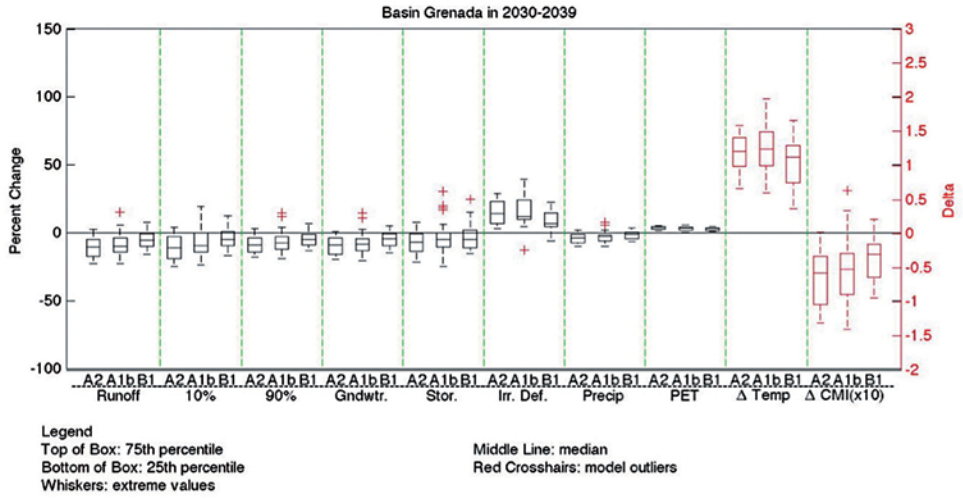
Jamaica



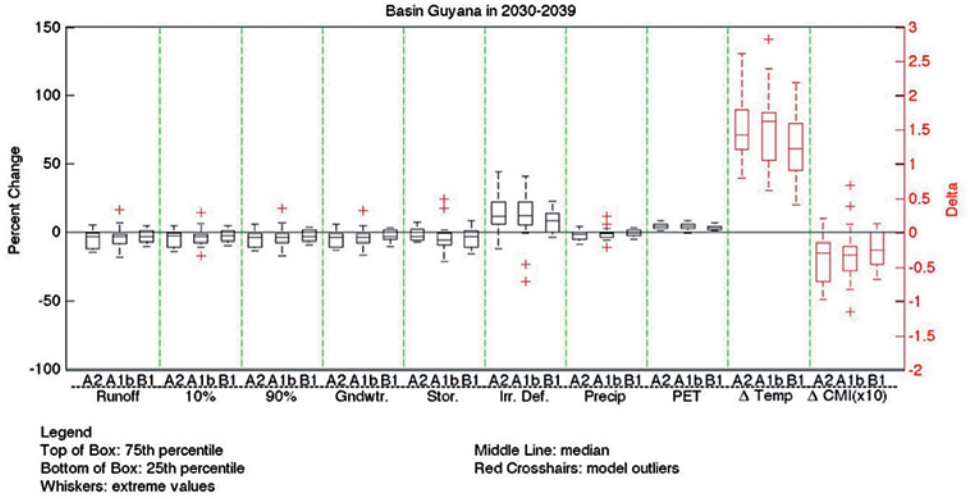
Haiti



Grenada



Guyana



Source: The World Bank Climate Change Knowledge Portal: http://sdwebx.worldbank.org/climateportal

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Annex 3

Gender equality and youth empowerment in the Caribbean region

Acronyms and abbreviations

ACDI/VOCA	Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance
ASPS	Agriculture Sector Policy and Strategy
BARNUFO	Barbados National Union of Fisherfolk Organizations
BMC	Borrowing Member Country
BNTF	Basic Needs Trust Fund
CANROP	Caribbean Network of Rural Women Producers
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CARICOM-CCYD	CARICOM Commission on Youth Development
CARICOM-CYDAP	CARICOM Youth Development Action Plan
CASE	College of Agriculture, Science and Education – Jamaica
CBDRR	Community-Based Disaster Risk Reduction
CBO	Community-Based Organization
CDB	Caribbean Development Bank
CEDAW	Convention on the Elimination of all Forms of Discrimination Against Women
CERMES	Centre for Resource Management and Environmental Studies
CFYR	Community, Family, and Youth Resilience
CGA	Country Gender Assessment
CIDA	Canadian International Development Agency
CNA	Country Needs Assessments
CNFO	Caribbean Network of Fisherfolk Organizations
CPA	Country Poverty Assessment
CRC	Convention on the Rights of the Child
CSP	Country Strategy Paper
CTCS	Caribbean Technological Consultancy Services
CYP	Commonwealth Youth Programme
DFID	Department for International Development
DRR	Disaster Risk Reduction
ECOSOC	United Nations Economic and Social Council
ECPA	Enhanced Country Poverty Assessment
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field Schools
FHH	Female-Headed Household
GALS	Gender Action Learning System
GBV	Gender-Based Violence
GEAP	Gender Equality Action Plan
GEPAP	Gender Equality Policy and Action Plan
GEPOS	Gender Equality Policy and Operational Strategy
HHMs	Household Methodologies
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ICTs	Information and Communication Technologies
IDB	Inter-American Development Bank
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy and Research Institute

IICA	Inter-American Institute for Cooperation on Agriculture
ILO	International Labour Organization
M&E	Monitoring and Evaluation
MAJIC	Marketing and Agriculture for Jamaican Improved Competitiveness Project
MAREP	Market Access and Rural Enterprise Development Project – Grenada
MCYS	Ministry of Culture, Youth and Sport – Guyana
MOYES	Ministry of Youth Empowerment and Sports – Grenada
MSMEs	Micro, Small and Medium Enterprises
NGO	Non-Governmental Organization
OECS	Organization of Eastern Caribbean States
PAYE	Commonwealth Plan of Action for Youth Empowerment
PROPEL	Promotion of Regional Opportunities for Produce through Enterprises and Linkages
Pro-WEAI	Project-Level Women's Empowerment in Agriculture Index
PSDPS	Private Sector Development Policy and Strategy
RADA	Rural Agricultural Development Authority – Jamaica
SDF	Social Development Fund
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SO	Strategic Objective
TA	Technical Assistance
TVET	Technical and Vocational Education and Training
UN	United Nations
UNDP	United Nations Development Programme
UN-ECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women
USAID	United States Agency for International Development
USD	United States Dollars
UWI	University of the West Indies
WEAI	Women's Empowerment in Agriculture Index
WHO	World Health Organization
WPAY	World Programme of Action for Youth (WPAY)
WUSK	World University Service of Canada
YPOS	Youth Policy Operational Strategy

Introduction

Gender equality and youth empowerment are at the core of sustainable development. This paper builds on the findings of FAO's background study, *Investing in Agriculture in the Caribbean: Development in the Era of Climate Change,*[1] which concludes that gender equality and youth integration in agriculture are essential considerations for improving the productivity and competitiveness of the agricultural sector in the Caribbean Development Bank's (CDB) Borrowing Member Countries (BMCs). As per the Terms of Reference agreed between FAO and CDB, this paper[2] was prepared following a series of consultations with CDB staff and other stakeholders in Barbados and Guyana in August 2018; it focuses on the challenges faced by rural men, women and youth (of both sexes), including vulnerable groups such as indigenous peoples.

The critical aspects of accelerating progress on gender equality and youth empowerment in agriculture are divided into five sections. First, **Section 1** analyses key social inequalities in the agriculture sector as regards gender inequalities, challenges of youth participation in agriculture, and vulnerability to climate change. **Section 2** describes the region's institutional and policy framework which aims to address gender inequality and youth disempowerment challenges in agriculture, including the following: Global and regional commitments of BMCs to address these challenges; national commitments (policies/strategies) and their links to existing agriculture policies; and institutional constraints faced in policy and programme implementation for gender equality and youth empowerment. **Section 3** discusses CDB's comparative advantage in promoting gender equality and youth empowerment in agriculture through its mandate, corporate strategy and various policies, particularly with regard to its policies on gender and youth (forthcoming), the private sector, education, and governance. **Section 4** maps some important ongoing initiatives and opportunities for BMCs to enhance partnerships and to deliver more effectively on their gender and youth objectives. Finally, **Section 5** presents a series of proposed options for mainstreaming gender and youth in Agriculture Sector Policy and Strategy (ASPS). It advocates for a holistic and inclusive approach to addressing social inequality and suggests an analytical framework for making value chains inclusive as well as gender- and age-sensitive.

Within these parameters, 16 specific recommendations are made around key intervention areas, and some final suggestions are added for CDB's consideration regarding the implementation of ASPS gender equality and social inclusion objectives. It is expected that the recommendations made under this section will be aligned with and guided by the forthcoming Gender Equality Policy and Operational Strategy (GEPOS) and Youth Policy Operational Strategy (YPOS).

Given the vast heterogeneity[3] of BMCs in terms of gender equality and youth employment, efforts are made to make particular reference to – and bring examples from – the four focus countries identified in the jointly produced Study on the State of Agriculture in the Caribbean: Grenada, Guyana, Jamaica and Haiti.

1 FAO Draft report (2018a).

2 Prepared by Ida Christensen, Programme Adviser (Social), FAO Strategic Programme to help eliminate hunger, food insecurity and malnutrition.

3 While Jamaica is far ahead in terms of achieving gender equality goals, Haiti and Guyana face big challenges: both countries have large populations that depend on agriculture, hence they are potential CDB/ASPS beneficiaries.

1. Social inequalities in the region's agriculture sector

Privilege and deprivation in the Caribbean region are heavily determined by gender, age, socio-economic status, ethnicity, migrant status, place of residence (rural/urban, coastal/hinterland), and disability.[4] As indicted in a recent CDB (2016a) report on *Poverty and Inequality in the Caribbean*, poverty is more widespread in the region's rural areas, especially where infrastructure and services are lacking, the geography is unfavourable, and vulnerability to environmental shocks and seasonal exposure is high.

Poor households depend on occupations in agriculture, with incomes derived mainly from the sale of labour, goods and services in the cash economy. Female-headed households (FHHs) make up nearly 40 percent of all households in some countries, especially in rural areas; they are more likely to be poor, especially where the household head is unmarried. Similarly, larger households are generally more likely to be poor in all BMCs. Poverty is not only exacerbated by disparities between men and women, but it also causes the gender gap to widen. In addition, indigenous peoples – living in Belize, Dominica, Guyana, and Suriname – tend to be among the most disadvantaged and impoverished, even when they do not perceive themselves as poor.

1.1 Key gender inequality issues in agriculture sector participation

In overall global gender statistics, the Caribbean appears to fare well in terms of gender equality, with a high Gender Parity Index (GPI) and good rankings reported in the most recent *Global Gender Gap Report*.[5] However, only four BMCs are included in such statistics: Barbados, Belize, Suriname and Jamaica, of which only Jamaica is among the focus countries of this study. Most importantly, while such data provide a general comparable average on countries' gender-based disparities, they do not give a focused picture of rural realities where agriculture is an important part of people's livelihoods.

The general profile of a Caribbean farmer is that of a male between the ages of 41 and 54 (Graham, 2012). However, women account for 22 percent to 30 percent of registered farmers, ranging from 22 percent in Grenada,[6] 25 percent in Trinidad and Tobago,[7] and 30 percent in Jamaica.[8] Recent statistics on the female share of agriculture labour force participation show that, in Trinidad and Tobago, women officially represent 24.5 percent[9] of the agriculture labour force, in Jamaica 25.4 percent,[10] in Dominica 15 percent,[11] and in Belize only 6 percent.[12] There is ample evidence,

4 UN Youth: *Regional Overview of Latin America and the Caribbean and CDB's regional study on poverty.*

5 World Economic Forum (2017) *Global Gender Gap Report 2017* – Barbados GPI 0.750 (ranked 23rd globally); Jamaica GPI 0.725 (ranked 39th); Belize GPI 0.692 (ranked 79th); Suriname GPI 0.618 (ranked 105th).

6 Fitzroy James, *Grenada National Agricultural Plan* (2015).

7 Interview with Ministry of Agriculture personnel (Trinidad and Tobago, 28 March 2017).

8 Rural Agricultural Development Authority (RADA), Jamaica, Agribusiness Information System. http://www.abisjamaica.com.jm/Admin/reports/farmer_demographic.asp

9 Central Statistical Office (CSO, 2017). http://cso.gov.tt/data/?productID=53-Labour-Force-by-Employment-Status-Industrial-Group-and-Sex-(Females)

10 Data Source: Jamaica Statistical Institute: http://statinja.gov.jm/LabourForce/NewLFS.aspx http://statinja.gov.jm/LabourForce/NewLFS.aspx

11 Rawwida Baksh and Associates, *Country Gender Assessments (CGAs) Synthesis Report* (Barbados, CDB, January 2016). www.caribank.org/wp-content/uploads/2016/05/SynthesisReportCountryGenderAssessment.pdf

12 Rawwida Baksh and Associates, Country Gender Assessments (CGAs) Synthesis Report.

partly gathered during CDB-funded Country Gender Assessments (CPAs), to suggest that women's low participation in agriculture in the Caribbean is linked to gender-based inequalities in accessing land, labour, financial capital, technology and market information, which renders them ill-equipped to face the challenge of transitioning from subsistence to commercial agricultural production.

Access to land and other productive resources

The land tenure systems of many Caribbean countries include informal tenure, both through illegal occupation on state or private land, and through legitimate but unregistered possession of interests in family land. Bynoe *et al.* (2014) find that weak land administration systems lead to insecure tenure rights for both poor men and women, which impacts on their ability to invest in farming and disaster risk and resilience measures. In this context, women are further disadvantaged compared to men in accessing land and other productive assets (CDB, 2016a).[13] Women often lack legal titles to land[14] and ownership of agricultural properties (Peebles, 2012). At the same time, their contributions to family farming are often not recognized largely because the "principal farmers" captured in national statistics are predominantly male (IDB, 2014). According to official statistics in Jamaica, 11 percent of the land under cultivation has been attributed to registered female farmers (who represent 30 percent of farmers), while 89 percent of the land is documented as being under the purview of male farmers.[15] In Trinidad and Tobago, under the government's agricultural land lease programme, only 12 percent of leases have been acquired by women.[16] In Saint Kitts and Nevis, 80 percent of farm holdings are owned or occupied by men, compared to 20 percent by women.[17]

Access to credit

While both male and female small- and medium- entrepreneurs face challenges in accessing credit, women tend to receive fewer business loans than men, and at lower cash value. This is despite their stronger track record of loan repayment. The lack of access to collateral (such as land) plays a key role in this. In *Guyana* for example, the demand for high levels of collateral and interest rates puts formal credit beyond the reach of many women. An estimated 90 percent of the women who are heads of farm households in the country (WUSC, 2017) have no title to their lands; therefore, their ability to access credit from lending institutions is non-existent. This poses obstacles to expanding and improving their farming and leads to low productivity levels. Similarly, in Grenada women who had accessed government-supported technical training to start or expand their rural business enterprise were either denied credit by financial institutions due to a lack of collateral, or had to have their husband's approval to utilise the collateral presented.[18]

Access to information, knowledge and decision-making

Women's more limited access to and control over resources also constrains their participation in training as well as their access to improved technology, market information, and agricultural inputs, such as fertilizers and irrigation to improve production. For example, access to irrigation water often depends on land tenure and property rights, which excludes many female farmers from benefits deriving from improved irrigation. Another common challenge facing rural women, youth and vulnerable groups in particular, is the lack of knowledge and resources required to meet the rapidly

13 CDB (2016a). *The Changing Nature of Poverty and Inequality in the Caribbean: New Issues, New Solutions.*

14 Belize is one example where women hold less titles to land than men. See Tamara Huggins, Rawwida Baksh and Associates, *Country Gender Assessment, Belize* (Barbados, CDB, January 2016).

15 Rural Agricultural Development Authority (RADA) Jamaica, Agribusiness Information System.

16 The application rate for leases by men and women was not available. Interview with the Ministry of Agriculture personnel (Trinidad and Tobago, 27 March 2017).

17 Rawwida Baksh and Associates, *Country Gender Assessments (CGAs) Synthesis Report* (2016).

18 Testimonies from the implementation of the IFAD-funded *Market Access and Rural Enterprise development Project (MAREP).*

evolving phytosanitary and other food safety standards imposed by local, regional and international markets for processed products. Agriculture extension services in most BMCs are not sufficiently sensitized to the importance of gender-equitable service provision, leading – often unintentionally – to the exclusion of women in accessing benefits and participating in decisions. Discussions around gender roles in indigenous communities, such as in Guyana where men are the decision-makers, are considered highly sensitive. There are indications, however, that gender roles are changing in many indigenous farming communities, with men seeking employment outside of agriculture (including through migration), leaving women in charge of farms and the sole providers for their families.

Unemployment

As demonstrated in the background report prepared by FAO for the ASPS,[19] women's disadvantage in employment in BMCs persists. The gender gap in unemployment is especially evident in Continental States, and has been widening: during the period 1991–2015, the gender gap rose from 2.5 to 9 percentage points. Women tend to remain unemployed for longer periods of time and are often overlooked in employment promotion strategies. In addition, gendered occupational segregation and differential wages are persistent in both the formal and the informal sector, with women earning less, as women-owned businesses tend to concentrate on low-productivity sectors. In agriculture, men tend to bear labour intensive duties, whereas women typically work on more time-consuming and tedious duties, such as weeding.

Workloads and time poverty

As indicated in CDB's Country Gender Assessments (CGAs) carried out in 10 BMCs,[20] there is a lack of recognition for unpaid reproductive activities carried out by both women and girls, and men and boys in the family, including as unwaged workers on family farms and in family businesses. Women's unpaid reproductive work in the home (or 'care economy'), and their work in the informal economy and subsistence agriculture are not quantified or taken into account in economic and social policy-making; nor is the resulting time poverty that limits women's ability to effectively pursue opportunities in education and training, and engage in waged work in the labour market.

It is important to note that gender-based constraints are highly context-specific and vary considerably between and within BMCs. Conditions in Haiti must be examined as a special case (see Box 1).

>> Box 1. Rural women in Haiti

A relatively recent gender gap analysis, carried out in Haiti by the Inter-American Development Bank (IDB) concluded that: (1) women are underrepresented in producers' associations and tend to participate, if at all, in informal, unstructured groups; (2) formal information channels do not reach most women unless a special effort is made to reach them specifically; (3) workload distribution in the household disproportionately burdens women (on average 2 hours a day are spent fetching water), thus reducing the amount of time they dedicate to agricultural production; (4) rural women are less educated than men (55 percent of women versus 30 percent of men never attended school); (5) women heads of households have smaller plots and less access to land; (6) female-headed households have lower income levels than male-headed households (USD 176

19 Investing in Agriculture in the Caribbean: Development in the Era of Climate Change (FAO, 2018a).

20 Rawwida Baksh and Associates, CDB Country Gender Assessments: Synthesis Report (January, 2016). The report covers findings from ten BMCs: Anguilla, Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines.

versus USD 347, respectively); and (7) more female-headed households face severe food insecurity than male-headed households (86 percent versus 71 percent, respectively).

According to Haiti's Ministry of Women's Affairs and Women's Rights (MCFDF), rural women in Haiti face six gender-specific constraints:

1. **Access to land.** Although about 60 percent of women work in agriculture, only between 20 and 30 percent of them officially own land. Decisions regarding the use of land are typically made by men. Although, legally, women have equal inheritance rights, these rights are rarely enforced due to a lack of knowledge and capacity to enforce them.
2. **Access to credit**. Very few microcredit institutions work in the agricultural sector, and those operating in rural areas have exceedingly high interest rates.
3. **Transportation of produce from the field to the market**. Roads are in such poor conditions that 50 percent of production, on average, is lost during transportation. Road accidents are common, and trucks are often overloaded and unsafe. Long distances also result in many women arriving late and spending the night near storage facilities, which exposes them to crime and violence.
4. **Storage**. Product storage and conservation is constrained by the lack of electricity, cold chain and safe storage facilities in the proximity of farms. Women are often forced to sell at lower than market prices to dispose of their production before the end of the day.
5. **Access to education and literacy** is uneven in the population. In low-income households, boys are given priority when it comes to education over girls, in part due to the role girls and women play in taking care of the household. Approximately 3 percent more boys than girls are literate.
6. **Violence against women and girls** in all its forms is endemic, regardless of income level and social status.

Gender-based violence

There are many complex gender issues in domestic and family life in the Caribbean, not only in relation to the use of time, accumulation of savings, distribution of food, access to and control over money and other resources, but also in relation to violence perpetrated on those who are most vulnerable. Gender-based violence (GBV) is widely perceived as a persistent and pervasive issue, which threatens resilience and severely damages the human capital base of BMCs. Statistical data indicate a large prevalence of men as perpetrators of GBV and other forms of violence.[21] However, data are limited to cases that are reported to the police. In addition, violence against men is likely to be underreported because of norms related to manhood and masculinity and the lack of supportive institutions, including shelters for male victims.[22]

Women's role in food value chains

Women in the Caribbean are active in all nodes of the value chain. As producers, they engage in subsistence backyard gardening, contributing significantly to securing food for their households and the community. The *Eat What We Grow, Grow What We Eat* campaign in Jamaica has catalysed a

21 For more information, see: http://caribbean.unwomen.org/en/caribbean-gender-portal/caribbean-gbv-law-portal/gbv-country-resources

22 Rawwida Baksh and Associates, CDB Country Gender Assessment: Synthesis Report (January 2016).

renewed pride among rural and urban women who are increasingly engaging in producing food at the household level. Women are also heavily involved in the marketing of agricultural crops (whether produced by them, purchased from others, or produced by their spouses), mostly travelling from rural areas to urban municipal markets. In some BMCs, women engage as "higglers" (intermediaries), purchasing directly from farmers and reselling to various markets, including overseas. Agro-processing activities by rural women are becoming more and more popular, and are being encouraged by the Rural Agricultural Development Authority (RADA) in Jamaica and other developmental partners in the Region. Women agro-processors work on value addition at different levels, from the cottage industry to micro-, small- and medium-size businesses. Women are also employed as casual labourers in factories in rural areas. There is clear evidence from attendance records from agricultural institutions (such as the College of Agriculture, Science and Education – CASE, in Jamaica) that women are venturing more into agriculture, generally considered a male-dominated discipline. Table 1 presents an example of the gender-specific challenges that women in Guyana face in each node of the small ruminant value chain.

Table 1. Gender concerns in the small ruminant value chain in Guyana[23]

Chain Activity	Challenges	Gender Concern
Input Supply	• Cost of inputs • Availability/Cost of Ram	Supplemental feed is necessary in a developed, small ruminant value chain for quality cuts. Access to funds by poor women and youth for feed and other inputs, especially in the initial stage, is a challenge due to lack of collateral for borrowing as well as the high interest rate by one of the main financing agencies. An initial grant, followed by a loan – once the enterprise has developed – is a desired option.
Production (Animal Husbandry)	• Quality of sheep and forage • Praedial Larceny	Personnel have little or no training in gender issues to effectively reach women. Loss of animals impacts poorer women more, as they are less able to recuperate from losses. Larceny is often accompanied by violence, which poses a threat to personal safety.
Transportation	• Poor road networks and distance of farms from market/ consumer	Female producers continue to be price takers in most instances, with little bargaining power to demand a higher price for animals. This affects household income.
Processing	• Lack of abattoir for small ruminants • New quality standards	Many young butchers are not adequately trained to prepare animals for specialised cuts. Also, the advent of improved facilities requires compliance with new standards that are difficult to meet by women, unless they have access to training.
Distribution	• Farmers and butchers lack sufficient knowledge of market requirements to adequately support the value chain	Communication with women and youth is limited if they are not deemed to be "the farmer" by extension officers and other technical personnel.

Women's role in the fisheries sector

Much like the agriculture sector, fisheries is strongly associated with poverty and low-paid hard labour, and is therefore unattractive to youth. Despite the absence of data on youth participation and on women's roles in fish value chains, there is strong evidence that women are active and

23 Draft Food and Agriculture Organization (FAO) design document for the "Technical Assistance Grant to Improve Gender Equality and Empowering Women and Youth in Agri-Food Systems in Jamaica and Guyana" (FAO, 2018b).

recognized in post-harvest, value chain activities. A recent study carried out by the Centre for Resource Management and Environmental Studies (CERMES)[24] indicates that short value chains, where fishers with low capital investment sell directly to institutional buyers (such as spear fisheries, small lobster and conch fisheries) are heavily male dominated, as is the harvest sector in fisheries worldwide. However, as fish value chains become longer and more complex, women's roles become more evident: Women can be seen working in tackle shops in Jamaica, and dispensing diesel fuel in Barbados. In other parts of the world, such as in Mozambique, declining opportunities in farming have often driven women to be more actively involved in fisheries, including in post-harvest activities. These trends and temporary labour shifts in the Caribbean – due to declines in other sectors – are poorly understood, as is the reality of those who are involved in the sector part-time, and for whom fisheries is an informal economic safety net.

There is little documentation on fisheries tenure rights and tenure systems in the region. An exception is the Grenada beach seine fishery, where men appear to determine the rule systems for access rights, while women are engaged in beach seine post-harvest fish selling. Men often make major value chain decisions, such as deciding whether women can obtain the small pelagic fish from beach seines for selling or subsistence (food security and nutrition), or whether that fish is used as bait on tuna longlines (foreign exchange earnings).[25] In terms of organizational leadership, most fisherfolk organizations in the region (with few exceptions, such as Barbados[26]) are male dominated by boat owners and fishermen. In many cases, women in the industry, being mainly fish vendors with whom the harvest sector has ex-vessel price issues, are unwelcome. Yet female scientists, technicians, directors of fisheries and fisheries officers are commonplace and active contributors to the sector.

1.2 Key challenges of youth participation in agriculture

Youth unemployment

As highlighted in a recent CDB report on *Youth Employment for Sustainable Development in the Caribbean*,[27] approximately 60 percent (10.7 million) of the population in the Caribbean is under 30 years old, representing a tremendous potential for social and economic transformation in the region. However, young men and women in the Caribbean face extremely high unemployment and are highly represented among the poor and vulnerable across most parts of the region. Youth unemployment rates for persons in the 15-24[28] age bracket generally range from 18 percent to 47 percent, while average youth unemployment is over threefold the rate of adult unemployment. The cost of unemployment to governments in the region is, on average, 1.5 percent of GDP (CDB, 2015).

Although these figures are not specific to the rural economy, there is evidence that unemployment in rural areas is higher. Rural youth face particular challenges and even higher employment rates for reasons rooted in a range of constraints. Youth generally lack access to land and productive resources and (in many BMCs) they have poor relevant education, technical or entrepreneurial skills to access employment or to start agri-businesses. Their inability to effectively access markets is also the result of a lack of information about prices, low awareness about how markets work, and

24 Gender scoping preliminary report: Caribbean fisheries in the context of the small-scale fisheries guidelines CERMES Gender in Fisheries Team (GIFT), Technical Report No. 86 (2017).

25 James Finlay, Patrick McConney and Hazel Oxenford, "Tenure in the Grenada Beach Seine Fishery." *Land Tenure Journal,* no 1 (2013).

26 In Barbados, two of the three national fisherfolk leaders are women. The current leadership on the Barbados National Union of Fisherfolk Organizations (BARNUFO) board of directors is mainly female.

27 "Youth are the Future: The Imperative of Youth Employment for Sustainable Development in the Caribbean has emanated" (CDB, 2015).

28 The Caribbean has no regional definition for youth, linked to the global United Nations definition. Youth age definitions vary from country to country.

low involvement in policy dialogue. In addition, most BMCs do not have a supportive social and economic infrastructure in place to offer incentives – especially rural finance – leading to demotivation and low self-esteem. The latter is compounded by weak family support structures and gender-based violence. Many young rural men and women work informally, often in unpaid, insecure and sometimes hazardous jobs. In terms of participation in agri-business and value chains, youth of both sexes encounter similar constraints to those discussed in Section 1.1 above, as they lack access to productive resources, finance, assets and collateral.[29]

Indigenous youth, migrant youth and youth living in at-risk communities are among those facing greater barriers to accessing and controlling resources. Persons with disabilities, including youth, are under-represented in both employment and education. The migration of both young men and women[30] (especially in Guyana, Haiti, and Jamaica) translates into fewer agricultural producers and processers in rural areas. Female migration to urban areas where unemployment rates are even higher, such as in Haiti, also contributes to the feminization of poverty (see Box 2). Agriculture in most Caribbean communities continues to be viewed as labour-intensive, unattractive or reminiscent of the region's pre-independence era.

>> Box 2. Rural youth unemployment and migration in Haiti

> According to UNFPA,[31] young people between the ages of 15 and 24 represent 21 percent of the country's total population. Nearly one in five (18.1 percent) young people in that age group have no education, while over a third (37.5 percent) have only completed primary education. In rural areas, although the literacy rates are slightly higher, gender disparities are wider, with 92.2 percent literate boys compared to 71.5 percent literate girls. The poor coverage of the public school system means that private schools are filling the void in elementary education, charging fees that the rural poor can ill afford. The quality of education is also low, with half of public school teachers lacking basic qualifications and almost 80 percent not having received pre-service training. Inactivity and unemployment rates for young people are more than 51 percent of the economically active youth, though these rates are higher for females. In rural areas, inactivity reaches 64 percent of young people, while 17 percent are unemployed. About 68 percent of the active youth population in rural areas work in the agricultural sector. Rural employment opportunities are limited (the most common being in construction, sales and small businesses), pushing rural youth to migrate to urban areas (mainly women) – where the rate of inactivity is even higher (76 percent) – or abroad (mainly men), primarily to the Dominican Republic.

31

Violence and the under-achievement of boys and girls[32]

Although anti-social and risky behaviour, such as delinquency, physical violence, and unsafe sexual practices, are typically the domain of social protection policies, they have important implications for investments in the agri-business sector. It is therefore important to focus attention on the nexus between youth development and gender.

29 CDB Private Sector Development Policy and Strategy (PSDPS) of July 2017.

30 United Nations Population Fund (UNFPA), 2016. La Jeunesse en Chiffre (Youth in Numbers): http://haiti.unfpa.org/fr/publications/la-jeunesse-en-chiffre

31 UNFPA (2016).

32 "Boys" and "girls" refer to children under the age of 16, which is the minimum legal working age according to the International Labour Organization (ILO).

CARICOM estimates that the cost of gang-related crime is between 2.8 percent and 4 percent of GDP in the region due to the cost of policing and corrections, as well as lost income from incarcerated youth and reduced tourism demand. Evidence shows that **boys and young men** are more likely to drop out of school to pursue opportunities to earn "fast cash", including in the illegal drug trade or in hazardous jobs (such as mining in Guyana). They are also more exposed to the risks of drug and alcohol abuse, crime and violence, and death. Young men are both the main perpetrators and victims of crime and violence. **Girls and young women** on the other hand, are the main victims of domestic and sexual violence, and are exposed to high rates of adolescent pregnancy and HIV-Aids infection. Adolescent pregnancy is the main reason for girls' truncated education; although, their school dropout rates are still lower, and their academic performance is superior to those of boys.

Gender segregation in boys' and girls' subject choices – in secondary, technical/vocational, and tertiary education – is manifested in the labour market. Despite their higher educational attainment, women are under-represented in targeted growth areas, better-paid jobs, large-scale enterprises, and leadership and decision-making positions. Further, gender segregation in the subjects chosen by males and females for study and specialization – particularly at the secondary, technical/vocational levels and tertiary levels – reinforce sex-stereotyping and occupational segregation in the labour force, resulting in gender-wage gaps to women's disadvantage. Women are more likely to be employed in lower-level jobs in the tourism and services sector, and to be unemployed and involved in non-remunerated care work in the home.

Child labour in agriculture and the vulnerability of boys

According to ILO data and CDB's recent report on poverty and inequality in the Caribbean,[33] child labour is widespread in Haiti, where 24.4 percent of children between the ages of 5 and 14 engage in economic activities at the expense of their education. The rate is also high in Guyana (16.4 percent) and Belize (5.8 percent), followed by Suriname (4.1 percent), Saint Lucia (3.9 percent), Jamaica (3.3 percent) and Trinidad and Tobago (0.7 percent). Child labour tends to be more prevalent in rural areas (agriculture labour) and among boys in the 5-14[34] age bracket, which is consistent with the higher school dropout rates for boys and their under-performance relative to girls. Poverty is the main driver of child labour. According to the same CDB report, in Belize, the poorest households are close to three times more likely than the average household to take children out of school due to financial difficulties. Agriculture policies and investments in empowering youth must tackle the issue of child labour, which deprives boys of the potential for future decent and gainful employment and perpetuates the inter-generational cycle of rural poverty.

1.3 Vulnerability to climate change

Small Island Developing States (SIDS) and low-lying states in the Caribbean are characterised by near or below sea level coastal topography, unprotected infrastructure, and undiversified and highly susceptible economic industries, all of which increase the likelihood of major impacts from extreme weather events related to climate change. These vulnerabilities compound many of the development challenges that have beset these countries for decades, including poverty and gender inequality, to the disadvantage of women.

As in other parts of the world, climate change and natural disasters in the Caribbean have differential impacts on women and men – including youth – which affect their ability to manage and mitigate

33 CDB, *The Changing Nature of Poverty and Inequality in the Caribbean: New Issues, New Solutions* (2016).

34 Data on adolescents (aged 15 to 17) in hazardous work are only available for Jamaica: 1.8 percent according to the ILO World Report on Child Labour (2015).

risks as well as to recover from such occurrences. Women's fewer productive resources, including land, labour, water, and technology, render them less able to address the increasingly stressed environment, caused by rapid climate variability. In cases of loss of arable land, for example, men are more likely to be able to acquire resources, utilise land that was under the purview of their wives, or relocate in search of alternative income sources. Women, due to their reproductive roles and caring commitments, are often not afforded the same opportunities and are therefore more exposed to falling into a downward spiral of poverty and vulnerability. This can exacerbate existing gender inequalities, particularly in impoverished agricultural communities where food insecurity is already severe.[35]

In Dominica and Grenada, national climate change and disaster mitigation policies do not give adequate consideration to social diversity or gender, even though evidence confirms that women, children and the elderly are the most vulnerable when natural disasters occur.[36] The particular needs of female farmers in hazard-prone farming communities are not adequately taken into consideration in risk knowledge, early warning and climate information systems, leading to poor decision-making and adaptation measures for resilience. The limited integration of gender analysis in these countries' climate and disaster risk resilience practices in agriculture has undermined food security in the wake of natural hazards and the increasing impacts of climate change. This is particularly alarming in some BMCs (including the four focus countries), considering the importance of the agriculture sector to food and nutrition security, poverty reduction and livelihood opportunities, especially for vulnerable small farmers, livestock holders and agro-processors.

2. Institutional/policy framework and ongoing strategic initiatives

2.1 Global and regional commitments to gender equality and youth empowerment

At the global level, all BMCs are signatories to the Convention on the Elimination of all forms of Discrimination Against Women[37] (CEDAW, 1979); Beijing Platform for Action, Commonwealth Plan of Action for Gender Equality (2005–2015); the Sustainable Development Goals (2015); and the Strategic Plan (2011–2016) of the Inter-American Commission of Women. Borrowing Member Countries are also signatories of the Convention on the Rights of the Child (CRC) and three major global policy frameworks for action on youth, led by the United Nations: the World Programme of Action for Youth (WPAY); the UN Youth Strategy; and the Global Initiative on Decent Jobs for Youth.

35 FAO, *The future of food and agriculture – Trends and challenges* (Rome, 2017).

36 CDB Synthesis of Country Gender Assessments.

37 Article 14 of CEDAW makes specific provisions for the rights of rural women to a range of agricultural support. In March 2018, in its sixty-second session, the Commission on the Status of Women (ECOSOC) addressed the specific challenges and opportunities in achieving gender equality and the empowerment of **rural women and girls**, urging countries to: (a) strengthen normative, legal and policy frameworks; (b) implement economic and social policies for the empowerment of all rural women and girls; and (c) strengthen the collective voice, leadership and decision-making of all rural women and girls.

At the regional level, under the *Caribbean Joint Statement on Gender Equality and the Post 2015 and SIDS Agenda,*[38] SIDS committed to supporting poverty reduction through macroeconomic reforms which reduce the burden on women and other vulnerable groups, including adolescent mothers, female heads of households, persons with disabilities, the elderly, indigenous peoples, domestic workers, and rural women in particular. Further commitments specific to the agriculture sector made under this joint statement included: (1) addressing inequitable access to land, water, technology and markets, which inhibits the involvement of women and youth in agriculture; (2) creating access to financing and investment opportunities to develop women's and girls' entrepreneurship; and (3) improving women's resilience to economic challenges, natural hazards and climate change.

On youth, the region has seen intensified efforts to focus attention on education, job opportunities, safety and security, health, and well-being. Currently, the *CARICOM Youth Development Action Plan (CYDAP) 2012–2017*[39] is the principal regional strategy that provides guidelines for interventions in this area. The Plan highlights the need for the reconceptualization of youth as assets for development, not liabilities.

Globalization and technological advances present real and practical opportunities through youth involvement, as well as wealth creation for the region. The objectives of this Action Plan were to create decent jobs, enhance social protection, strengthen skills for employment and entrepreneurship, and promote active participation in the labour market. The Caribbean Community (CARICOM) has been collaborating with its member states, youth ambassadors as well as local, regional and international parties to formulate and implement programmes and projects to meet youth advancement goals.

The Caribbean Agricultural Research and Development Institute (CARDI), a major player in the region's agriculture development, has recently reoriented its focus to include supporting women and youth, with enhanced training and capacity building programmes, and entrepreneurship opportunities along value chains.

2.2 National gender equality commitments

National Gender Policies are in place in Belize, the British Virgin Islands, the Cayman Islands, Dominica, Grenada, and Jamaica. At the time of drafting this paper, Guyana and Trinidad and Tobago were in the process of developing their Gender Policies. It is worth mentioning that specific reference to youth is made in most of these policies. In a number of BMCs, ***national social protection schemes*** are in place to protect vulnerable women in particular. Barbados, Jamaica and Trinidad and Tobago have well-established social safety-net programmes for women and children of low-income households. Barbados, Jamaica, and Trinidad and Tobago have similar safety nets for poor women and children. In 2014, Grenada adopted a gender-sensitive Social Protection Policy Framework, while Saint Kitts and Nevis adopted the pro-gender Social Development Assistance Act. In Saint Lucia, gender initiatives are included in the National Social Protection Policy and Strategic Action Plan, and budget and fiscal analysis for social protection. Guyana has several social programmes and plans within the different sectors, such as water, health, education, housing, providing labour opportunities, and human services. The national gender policies, commitments and actions in the focus countries are summarized below.

38 Generated (with the support of UN Women) by high-level government officials and civil society representatives from CARICOM countries, with inputs from regional inter-governmental bodies and international partners in the Caribbean.

39 CARICOM Youth Development Action Plan (CYDAP) 2012–2017 (Paramaribo, Suriname, DRAFT 11-13, June 2012).

National policy for gender equality in Jamaica

The Vision 2030 Jamaica National Development Plan incorporates a commitment to eliminate all forms of gender discrimination, by identifying and addressing constraints to women's empowerment in order to build a society where gender balance, equality and equity are valued. The objectives of this policy are: (1) to reduce gender discrimination and promote gender equality and social justice; (2) to build and strengthen institutional capacities to mainstream gender in different segments of the cultural, social, economic, and political set-up; and (3) to ensure sustainable behaviour change, and to improve the efficiency and the capacity of the public sector to develop, implement and monitor gender plans, projects, programmes and policies.

Jamaica's Vision 2030 National Development Plan includes cross-cutting policy for gender equality which is aligned with several other national policy and legislative measures. The policy baseline is built on the principles of social justice, human rights, equality and equity, good governance, accountability and transparency, and participation. The strategies and tools that the policy comprises to ensure gender equality include gender mainstreaming, gender-sensitive budgeting, gender-aware information, gender analysis, cross-sectoral collaboration, gender training, gender-aware monitoring and evaluation, and gender equality legislation.

Guyana's national commitments to gender equality

The Government of Guyana has demonstrated support for gender equality over the years. The year 1981 saw the establishment of the Women's Affairs Bureau (WAB), with responsibility for coordinating national efforts to remove discrimination against women in Guyana. These efforts included the implementation of a system of gender focal points across the country's ministries. In addition, a National Commission on Women – with Cabinet-appointed representatives across political parties, non-governmental organizations (NGOs), and community-based organizations (CBOs) – has served as the advisory council for the WAB since 1996, leading the work on developing the Guyana and Caribbean *Plans of Action for Beijing*, and the *National Plan of Action for Women 2000–2004*.[40] Furthermore, the Guyana Women's Leadership Institute (GWLI) was established in 1997, with the aim of empowering women in terms of both personal and public leadership. A Men's Affairs Bureau lies in the Ministry of Social Protection with the mandate to enable men and boys to achieve their potential in development, including through addressing the underachievement of boys.[41]

In 2001, Guyana amended its Constitution (Article 212) to include the establishment of five commissions, one of which was the Women and Gender Equality Commission, with the mandate to promote national recognition and acceptance that women's rights are human rights, and to promote respect for gender equality and the protection, development and attainment of gender equality.[42] Guyana has also ratified international conventions, protocols and treaties. For example, in 2012 Guyana acceded to the ILO No. 189 Convention on Domestic Workers; in 2013 the ILO Decent Work Country Programme was introduced, and regulations to give it legal status in domestic laws were developed.

Dominica and Grenada Gender Equality Policy and Action Plan (GEPAP)

Although the first national gender policy was adopted in Dominica in 2006, gender mainstreaming structures and mechanisms still need to be strengthened to promote gender-responsive planning

40 Women and Gender Equality Commission, Five Year Strategic Plan 2013–2018. www.wgec.gy/sites/default/files/WGEC%20_FIVE%20YEAR%20STRATEGIC%20PLAN.pdf

41 A.M. Viteri, *Assessment of Past Initiatives.* Consultancy to Develop a Costed Strategic Plan for Women's Development in Guyana (May 2017).

42 Government of the Republic of Guyana (June 2014). *National Review of the Implementation of the Beijing Declaration and Platform for Action (1995) and the Outcomes of the Twenty-third Special Session on the General Assembly (2000).* https://sta.uwi.edu/igds/documents/Guyana_review_Beijing_20.pdf

and budgeting and to effectively mainstream gender in all development policy-making and service delivery at the national and sectoral levels. Similarly, Grenada's *Gender Equality Policy and Action Plan (GEPAP)*, which was adopted in 2014, seeks to mainstream gender in national development. However, much needs to be done, such as the appointment of Gender Focal Points (GFPs) in Ministries and Statutory Bodies, to ensure the effective coordination and implementation of *GEPAP*.[43]

The Division of Gender and Family Affairs in Grenada's Ministry of Social Development and Housing has the institutional responsibility to promote gender equality. The country has progressed in its gender equality advancements, increasing the participation of women in public decision-making and addressing all forms of violence against women.

Haiti gender equality action plan

The Ministry for Women's Affairs in Haiti has developed a gender action plan to mainstream gender equality in all government activities and approaches, including in the agricultural sector. The plan involves:

- increasing the institutional capacity for the Ministry;
- building synergies with the central government and with other ministries for the implementation of the President's roadmap for gender equality;
- addressing the feminization of poverty in the agricultural sector;
- improving the conditions of transportation for women engaged in marketing activities;
- providing training to women in trades traditionally dominated by men; and
- providing support to women victims of violence.

The gender equality action plan is included in the *Strategic Development Plan for Haiti as an Emerging Country in 2030*, under the Ministry of Planning and External Cooperation.

2.3 National commitments to empower youth

Under the *World Programme of Action for Youth (WPAY)*, adopted by the United Nations General Assembly in 1995, BMCs have committed to improving the situation of young people around fifteen youth priority areas. These include: (1) education; (2) employment; (3) hunger and poverty; (4) health; (5) environment; (6) substance abuse; (7) juvenile justice; (8) leisure-time activities; (9) girls and young women; (10) the full and effective participation of youth in the life of society and in decision-making; (11) globalization; (12) information and communication technologies (ICTs); (13) HIV and AIDS; (14) armed conflict; and (15) intergenerational issues.

In the context of Agenda 2030, BMCs are also expected – guided by the UN Youth Strategy – to step up efforts to address the needs, build the agency, and advance the rights of young people in all their diversity, and to ensure their engagement and participation in the implementation, review and follow-up of the Sustainable Development Goals (SDGs). In response, many BMCs have developed national youth policies, some with specific linkages to agriculture. The national youth policies, commitments and actions in the four focus countries – Grenada, Guyana, Haiti and Jamaica – are summarized below.

43 Rawwida Baksh and Associates, *Country Gender Assessments (CGAs) Synthesis Report*.

Grenada

Grenada is a signatory to the CARICOM Youth Development Action Plan 2012–2017. However, the government has not yet adopted a national youth policy. The Division of Youth Empowerment within the Ministry of Youth Empowerment and Sports (MoYES) is responsible for youth issues. The Imani Programme is a youth-oriented programme administered by the MoYES; it is the central youth employment initiative in Grenada that pays a stipend to participants, ranging from USD 260 to USD 370, depending on qualifications. Nevertheless, the programme faces a number of problems owing to its political affiliations.

Guyana

As a Commonwealth of Nations member, Guyana has signed the Commonwealth Plan of Action for Youth Empowerment (PAYE) 2006–2015. The institutional body that is responsible for youth issues is the Ministry of Culture, Youth and Sport (MCYS) – under the Ministry of Education – which aims to ensure equal access to culture and sporting experiences for youth, as well as provide access to knowledge that will in turn allow for better national development. The National Youth Council is expected to be launched with the establishment of the national youth policy.

Haiti

Two governmental bodies are responsible for youth issues in Haiti: The Ministry of Education and the Ministry of Youth, Sport and Civic Action. Haiti's 2010–2015 Operational Plan prepared by the Ministry of Education was aimed at addressing education system issues, such as accessibility. The aims changed, however, following the 2010 earthquake, and the focus shifted to providing solutions for the destruction of academic infrastructure and displaced youth without access to the education system. The responsibilities of the Ministry of Youth, Sport and Civic Action concerning youth are to develop, coordinate and monitor sports including training of sport administrators and to enhance youth leadership.

Jamaica

Jamaica, also a signatory of PAYE 2006–2015, has developed a National Youth Policy, revised and approved in 2017. Targeted interventions for youth are in the following main areas: living environments, education and training, employment and entrepreneurship, health, participation and empowerment, and care and protection. The National Centre for Youth Development, in the Ministry of Youth and Culture, is responsible for coordinating and implementing programmes, services and activities to enhance youth development. The National Youth Council of Jamaica is an umbrella organization, which includes local youth clubs that assist the implementation and evaluation of youth policy interventions. The National Youth Council of Jamaica is a member of the Commonwealth Youth Council and the Youth Ambassadors of the CARICOM Youth programme.

2.4 Institutional challenges in policy/programme implementation

Weak evidence base for policy-making as regards youth, gender equality and women's empowerment

As mentioned in Section 1.2, many BMCs face challenges when gathering and analysing sex-disaggregated and gender-sensitive data in agriculture. As a result, statistical flaws and the underestimation of women's contribution to agriculture are frequent. Recent studies on small producers in the Caribbean show similar findings as in other parts of the world: Although women are actively engaged in agriculture – as small producers (crops and small livestock), contributors of labour on family farms, post-harvest agro-processors and sellers in local and regional markets – their

contributions remain invisible in the statistics (Rajack-Talley, 2015). National statistics generally only capture information on female farmers when they are officially registered as owners or co-owners of farms, while the "principal farmers" are predominantly male (IDB, 2014).

The underestimation of women's participation in agriculture undermines the level of acknowledgement of women's contribution to food production, household diets, animal and crop production systems, fisheries, incomes, and national wealth. It also contributes to building a poor evidence base for gender equitable policy-making. Rajack-Talley (2015) argues that this results in poor national planning for the agricultural sector as well as inequitable and inefficient targeting of project interventions, particularly when policies are based on the assumption that channelling inputs, technology, training and information to the "principal farmer" (usually a man) automatically translates into benefits for a female spouse or youth in the same farm household. Failing to target women in investment projects and programmes in the sector also leads to obstacles in achieving project outcomes and lasting impact.

This weak level of disaggregation of data also applies to the definition of "youth," (often referred to as a homogeneous group). Although statistical information on youth is generally disaggregated in five-year age groups (15-19, 20-24, 25-29, 30-34), the definition of youth varies across BMCs, making comparative analysis in the region difficult. Sex-disaggregation of youth data is also weak, posing constraints in understanding gender-differentiated aspects of youth's access to resources, opportunities, the development of skills and exposure to risks.

As confirmed in CDB's *Effectiveness Review* (2017a), data collection systems regarding income poverty and inequality at the country and regional levels are weak. Country Poverty Assessments (CPAs) – carried out by BMCs with financial and technical support from CDB – are major knowledge products and have contributed significantly to building an evidence base for national policy planning and programming across the region. However, CPAs have been sporadic and infrequent (ten-year intervals) with no mid-term reviews. As a result, it is difficult to capture the multidimensional and dynamic nature of poverty, as well as identify factors to support poverty reduction and social inclusion. The issue is further compounded by inadequate project monitoring and evaluation (M&E) systems, which are ineffectual at tracking and reporting on progress against targets to reduce poverty, vulnerability and social marginalization.

Coordination and capacity weaknesses

Many countries in the Caribbean lack sufficient public sector expertise in gender mainstreaming at policy, programme, and project levels. This is reflected in the lack of gender-related policy recommendations and the absence of analysis and comprehensive, gender-responsive strategies in some national agriculture policies. For example, weaknesses in mainstreaming gender considerations were found following an analysis of Trinidad and Tobago's draft Agricultural Strategic Plan (2016–2020), Jamaica's agriculture sector plan,[44] and Belize's National Food and Agriculture Policy (2002–2020).[45] In addition, while Jamaica's National Fisheries Policy addresses gender equality, and Belize's Revised National Gender Policy addresses fisheries, institutionally, there is little evidence of interaction between public sector departments of gender affairs and fisheries authorities, fisherfolk organizations, or environment and natural resource management actors.

According to the Economic Commission for Latin America and the Caribbean (2017), most institutional mechanisms for governing gender equality objectives in BMCs are low in the national

44 Agriculture Task Force. *Sector Plan for Agriculture, Vision 2030 Jamaica – National Development Plan* (Jamaica, 2009). www.donwheelerconsulting.net/wp-content/uploads/2013/07/Vision-Jamaica-2030-Final-Draft-Agriculture-Sector-Plan.pdf

45 Ministry of Agriculture and Fisheries and the Government of Belize. *The National Food and Agriculture Policy, 2002–2020* (Belize, 2003). www.agriculture.gov.bz/wp-content/uploads/2017/05/Policy-Document1.pdf

political hierarchy (Haiti and Trinidad and Tobago being exceptions), while none include institutional strengthening among their objectives. As a result, they continue at low- (Belize, Jamaica, Suriname) or mid-levels (British Virgin Islands) of the hierarchy. The institutionalisation of gender specialists and gender focal points in ministries of agriculture and associated agencies (such as funding and marketing agencies) is not yet common practice across the Caribbean. This may be, in part, due to limited government capacity to provide sufficient expertise to cover all service-delivery activities, particularly in countries where public service human resources are stretched thin. For example, with the exception of Jamaica and Belize, national fisheries sector policies and related legislation give no specific guidance on women's issues or gender roles. Lack of sufficient awareness around gender-specific roles and constraints in agriculture, together with institutional weaknesses, often lead to the exclusion of women from accessing new technologies, information and training related to agriculture and natural resource management.

Gender-sensitive budgeting

Gender-sensitive budgeting – as a tool to analyse budget allocations, public spending and taxation from a gender perspective – is not yet widely practiced in BMCs, and certainly not in the agriculture sector. Aside from Jamaica, some initiatives have taken place in Barbados to train government officials on gender-responsive analysis of ministry budgets. In 2014, Trinidad and Tobago developed guidelines on implementing gender-sensitive budgeting across ministries, led by the Ministry of Gender, Youth and Child Development. At the regional level, in 2015, the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), the United Nations Children's Fund (UNICEF), and the Organization of Eastern Caribbean States (OECS) Commission organized a workshop aimed at improving the knowledge and increasing awareness among relevant policymakers to ensure the budgeting of child and gender-related policies and programmes in social protection. More recently, efforts have also been made in Saint Vincent and the Grenadines to incorporate gender in national budgets.

3. CDB's comparative advantage in gender equality and youth empowerment in agriculture

3.1 Commitments under the CDB Strategic Plan 2015–2019

With a mission to "systematically reduce poverty in its BMCs through social and economic development," CDB recognizes gender equality as a driver of growth and a critical contributor to economic efficiency and effectiveness. The Caribbean Development Bank also recognizes the importance of investing in youth to achieve sustained economic growth, social inclusion and poverty reduction, as reflected in its target of assisting BMCs to reduce inequality, and halving the incidence of extreme poverty by 2025.

In the area of gender equality, CDB has made considerable progress in including gender analysis in the design of Country Strategy Papers (CSPs) and projects, as well as in strengthening the evidence

base on gender inequality in the region through Country Gender Assessments,[46] re-designed Country Poverty Assessments (CPAs), stronger gender policy dialogue, and explicit gender monitoring in BMCs. Under its current Strategic Plan, CDB aims to double the share of loans or projects with a "gender-specific" or "gender mainstreamed" rating (see definitions under Section 3.6), from 20 percent at baseline in 2013 to 40 percent by 2019.[47]

In the area of youth empowerment, CDB's key strategies have included:

- investments in projects in education and training – such as technical and vocational education and training (TVET), creative industries and innovation, decent work and livelihoods inclusive of community-level models for entrepreneurship and citizen security; and
- engagement with youth across BMCs on social and economic development issues and challenges that are impacting their lives *via* the Youth 'Vybzing' Outreach Programme,[48] which is showcased at CDB's annual meeting.

In the area of social well-being, the importance of tackling the issue of gender-based violence in all sectors supported by CDB, including agriculture, was underlined in a recent statement by CDB's Vice-President. She stated that the phenomenon "*affects gross domestic product through loss in human capital and productivity as well as medical and judicial costs….(it) not only affects the victims, but it also carries a lasting impact for families, including children who are deprived of their rights to lead a violence-free life.*"[49]

3.2 CDB Gender Equality Policy and Operational Strategy (GEPOS)

Since 2008, the Gender Equality Policy and Operational Strategy (GEPOS)[50] has been guiding CDB's corporate actions to mainstream gender into its lending and other operations. The goal of the policy was for CDB "to be a leading catalyst, promoting gender equality in the region by working with borrowing members and other development partners in a responsive and collaborative manner to analyze the economic and social causes of gender inequality in order to reduce poverty and vulnerability and to assist all women and men to achieve their full potential (CDB, 2008)." The objecitves of the Policy were structured around three main areas: (a) to reduce economic and social vulnerability by empowering women and men to build and protect their assets, including livelihoods and savings, as a means of building sustainable, equitable communities; (b) to strengthen the capacity of all women and men, girls and boys, to acquire education, skills, and self-confidence in order to access economic opportunities, increase livelihood options and improve their quality of life in the changing global economy; and (c) to support governance processes in which women and men have equal access to power and authority in society, and effectively influence policies and advocate for their rights.

In this policy, CDB made a number of core commitments, starting from acknowledging that every policy, loan and project affects men and women differently, to addressing gender dimensions (economic and social) in all CDB policies, loans and projects, as well as in the Bank's internal operations. In particular, the Bank committed to: (1) implementing specific measures to eliminate

46 Carried out in 10 BMCs: Anguilla, Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines.

47 CDB Strategic Plan 2015–2019 (December 2014).

48 CDB rolled out the Vybzing Programme in 2002. The programme emphasises youth empowerment and participation in the development process.

49 Welcome speech by Monica La Bennett, Vice-President (Operations), CDB for International Women's Day 2018 (8 March 2018).

50 CDB Gender Equality Policy and Operational Strategy (GEPOS), November 2008: www.caribank.org/wp-content/uploads/2016/03/GEPOS_2008_FINAL.pdf . At the time of drafting this paper, the GEPOS 2008 was being evaluated and the process of preparing a revised GEPOS was underway, to be finalised by the end of 2018.

gender inequalities; (2) supporting stakeholders and development agencies – through partnerships between women and men – in promoting gender equality as a means of reducing poverty and achieving sustainable development; (3) advocating for gender equality in the BMCs; and (4) implementing a corporate strategy to sensitize CDB staff to gender equality dimensions in all aspects of their work.

3.3 CDB Youth Policy and Operational Strategy (YPOS)

The first CDB Youth Policy and Operational Strategy (YPOS) – currently under preparation – will guide the Bank's support to youth development in BMCs. The YPOS is expected to: (1) provide the opportunity to build on project successes and lessons learned; (2) form the basis for a better strategic context for youth engagement and a synergistic approach to youth development across the Bank – including with the ASPS; (3) ensure that youth issues – including those of youth in greatest need – are promoted as development priorities; and (4) create a framework for monitoring and evaluating the results of the Bank's youth development work. Areas of special attention include support to BMCs to enhance and share knowledge in support of evidence-based decision-making for youth development, and improved capacity to contribute to gender-responsive and socially inclusive youth development.

3.4 Gender and youth considerations in other CDB policies

The Private Sector Development Policy and Strategy (PSDPS) of July 2017 (CDB, 2017b) aims to guide the transformation of the private sector to become a major driver of economic and social well-being in the region. To achieve this goal, one of the policy objectives is to assist BMCs and private enterprises to develop policies and approaches that facilitate the integration of gender and diversity issues in private sector enterprise development. The Policy includes gender equality as a cross-cutting priority and commits to providing specifically targeted technical assistance (TA) to help BMCs promote youth development and support gender-equitable entrepreneurship and business ownership. It also adopts a gender perspective in the development of infrastructure and access to services.

The Education and Training Policy and Strategy (CDB, 2017c) aims to guide CDB's interventions in education and training as a means for BMCs to achieve their social and economic development goals. Objective 2 of the policy is aimed at enhancing the efficiency, relevance and effectiveness of education and training so as to create systems which are responsive to national, regional and global labour markets. It is aimed at supporting BMCs with curriculum/programme development for both formal and non-formal education systems, including for out-of-school youth and those seeking continuing education opportunities. The Caribbean Development Bank places a strong focus on:

- ► enhancing teacher effectiveness, both in core curricula areas and in areas of critical skill shortages;
- ► modernizing the competences of teachers; including in the use of ICTs; and
- ► promoting workforce experience for young learners through collaboration with local and regional stakeholder institutions and industry.

Although the Education and Training Policy and Strategy integrates issues of social inclusion and gender equality and is highly relevant for the ASPS, it lacks explicit reference to agriculture in school curricula or as a topic of formal or informal training.

The Governance and Institutional Development Policy and Operational Strategy (CDB, 2017d) notes the growing trend of young men and women in the region alienating themselves from the education system and engaging in deviant antisocial behaviour. Policy responses to this trend fall under the area of "enhancing citizen security" through supporting youth resilience and social crime

prevention, as well as targeted initiatives to reduce gender-based violence. In addition, support is provided to improve data collection on gender-based violence.

The Disaster Management Strategy and Operational Guidelines (CDB, 2009) do not address issues of social inclusion, gender equality or youth empowerment, while the **Technical Assistance Policy and Operational Strategy** of 2012 includes gender equality as a cross-cutting theme, alongside capacity development and good governance. As explained in Section 3.6 below, technical assistance projects now undergo a corporate assessment to ensure quality-at-entry with respect to aspects of gender, governance, violence and crime prevention, climate change, and poverty reduction.[51]

Appendix 1 presents a matrix that compares CDB's various policy responses to the gender constraints that are most relevant to ASPS.

3.5 CDB's support to BMCs' capacities for gender and youth statistics

The Caribbean Development Bank does not have a corporate targeting policy or strategy. The targeting of its pro-poor operations are guided by the findings of Country Poverty Assessments (CPA), which feed into the Bank's four-year Country Strategies, at the country level, and the Environment and Social Impact Assessments, at project level. One crucial area of CDB's governance programming is statistical development, aimed at improving the availability of timely and reliable country monetary and multidimensional poverty data to support development initiatives at the national and regional levels. The CDB's Enhanced Country Poverty Assessments (ECPA) – launched in 2018 – include the measurement of various dimensions of well-being to create the evidence base needed for measuring results and reporting on the achievement of the SDGs.

Country Needs Assessments (CNAs) – implemented in 12 BMCs – were designed to identify the level of local institutional and technical capacity, and the extent of financial and technical support required from CDB to assist in the successful implementation of the ECPA. These efforts also focused on improving country-level statistical capacities (with sex-disaggregated and gender-sensitive data), and gender- sensitive inclusive budgeting processes, which are expected to strengthen both the evidence base for gender equality decision-making and accountability.[52] In the region's SIDS, CDB also supports the process of identifying gender-responsive SDG priorities, targets and indicators which are closely linked to the Samoa pathway.[53]

3.6 CDB's corporate mechanisms for gender mainstreaming and social safeguards

During the early identification and preparation stages, all CDB projects go through a process of environment and social performance screening against eight performance requirements,[54] and are assigned a category (A , B, or C) according to the assessed level of risk – category A being the highest risk. Virtually all projects guided by the ASPS would fall under either category A or B (though most under category B), both of which require specific Social and Gender Impact Assessments with associated risk management plans. For gender specifically, the implementation of GEPOS 2008 has led to important improvements in CDB's capacities to carry out gender analysis, though the

51 Technical Assistance Policy and Operational Strategy (2012).

52 Governance and Institutional Development Policy and Operational Strategy (2017d).

53 Small Island Developing States Accelerated Modalities of Action (Samoa Pathway). https://sustainabledevelopment.un.org/sids2014/samoapathway

54 (1) pollution prevention, control and management; (2) toxic and hazardous substances control and management; (3) natural habitats and biodiversity conservation; (4) cultural property and heritage; (5) directly affected communities; (6) vulnerable groups; (7) land acquisition and involuntary resettlement; and (8) community worker health and safety.

provision of guidelines, resourcing, and an accountability framework. The revised Gender Marker[55] (effective from 20 March 2017), used as a quality-at-entry tool, helps guide staff to mainstream gender throughout the project cycle. The Gender Marker also serves as a key accountability mechanism and allows for the tracking of the funds allocated to gender-mainstreamed projects, which is in line with the Results and Monitoring Framework (RMF), Level 3 of CDB's Strategic Plan, and SDF 9 – of CDB's Unified Special Development Fund (**SDF**). Both large capital and technical assistance projects (USD 1 million and over), and small technical assistance projects (under USD 1 million) are assessed and scored against a 4-point scale. Projects with a score of 3 or 4 are considered:

- "Gender Specific" if they have the advancement of gender equality as their principal purpose, with specific interventions to directly achieve this purpose; and
- "Gender Mainstreamed" if they have the potential to contribute significantly to gender equality, with gender considerations taken fully into account across all components.

Approved projects with a gender specific or gender mainstreamed rating grew from 20 percent of all projects in 2013, to 76 percent in 2017, surpassing the 55 percent target considerably (CDB, 2017a), thus reflecting an impressive increase in mainstreaming gender in CDB's project designs. However, as highlighted in the *CDB Development Effectiveness Review 2017* (CDB, 2017a), there is much room for improvement in gender reporting during implementation, which has not yet commenced. Hence, while CDB has an adequate system in place to check quality-at-entry, there are weaknesses in tracking performance and capturing gender results during project implementation.

4. Ongoing initiatives and opportunities to enhance partnerships

4.1 CDB's work and instruments to deliver gender equality and youth empowerment actions

The Basic Needs Trust Fund (BNTF) targets its sub-projects towards poor and vulnerable (including rural) communities through a socially inclusive development process that empowers the poor and supports institutional development. Community participation is essential to every sub-project, as this facilitates local ownership of BNTF investments and enhances social capital within each community.[56] The BNTF incorporates gender analysis across the project cycle, in institutional assessments, in the management of outcomes, and in advocacy strategies among beneficiary communities and stakeholders. This analysis guides the targeting of gender-specific and gender-integrated interventions aimed at addressing gender disparities.[57] In addition, the BNTF enables CDB to directly address

55 Improved from the 2013/14-version in terms of reduced complexity, clarity of coding criteria and alignment with the project cycle management.

56 Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and the Turks and Caicos Islands.

57 See: www.caribank.org/BNTFOpsManual/BNTFOperationsManual.html

development challenges and governance issues at the community level, including in remote, indigenous and highly vulnerable communities. This makes the BNTF an excellent instrument to support targeted initiatives to engage women and youth in agriculture activities under the ASPS.

The Community Disaster Risk Reduction (CDRR) Fund finances projects that reduce the risks of natural disasters and support climate change adaptation efforts in communities across the Caribbean. Eligible organizations include non-governmental organizations (NGOs) and community-based organizations (CBOs), which are registered and operating in BMCs; regional and national research institutions; and government agencies. A requirement for approving project proposals is the identification of the priorities and needs of both men and women, as well as gender equitable participation in project development, planning and implementation.[58] The design of the ***Jeffrey Town Integrated Disaster Risk Reduction Project in Jamaica*** **(CDB, 2016b)** is an excellent example for CDB to build on, in terms of gender-sensitive and pro-poor targeting. It includes a thorough baseline study with strong social and gender analysis elements as well as indicators for measuring gender-differentiated behaviour-change outcomes. Clear targets are also set for women's participation in rural infrastructure rehabilitation works; their application of newly introduced, drought-tolerant agricultural practices; and their engagement in managing and maintaining improved communal water supplies.[59]

The Caribbean Technological Consultancy Services (CTCS), through its interventions in the Micro, Small and Medium Enterprises (MSME) sector, is also a highly suitable vehicle for addressing youth-specific needs and bridging gender gaps in employment, promoting youth and women's entrepreneurship and contributing to financial inclusion in BMCs. The CTCS supports requests for technical assistance that: (a) enhance equal access to opportunities and resources for women, men, and youth; (b) increase women's involvement in MSMEs; and (c) enable more women to participate in the productive sectors in BMCs. Caribbean Technological Consultancy Services also target at-risk youth, providing skills training and apprenticeship programmes, including in agriculture (crop production), beekeeping, clothing construction, furniture-making, customer service, sales and marketing, and information technology. The CTCS Operations Manual (CDB, 2017e) provides gender-sensitive indicators suitable for gathering information on measurable change as a result of short-term, technical assistance activities. However, while sex-disaggregated data are included in this guidance material, no suggestion is made to disaggregate data by age or residence in order to distinguish between beneficiary age groups (young/non-youth), or rural/urban activities.

The CDB and Youth 'VYBZING' Outreach Programme promotes the engagement of young men and women (aged 16 to 29) in a variety of development areas through facilitated dialogue around issues such as citizen security, innovation and entrepreneurship, sustainable agriculture and food security, and ICTs. The programme also supports the creation of youth-targeted multimedia messages, addressing youth-specific development issues, including "high-risk" topics, through ICTs and multimedia.[60] This outreach programme has good potential to raise political awareness and advocate for solutions to overcome both economic and socio-cultural obstacles to youth participation in the agriculture sector. One experience to build on is the Guyana Youth Forum,[61] held in May 2014 under the theme "Youth Voices for Climate Change," which brought together youth, government and CDB stakeholders and resulted in a Youth Declaration on Climate Change. The Declaration was officially presented at the Forty-Fourth Annual Meeting of the Board of Governors of CDB.

58 See: www.caribank.org/programmes/cdrr1/who-we-are

59 Jeffrey Town Integrated Disaster Risk Reduction Project, Jamaica: Social and gender consultant report for baseline study, Eleanor Wint (26 August 2016).

60 See: www.caribank.org/programmes/vybzing

61 See: www.caribank.org/programmes/vybzing/vybzing-2014

The CDB-supported ***Youth and Community Transformation Project***[62] is a good example of linking benefits in agriculture with efforts to address youth vulnerability issues. It represents a comprehensive social intervention that is designed to reduce the vulnerability of youth at risk of crime, through gang membership resistance education, self-esteem enhancement, conflict resolution, anger management, independent living skills, and youth employability.[63] Skills training and apprenticeship programmes were the main modality aimed at providing young people with the relevant skills required for the job market, thereby increasing the possibility of employment and entrepreneurship.

A concrete example of CDB's enhanced efforts to integrate gender dimensions into value chain strategies is found in the ***Technical Assistance (TA) project to conduct value chain analysis on selected agricultural commodities in Suriname***.[64] The Strategy and Investment Plan aims to be socially inclusive and gender-responsive, proposing interventions to reduce gender-related constraints and empower disadvantaged stakeholders along the value chains. A gender analysis will elicit information about access and control of production, outputs and income, examining men's and women's participation at every stage of the agricultural value chain, and considering gender-differential constraints and benefits. In recognition of the need to support relevant policy development, one of the components of the project is to produce a policy brief on gender equality and value chain development in Suriname. This type of study can be further supported in other BMCs under CDB's technical assistance funding.

4.2 Key partner initiatives in the region

The Food and Agriculture Organization of the United Nations (FAO) and the International Fund for Agricultural Development (IFAD)

FAO, financially supported by IFAD, is implementing a three-year project[65] to ***strengthen rural employment for young men and women in six countries***[66] ***in the Caribbean***. The project aims are as follows:

1. Facilitate a common sub-regional policy and programme development process with governments, stakeholders and partners, including rural youth and farmer organizations for rural youth employment.
2. Develop and promote an evidence-based knowledge platform to support information sharing, training and capacity building on rural youth employment creation and entrepreneurship.
3. Build capacity to increase access to employment and facilitate the adoption of innovations and best practices for enterprise development among young women and men.

Some successes from implementing this initiative in Guyana, Haiti and Grenada are presented in Appendix 2, drawing from a recent collection of good practices.[67]

62 See: http://humandevelopment.gov.bz/wordpress/wp-content/uploads/2016/01/TOR-Communications-Consultant-final.pdf

63 645 females and 605 males benefitted from various training programmes in 2017.

64 Technical Assistance (TA) Agricultural Sector Value Chain Analysis – Suriname (Paper BD 162/17), co-financed by the Islamic Development Bank.

65 "Strengthening decent rural employment opportunities for young women and men in the Caribbean" is a three-year joint grant project between IFAD, FAO and PROCASUR. For more information, see www.procasur.org/

66 Belize, Cuba, the Dominican Republic, Grenada, Guyana, and Haiti.

67 The Good Practices and Local Champions Catalogue: A Caribbean example "Strengthening Decent Rural Employment Opportunities for Young Women and Men in the Caribbean" (PROCASUR, FAO and IFAD, 2017).

The background work to this project includes a mapping, review and analysis of the framework for decent work opportunities and private sector investment, specifically in rural youth mentorship and internship in the agricultural sector. The study considers a wide range of factors associated with challenges faced by the rural youth, including: (1) governance policies, strategies and programmes to support the establishment of national and regional coordinating mechanisms for rural youth entrepreneurship and employment, and climate-smart response in the agricultural sector; and (2) institutional and investment incentives as they relate to rural youth agro-enterprises, mentorships and internships schemes.

FAO is also embarking on a technical assistance project on ***Improving Gender Equality and Empowering Women and Youth in Agrifood Systems*** in Guyana and Jamaica, with the aim of possibly expanding the assistance to other countries in the future. The project is aimed at supporting women and youth in accessing productive resources and services, skills and technological know-how, thereby empowering them to overcome the constraints which they face as agricultural producers and processors. The project targets the agrifood value chains of root crops and small ruminants to increase efficiency, address gender inequality, and reach local markets while promoting the consumption of healthy agricultural products. The project is not only in line with FAO's current activities involving the implementation of gender-sensitive value chains for women's economic empowerment, but it is also in line with CARICOM's Agribusiness Strategy, which prioritizes value chain development.

UNDP

The UNDP project,[68] ***Strengthening Disaster Management Capacity of Women in Guyana and Dominica***, can generate valuable information and lessons that CDB can use to make its climate adaptation efforts more gender-sensitive. This may be particularly useful given the gender inclusion weaknesses identified in CDB's Disaster Management Strategy and Operational Guidelines. The project aims to reduce climate vulnerabilities by targeting three broad drivers, namely: (1) gaps in gender analysis, hazard and risk data; (2) limited integration of climate change and disaster risk planning and practices in the agriculture sector; and (3) limited access to appropriate, sustainable finance for vulnerable small farmers and women's groups.

UN Women

Through the ***Women Farmers, Sustainable Development and Decent Work Programme***,[69] UN Women is working closely with FAO, UNDP, UNICEF and the Pan American Health Organization (PAHO) to reduce socio-economic disparities in vulnerable communities in the region. The programme is aimed at low-income women farmers, including young women, and it addresses bottlenecks to gender-responsive public policies which are designed to protect agricultural markets for local producers; tackle productivity and competitiveness challenges of women-owned SMEs; and strengthen linkages between local produce, consumption, food security and healthy nutrition – all areas of direct relevance to the ASPS.

A recently approved joint UN project[70] – also led by UN Women – is aimed at enhancing gender equality and women's empowerment in the agriculture sector in 14 Caribbean countries[71] as a means

68 UNDP – *Strengthening Disaster Management Capacity of Women in the Cooperative Republic of Guyana and Commonwealth of Dominica* (start date 1 June 2018 – end date 30 June 2021).

69 *Global to Local – Realising Gender Equality within the SDGs – Women Farmers, Sustainable Development and Decent Work,* UN-Women (2015–2018).

70 *Building Effective Resilience for Human Security in the Caribbean Countries: The Imperative of Gender Equality and Women Empowerment in a Strengthened Agriculture Sector* (UN-WOMEN, UNDP, FAO, UNFPA, WHO, September 2018).

71 All CARICOM members, with the exception of Haiti.

to build resilience for human security. The three-year project will aim to build the evidence around the economic value-added arguments of gender mainstreaming in order to influence national policy-making in agriculture. An additional focus of the project includes raising gender awareness among country-level partners, together with the development and dissemination of relevant guidelines for gender mainstreaming. The project is highly relevant for CDB's work on resilience and agriculture, as its results are likely to enhance BMCs' capacities to implement gender-sensitive agricultural interventions.

The Caribbean Development Bank is already collaborating with UN Women on ***reducing gender-based violence (GBV)***. Specifically, the collaboration is aimed at enhancing technical capacity at the regional level to collect systematic, harmonised and comparable data on GBV, which could be used to inform evidence-based decision-making.[72] More collaboration with UN Women in this area, especially focusing on rural communities, can bring added benefits to the results of agriculture programmes funded under the ASPS.

The United States Agency for International Development (USAID)

USAID funds several social programmes targeting youth in the region, including on disaster risk management, food security, HIV/AIDS prevention, crime reduction, literacy, and youth entrepreneurship. The USAID-funded **Marketing and Agriculture for Jamaican Improved Competitiveness** (MAJIC) project,[73] is pioneering an expanded utilization of the Farmer Field School (FFS) extension and farmer training approach, in collaboration with the Rural Agricultural Development Authority (RADA). The approach has proven highly successful and appropriate for youth, especially due to enhanced practical learning and retention of training content as well as the sharing of experiences among group members. USAID also supports the ***Community, Family, and Youth Resilience (CFYR)*** Programme – in Guyana, Saint Kitts and Nevis, and Saint Lucia – which addresses the needs of "at-risk youth" with community-based interventions, including rural employment and agro-enterprise development. Currently, the CFYR is undertaking juvenile justice reform activities in Barbados, Guyana, Suriname, and Trinidad and Tobago.

World University Service of Canada (WUSK)

The Canadian-funded programme ***"Promotion of Regional Opportunities for Produce through Enterprises and Linkages" (PROPEL)***[74] works in Barbados, Dominica, Guyana, Jamaica, and Saint Lucia to promote the participation of women and youth in value chains. The major areas of gender analysis and programming in 2017–2018 included: (1) identifying the needs of targeted women producers, agri-processors, and entrepreneurs; (2) increasing equitable opportunities for female beneficiaries in business development training, credit forums and governance capacity building initiatives; (3) collaborating with stakeholders to increase the capacity of market players in identifying the needs of women and better integrating women into the high-value market economies; (4) improving knowledge sharing and relationship building through various communication means and multistakeholder forums; and (5) promoting female agrifood sector champions as spokespeople for women in agriculture.

ACDI/VOCA

ACDI/VOCA works on disaster risk reduction in Haiti under the ***Expanded Food Security Program (EFSP)***, promoting soil conservation, rehabilitation of irrigation systems, watershed management, nursery development, and other agriculture and natural resource activities to mitigate deforestation.

72 CDB Annual Report (2007).

73 See: http://cocoajamaica.com/about-us?id=107

74 Funded under WUSC (World University Service of Canada).

In Jamaica, ACDI/VOCA funds a project on ***Rural Economy and Ecosystems Adapting to Climate Change***, which includes specific climate change action training for Jamaican youth, aged 14 to 28.

4H-Clubs is a global network of youth organizations, active in most Caribbean countries, with a mission to mobilize, educate and train youth in leadership skills and vocations. The Jamaica 4-H Clubs is the leading youth training organization in the country, with over 105 000 members providing training opportunities to youth under the age of 25, through schools, churches, communities, and special youth facilities. By 2020, the Jamaica 4-H Clubs aspires to become the leading youth organization in the Caribbean.

4.3 Strategic partnerships to enhance gender equality and youth empowerment in agriculture

Strategic partnerships are key to ensuring that gender equality and the empowerment of women and youth are addressed systematically in CDB-supported agriculture projects at the country level. There are ample opportunities for CDB to further strengthen its work with relevant international and regional development agencies, including with the United Nations Development Programme (UNDP), UN Women, IFAD, FAO, USAID, CARDI and others. In addition, CDB could further enhance its support to international or national NGOs (such as ACDI/VOCA, WUSC or 4H-Clubs), with dedicated mandates to improve education, employment, and empowerment opportunities for youth and women. Their role in enhancing CDB's impact on the ground is of key importance, as NGOs collaborate directly with women's and men's organizations, non-governmental organizations, community-based organizations, professional associations, faith-based organizations and other civil society organizations present in the region's rural areas.

In addition, CDB's projects in agriculture, guided by ASPS, could affect a cross-section of disciplines and national ministries in BMCs, including the Ministries of Agriculture, Education, Public Infrastructure, Communities, Social Cohesion, Tourism, Investment and Business, Indigenous People's Affairs, Social Protection, and Health. Depending on the BMC, other country-level stakeholders working on women and youth in the agriculture sector, within and beyond the ministries, may include:

- national gender institutions, such as women's gender bureaus or equal opportunity offices;
- national statistics offices;
- national and regional universities, such as the University of the West Indies (UWI);
- gender focal points (or youth focal points where applicable) from various government agencies;
- major women's organizations/networks, such as the Association of Women in Agriculture in Barbados and the Caribbean Network of Rural Women Producers (CANROP);
- agricultural/farmers'/fishers' organizations;
- financial institutions, particularly those focusing specifically on agriculture, rural development, or development in general;
- private sector processors, input or service providers;
- trade unions; and
- professional associations active in construction/engineering (where projects involve infrastructure).

5. Proposed options for mainstreaming gender and youth in ASPS

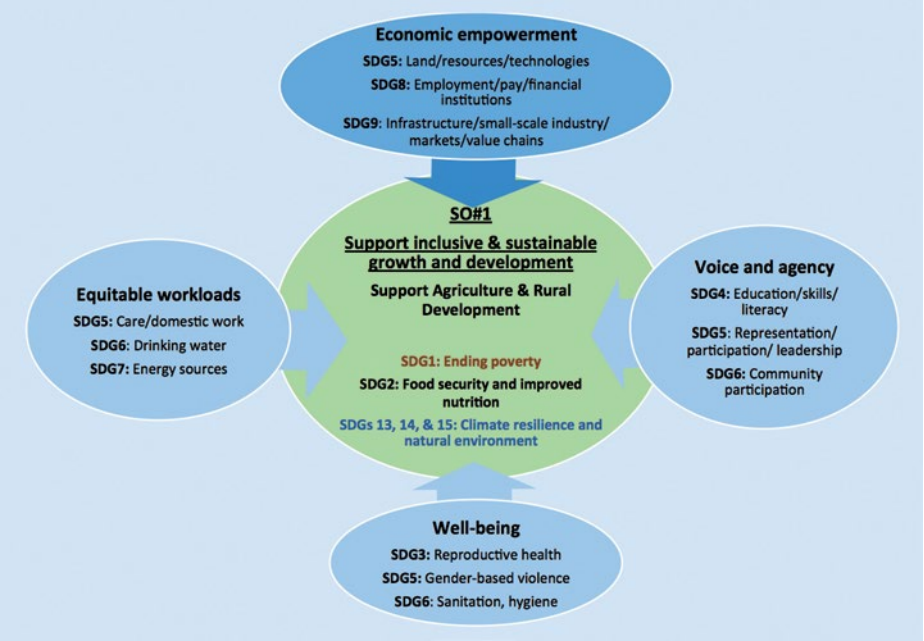
Two new CDB policies and operational strategies are currently under development which will provide a framework for the strategic and effective integration of gender and youth perspectives in all Bank-financed activities: The Gender Equality Policy and Operational Strategy (GEPOS), and the Youth Policy and Operational Strategy (YPOS). It is understood that the mainstreaming of gender equality and youth empowerment proposed under the ASPS will be aligned with and guided by these policies.

5.1 Adopting a holistic and inclusive approach to addressing social inequality

By addressing social inequality through the adoption of a holistic and inclusive approach, CDB will be well positioned to achieve a key goal of its Agriculture Sector Policy and Strategy: a *transformed and competitive inclusive and climate-resilient agricultural sector, which is a driver of economic development, poverty reduction and job creation*. A holistic and inclusive approach will also contribute to achieving strategic obective 1 (SO#1): *inclusive and sustainable agricultural growth and development in the BMCs*. Specifically, CDB's overall assistance to agriculture would need to adopt **a holistic approach** that addresses *economic empowerment* alongside three other domains of social inequality that primarily affect women, youth (men and women), and other vulnreable groups living in the region's rural communities: (1) *voice and agency, (2) equitable workloads,* and (3) *well-being* (see Figure 1).

In addition, when addressing gender issues, CDB would need to adopt **a gender-inclusive approach** where men and boys are active partners of change alongside women. Projects exclusively focused on benefiting women may fail to consider appropriate roles and benefits for men, and may not be accepted by either men or women in the household or entire communities. Therefore, to ensure long-term sustainable benefits, women require increased bargaining power within the household where men and women live together.

Figure 1. Gender equality and youth empowerment in the SDGs: How they relate to CDB's Strategic Objective (1) and the ASPS.



The areas of proposed interventions to be supported by CDB under each of the four domains of social inequality are categorized into three levels, according to their potential to have an impact on:

(level 1) **reaching** women and youth and promoting **gender and age equity**;

(level 2) **benefiting** women and youth and promoting **gender and age equality**; and

(level 3) **empowering** women and youth and promoting **gender and age transformative change**.[75]

Level 3-type interventions go beyond treating the symptoms of socio-economic exclusion of youth and gender inequalities; they address the underlying causes that are often rooted in cultural norms, behaviours, power relations and social institutions. Therefore, the more support that can be channelled into **level 3**-type interventions, the more sustainable the benefits will be. These three levels could serve as a guide within which CDB could frame the 16 recommendations presented in Section 5.4 below.

Economic Empowerment

Productive resources and financial services

- **(level 1)** Provide access to inputs for existing enterprises.
- **(level 2)** Support a range of financial services and products which meet the needs of women and youth needs.

75 This concept is adapted from IFPRI's work in agricultural development that distinguishes between approaches to **reach** women as participants, those that **benefit** women, and, finally, those that actually **empower** them in the long term. These terms refer not only to project objectives, but also to the set of activities a project undertakes (strategies) and the ways it measures impact (indicators). Simply reaching women does not ensure that they will benefit from a project, and even if women benefit (e.g. from increased income or better nutrition), that does not ensure that they will be empowered (e.g. in control over that income or making choices of foods for their households). See: www.ifpri.org/blog/reach-benefit-or-empower-clarifying-gender-strategies-development-projects

- **(level 3)** Strengthen women's ownership of land, which also enables them to access a wider range of financial services.

Skills, knowledge and technology

- **(level 1)** Support technical training for existing crops/ livestock/fish activities and access to information.
- **(level 2)** Provide training, coaching and mentoring services for women and youth to develop the technical skills needed for new agro-enterprises, entrepreneurship and negotiating skills.
- **(level 3)** Promote women and youth as role models for change to break through the barriers that keep them behind, while also improving the image of the agriculture sector as an attractive and viable employment option.

Markets and employment opportunities

- **(level 1)** Generate decent employment opportunities for women in traditional roles, promoting access to infrastructure, storage, and transport facilities.
- **(level 2)** Create decent employment opportunities for women and youth in new roles, adding value to traditional and new products, establishing linkages and contracts with buyers, and developing new markets.
- **(level 3)** Establish new spaces and support the economic engagement of women and youth through community sensitization.

Voice and Agency

Representation

- **(level 1)** Strengthen producer organizations and cooperatives, and promote the involvement of women and youth.
- **(level 2)** Ensure legal recognition for producer organizations, train women to hold leadership positions in producer organizations, and strengthen the voice of women and youth in improved governance structures for value chains.
- **(level 3)** Encourage women to lead in non-traditional executive positions and to gain a national voice through networking forums.

Decision-making

- **(level 1)** Strengthen access to benefits for women and youth.
- **(level 2)** Strengthen women's voice in the household, including decisions regarding the use of benefits.
- **(level 3)** Adopt a household perspective[76] for empowerment by engaging household members (male and female) in analysing and addressing gender and age inequalities in roles, responsibilities, decision-making and the sharing of benefits; catalyse behaviour-change through household methodologies (see *Appendix 3* for details), and engage champions of change at the community level while sensitising communities on the benefits of women's and youth economic empowerment.

Equitable Workloads

- **(level 1)** Introduce equipment to improve existing tasks, flexible work hours and part-time work.

76 Details on household methodologies are included in Appendix 3: www.ifad.org/web/knowledge/publication/asset/40253899

- **(level 2)** Provide equipment to improve the productivity and quality of production, and to reduce domestic workloads.
- **(level 3)** Redistribute household tasks (e.g. through household methodologies – HMMs) among household members or provide technologies which give women and girls independence from traditional gender roles.

Well-being

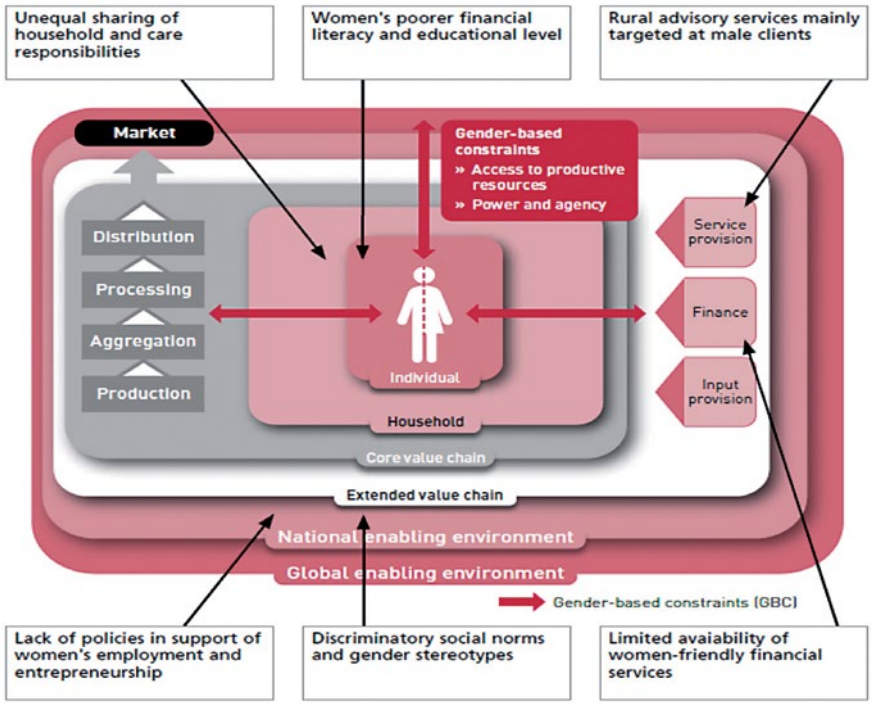
- **(level 1)** Nutrition training.
- **(level 2)** Reproductive health training; awareness raising about GBV.
- **(level 3)** Develop girls'/women's and boys'/men's skills in conflict prevention and reducing violence (including GBV); strengthen women's self-confidence and independence through adult literacy classes, negotiation skills and discussing social issues in the community; engage men in household nutrition and health issues through HHMs (see Appendix 3); and, for agro-employees, provide decent employment conditions, sick pay and child care solutions.

5.2 Towards inclusive, gender- and age-sensitive value chains

To meet the ASPS goal, the selection of value chains under the national development strategies must be based on their potential to reduce poverty and vulnerability, promote gender equality and advance youth empowerment. The following criteria facilitate the selection of value chains: opportunity for the inclusion of disadvantaged groups (the poor, women, FHHs, youth, indigenous people, and people with disabilities); decent working conditions; and potential impacts on surrounding communities. This would include supporting the BMCs' capacities to carry out an analysis of gender-based and youth-specific constraints to participating in horticulture, livestock and fisheries value chains, examining the actors operating at each node of the chain; the activities they perform; their level of engagement; and the differential challenges faced in performing their tasks. A disaggregation of this information by gender and age can help address barriers or bottlenecks caused by gender-based discrimination, and build an enabling environment for value chain development. A framework and related guidelines to support such analysis were recently developed by FAO (see Figure 2).

Appendix 4 includes tables with suggested criteria and guiding questions for socially inclusive and gender-sensitive value chain development.

Figure 2. Examples of gender-based constraints at different levels of the value chains.[77]



Female-dominated value chains, including hot peppers, poultry, goats, and milk, represent a strategic entry point for investment, from a gender equality point of view. Strengthening the position of women within sectors where they are already active can offer multiple opportunities for social and economic empowerment with limited risk of community opposition. For example, according to a recent FAO study[78] on gender equality in agrifood systems, women in Jamaica and Guyana participate actively in small ruminant production and in small-scale milk production and processing into cheese and soap. Support in these value chains could focus on enhancing women's involvement at the production level through improved animal husbandry techniques, facilitated access to funding to expand herds and possibly to diversify into breeds of goats for milking. In addition, training in milk preservation and the manufacturing and marketing of cheese and other by-products could increase economic gains considerably.

Overcoming gender constraints in agrifood systems also requires the active engagement of men and boys in these female-dominated value chains, as they are crucial agents of change in the transformation of unequal gender relations, both within the household and along the value chain.

Male-dominated value chains, such as fish or cattle for beef, may seem more challenging when working on gender equality. However, much can be gained from enhancing the visibility and the efficiency of the work that women already perform in these chains, including as family labourers, or from exploring new ways for women to turn their family responsibilities into business opportunities – such as through small-scale processing of food products and livestock management. Working in male-dominated chains also provides interesting opportunities to achieve gender-transformative results, as women move to higher earning potentials, often challenging long-established, inequitable

77 Adapted from Developing Gender-Sensitive Value Chains – Guidelines for Practitioners (FAO, 2018c). www.fao.org/3/i9212en/I9212EN.pdf

78 FAO (2018b).

divisions of labour. Both female-dominated and male-dominated value chain options could be pursued and supported by CDB.

5.3 Sixteen specific recommendations

The sixteen specific recommendations presented below are aligned with the gender equality considerations reflected under CDB's new policies on private sector engagement, education and training, and governance, as well as the ongoing thinking around the development of the new GEPOS and YPOS.

The recommendations on youth employment are in line with the priority objectives and action areas identified in CDB's recent flagship publication on youth employment in the Caribbean.[79] However, they cannot be aligned to the Bank's existing policies on disaster risk management and technical assistance (both under review), as they do not address issues of social inclusion, gender equality or youth empowerment. It is hoped however, that the recommendations provided here will help inform the gender and youth focus of the new policies that will replace them.

Stimulate the participation of agricultural entrepreneurs in markets and value chains

1. **Strengthen existing (and/or promote new) legal and regulatory instruments** at the regional and country level, which govern rights to productive resources for youth and women, including the right and access to land titles and capital.

2. **Support the development of targeted financing mechanisms, products and delivery modalities** that can reduce the specific entry barriers of youth and women into agribusinesses. With the increasing professionalization and modernization of farming practices and fisheries fleets, access to affordable investment capital will be of vital importance to the success of value chain development. For example, an important area of intervention would be to facilitate a revision of CDB's conditionalities for loan approvals, such as requirements for collateral or a man's signature. **Crop insurance** modalities would also need to be developed to protect against risks, especially unpredictable weather events.

   Appendix 4 presents a list of options for innovative financial services and products for rural women and female-owned, small agrifood enterprises (Table D), together with some good practices and references for further information (Table E).

3. **Assist with the development and strengthening of producer organizations and clusters**:

   - **Promoting governance structures that improve equitable access to decision-making**, such as: (1) introducing realistic quotas for the participation of women and youth at all organizational levels; (2) supporting and protecting specific products or by-products made by women (also through branding); (3) championing women's leadership; and (4) adapting meeting times, locations and agendas to meet the needs and interests of women and youth. The Caribbean Network of Fisherfolk Organisations (CNFFO) is a good example of the involvement of women in community organizations and positions of leadership.

   - **Providing targeted support to women's producer organizations and youth groups (including indigenous farmer cooperatives)**, such as members of the regional Caribbean

79 Youth are the Future: The Imperative of Youth Employment for Sustainable Development in the Caribbean has emanated" (CDB, 2015).

Network of Rural Women Producers (CANROP).[80] Through membership in such organizations, women can benefit from group credit opportunities, input provision, veterinary services, post-harvest infrastructure, such as cold rooms and packing houses, and transport services.

4. **Support the development of new time- and labour-saving technologies and approaches.** In this respect, ensure that the national agrifood value chain plans for fruit, vegetables, spices, herbs, livestock or fish pay due consideration to investing in new technologies and approaches which not only reduce costs, time and labour, but also promote safety. For gender equality in value chains, investments in such technologies should be directed to supporting women's *productive* tasks as well as their *household-related* tasks, which – as previously explained – have an indirect impact on their ability to engage in gainful activity. Given women's roles as caregivers and food managers at the household level, investing in labour- and time-saving technologies is particularly important to avoid negative effects on the nutrition of family members, especially children. Participatory needs assessments can help define the inputs, practices and technologies that meet the needs of women and youth. These might include:

   - appropriate public and private (farm-level) infrastructure (see Recommendations 11 and 12 below);
   - inputs, such as climate-smart seeds;
   - mobile technology and apps for service provision (veterinary services, weather forecasting, insurance);
   - affordable commercial solutions, such as smaller packages of inputs, to overcome limited access to rural finance; and
   - traceability schemes for livestock to improve food quality/certification and curb praedial larceny, which often poses personal safety risks.

5. **Enhance the active participation of women and youth as input providers and marketers in horticulture, livestock, and fish value chains.** In this respect, explore options for training women and youth as agro-dealers, which can have multiple economic and socio-economic benefits, including: (1) the creation of new employment and entrepreneurship opportunities outside the production node; (2) increased access to quality inputs and advice closer to home, thus lessening women's mobility and time constraints; (3) strengthened links between farmers, input suppliers, output markets, and traders; and (4) improved access to larger markets can allow private businesses to reach out to rural areas and increase brand loyalty.

6. **Support efforts to mainstream gender-responsiveness in national agriculture sector strategies for disaster risk reduction** to strengthen vulnerable women's abilities to better prepare for, and respond to disasters. This entails:

   - Strengthening capacities to apply mitigation and adaptation measures in hazard-prone communities to reduce livelihood vulnerability.
   - Improving the accessibility and availability of preparedness measures (community-based and national early warning systems) to hazard-prone communities.
   - Enhancing the opportunities of communities and women's groups to access financing and to accumulate assets and income.

80 The Caribbean Network of Rural Women Producers (CANROP) includes members in Grenada, Guyana, and Jamaica, who produce vegetables, roots and tubers, herbs and spices, straw craft, jams and jellies, cassava bammy, dried fruit, flour from breadfruit, cassava, and bananas for use in soups and to make dumplings. For more information, see: **https://canrop.com/jamaica-network-of-rural-women-producers-jnrwp/**

- Encouraging the adoption of best practices through knowledge exchange between communities and women's groups.

Stimulate research and innovation, education and training, and an enabling agri-business environment

7. **Ensure that national training and education programmes** tailor content and delivery modalities to the needs of women and particularly youth, such as on cropping, fishing, and livestock rearing practices; climate change adaptation; and technology use. Introduce realistic quotas for the participation of women and youth, and promote the gender-sensitivity of rural advisory services as a means of eliminating explicit and implicit discriminatory selection criteria for participation in training.

8. **Promote a positive image of small-scale agriculture, livestock and fisheries among youth**:

   - **Support national policies to ensure the inclusion of agriculture in the education system,** through curriculum development and adaptation for all levels of education (including university); promote school gardens and school visits to local farms, as well as college programmes in culinary arts.
   - **Provide technical education in agri-business to match rural job market needs,** targeted to young men and women who are unable to complete secondary school.
   - **Support positive awareness programmes and campaigns** to sensitize youth on the importance of agriculture and its economic, environmental, health and social benefits, using social media and television to showcase innovative approaches and successful farmers' achievements.

9. **Promote youth- and gender-sensitive innovation and exposure strategies:**

   - **Support innovation centres** to identify innovation skills and provide financial assistance for the best ideas generated by youth and women; promote platforms to facilitate international (including regional) exposure; encourage innovators to research and experiment.
   - **Promote research, testing and smart agriculture,** such as applied permaculture with new technologies, aquaponics and hydroponic systems, organic agriculture, fisheries, marine-biomass harvesting, urban gardening, landscaping, agri-business, and technical training in machinery use, processing and marketing for natural products, or rural tourism.
   - **Establish national youth forums and exhibitions**, including at the community level, to encourage and highlight existing good practices in agri-business and share innovative ideas for affordable and accessible technology use.
   - **Create** a mentorship programme to support young women and men in starting up their businesses, and provide close support on a regular basis to enhance entrepreneurial skills development.
   - **Facilitate** professional internships and on-the-job-training, which expose young men and women to various employment opportunities along the fishery, horticulture and livestock value chains.
   - **Support the development of ICTs for agriculture**, with due consideration to gender-specific affordability and accessibility problems. Being labour-saving and time-saving technologies, ICTs can help improve the image of agriculture as a modern business – rather than an option of last-resort – and attract the interest of youth.

10. **Explore innovative household methodologies (HHM) to reach those "left behind"**, supporting their pathway out of poverty and building the enabling environment needed for transformative change towards inclusive and sustainable growth. Household methodologies tackle the underlying social norms, attitudes, behaviours and systems that represent the root causes, rather than the symptoms of gender inequality. The tools, including targeted household mentoring, help to unite what are often disparate livelihood strategies pursued by women and men – young and old, in the same household or group – into a *joint vision and practical strategy*.

    Household methodologies have been implemented in a number of countries, mainly in Africa and Asia, and have recently been piloted in Guatemala. They are proving to be effective in stimulating positive behavioural changes and transforming the lives of rural women and men, including in the areas of GBV. Moreover, HHMs represent a good return on investment, as they deepen the impact and enhance the sustainability of development initiatives, benefiting women, men, families and whole communities, as well as companies and financial service providers. Appendix 3 provides more details on these methodologies and some examples of results that have emerged from evaluations of interventions.

Infrastructural investments

11. **For public infrastructure,** including water management, post-harvest/processing, transport/markets, energy, and ports, CDB will support strategies that address gender disparities in accessing rural infrastructure services, by promoting:

    - equitable participation in infrastructure planning and siting, and decision-making (such as in clusters, producer organizations, or community groups);
    - gender-equitable employment opportunities in infrastructure construction or maintenance; and
    - training and equitable participation in water user groups and operations and management committees.

    Regarding water, CDB will also support rural water and sanitation infrastructure, given their importance to reducing time spent fetching water (for example in Guyana and Haiti), lowering the incidence of water-borne diseases and improving nutrition at the household-level.

12. **For private infrastructure**, including on-farm irrigation, renewable energy, greenhouses, post-harvesting facilities (packing houses, cold storage, storage, equipment facilities), and slaughterhouses, CDB will ensure the following:

    - The choice of infrastructure at producer organization or cluster level will be based on its potential to contribute to gender-equitable business creation, access to markets and employment.
    - The promotion of on-farm infrastructure is appropriate to women's needs, both as producers and as household managers, including facilities such as rainwater harvesting reservoirs, biogas units replacing firewood, improved stoves or solar ovens, simple wind turbines, livestock pens, simple food processors, among others.
    - Infrastructure associated with farms for youth training purposes (such as school gardens and Junior Farmer Field and Life Schools (JFFLS), youth groups, or for women's groups are prioritized.

Governance and capacity building for institutional effectiveness

13. **Strengthen the evidence base for informed policy-making**, addressing gender inequality and youth inclusion challenges across the various sub-sectors of agriculture (crops, fisheries, livestock, climate change adaptation). Ensure that policy formulation is informed by **enhancing national statistical capacities** to collect, analyse and share data for sex- and age-disaggregated as well as gender-specific indicators, thus filling the important data gaps that currently exist. Specifically, CDB could explore the possibility of promoting the use of newly developed methodologies and tools to facilitate informed policy-making in BMCs. Examples are as follows:

    - The *Guidelines for collecting data for sex-disaggregated and gender-specific indicators in national agricultural surveys,*[81] are aimed at improving the availability of systematically integrated and comparable sex-disaggregated and gender-relevant data within agricultural surveys by identifying key indicators relating to cropping and livestock activities and proposing adaptations to existing national agriculture surveys to better capture these indicators.
    - The *Women's Empowerment in Agriculture Index (WEAI),*[82] can be used as a tool to complement national census surveys or project-level M&E systems;[83] the Index can help diagnose areas of women's disempowerment and design agriculture programmes to address those areas. The Women's Empowerment in Agriculture Index is described in more detail in Appendix 5
    - FAO's *Gender and Land Rights Database* includes information on different factors that relate to gender inequalities embedded in land rights, exploring land-related statistics and a recently developed FAO legal assessment tool. Country profiles on three BMCs are included: Haiti, Jamaica, and Trinidad and Tobago.

14. **Enhance multidisciplinary and cross-sectoral synergies and policy coherence concerning gender equality and youth empowerment:**

    - **At the national level**, support linkages between: (1) policies governing agriculture, livestock, fisheries, infrastructure development, education, and public health; and (2) gender/youth policies and plans (where available).[84] This would sharpen the strategic focus on mainstreaming gender equality and youth empowerment across the various agriculture sub-sectors and enhance national capacities to provide more coherent and effective support, including through more tailored and appropriate public and private service provision.
    - **Within CDB's own corporate framework,** align the ASPS with other CDB policies, strategies, action plans and operational guidelines, especially those governing private sector engagement, education and training, disaster risk management, technical assistance, and governance. This would enhance CDB's capacity to provide more coherent guidance and support to BMCs on mainstreaming gender and youth empowerment in agriculture.

15. **Support ongoing and new, national gender-sensitive budgeting processes**, including proposals to reprioritize expenditures and revenues, taking into account the different needs and priorities of women and men operating in agriculture and the rural economy more broadly.

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81 *Guidelines for collecting data for sex-disaggregated and gender-specific indicators in national agricultural surveys*, Global Strategy to improve Agricultural and Rural Statistics (GSARS, FAO, October 2017). See: www.fao.org/gender-landrights-database/en/

82 An adapted project-level WEAI (the *Pro-WEIA*) is currently being tested – although not in the region. The results will be highly relevant for CDB's efforts to address current deficiencies in project M&E systems, and to improve the monitoring of project outcomes related to women's empowerment. See Appendix 5 for more information on this.

83 *Women's Empowerment in Agriculture Index (WEAI)* is an innovative tool that measures women's empowerment in agriculture. http://weai.ifpri.info/

84 *Strengthening Sector Policies for Better Food Security and Nutrition Results: Gender Equality.* Policy Guidance Note 6 (FAO and the European Union, 2017).

During gender-responsive budgeting processes, CDB could also promote efforts to address other inequality factors, such as age, ethnic affiliation, disability, or place of residence (urban/rural). In addition, CDB can assist in the analysis of budget allocations, public spending and taxation from a gender perspective, with the aim of using the analysis results to advocate for the reallocation of budget line items to better respond to the diverse priorities of women, men, and youth.

16. **Facilitate replication and upscaling of good practices** by collecting, examining and sharing relevant regional and global approaches and best practices in gender equality, women's empowerment and youth employment in agriculture. Good practices can be replicated or upscaled successfully through South-South and Triangular Cooperation (SSTC) to achieve more impact. Moreover, experience and knowledge exchanges around approaches to gender mainstreaming can also be facilitated through exchanges between BMCs that share similar challenges, such as Dominica and Guyana. Lastly, intercountry women's or youth exchange visits can also be actively pursued as a mechanism for peer-to-peer learning and empowerment.

5.4 Four considerations for the implementation

The ASPS can steer agriculture investments in the region through a better understanding of the social complexity of diverse rural areas; it can address the critical issues facing resource-poor women and youth who are burdened by a series of life challenges that render them economically inactive. In this regard, four additional suggestions are briefly discussed below for CDB's consideration.

1. **A targeting framework for agriculture:** The Enhanced Country Poverty Assessments (ESPA)[85] – which have replaced the older generation of CPAs – provide a good basis for the improved understanding of social diversity and rural poverty, as they include multidimensional poverty indicators (MDIs) as well as an enhanced geographic poverty and vulnerability mapping. By developing a corporate targeting framework, CDB could use ESPA results more strategically; the framework and related guidelines could help sharpen the focus of CDB's agriculture investments – and its stated objectives – in the agriculture sector, and further BMCs' efforts to achieve the SDGs (and leave "no one behind") by 2030. A suggested short checklist for poverty-targeting in the agriculture sector is attached in Appendix 6 and could be used as a guide to screen project proposals during the design stage of the project cycle.

2. **Deepen CDB's understanding of:** (a) youth employment issues in the specific context of agriculture and the rural economy; (b) innovative methodologies to address (and measure) women's empowerment in agriculture more holistically. This may require further examination (by the Bank's gender and social inclusion experts) of new evidence and tested approaches from outside the region which could help enhance CDB's operational and methodological capacities to target women and youth in agriculture investment projects, both through grants and loans. Appendices 3 and 5 provide some examples of current innovative methodologies on working with households and on measuring women's empowerment in agriculture at the project level. Appendix 7 provides a list of relevant resources, guidelines and e-learning courses, developed by FAO and others, for the Bank's consideration.

3. **Nutrition-sensitive agriculture**: As presented in detail in the ASPS Annex on Nutrition, CDBs' efforts to empower women would need to be linked to efforts to enhance nutritional outcomes in BMCs – both undernutrition and overnutrition. Women are at the nexus between agriculture

85 At the time of drafting this paper, Country Needs Assessments (CNAs) had been carried out in 12 BMCs and a toolkit for national teams was being prepared.

and nutrition due to their economic roles as agricultural producers, processors and marketers on the one hand, and their domestic roles in making food choices for their families, preparing meals and being in charge of childcare and feeding on the other. This means that improvements in women's decision-making power and control over resources can have significant positive effects on their own nutrition and that of other household members, especially children.

4. **Indicators for the ASPS results framework** must be gender-sensitive to track CDB's progress in including gender equality and women's empowerment considerations into its project design portfolio, including in the proposed M&E systems with appropriate indicators to measure outcomes and impact. Indicators must capture the impact of interventions on sub-groups of men and women according to age and ethnic origin, as well as gender-differentiated impacts on women's and men's vulnerability and adaptation to changing climatic conditions.

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Appendix 1

Mapping of CDB policy responses to gender constraints relevant to ASPS

Gender constraints relevant to ASPS identified by other CDB policies[86]	CDB policy response
Gender-stereotypic subject selection in technical and vocational education and training (TVET) and universities, leading to the disadvantageous distribution of skills and economic advancement for women.	**CDB policy on the private sector**:[87] Support the educational enrolment of women and girls in non-traditional fields.
Lack of affordable care for dependents (children and the elderly).	**CDB policy on the private sector**: Reform of private and public sector organizations to provide paid maternity, paternity and parental leave, part-time and flexitime arrangements, and child care services.
Limited security to access credit and financial products and services, due to lack of ownership of land and other assets.	**CDB policy on the private sector:** Adjusting financial products to women's needs, e.g. via lines of credit offering loans to households with high dependency ratios, which are often female headed.
	Gender sensitisation and gender mainstreaming of development finance institutions (DFIs).
Lack of access to technical assistance, business development services and market information, including domestic and international trade-related or industry-specific information.	**CDB policy on the private sector:** Digital and financial inclusion for women as suppliers in value chains and as entrepreneurs.
	Business advisory services to female entrepreneurs and business owners.
Lack of financial and business skills due to limited training and opportunities.	**CDB policy on education:**[88] Increasing financial literacy.
Youth unemployment.	**CDB Policy on Private Sector**: Focus on investment in higher education and vocational training to better match the supply of and demand for skilled workers.
	Support the enrolment of women and girls in non-traditional fields to allow for better employment and earning opportunities.

Trends of young males (but increasingly also females) alienating themselves from the education system and engaging in deviant antisocial behaviour.	**CDB Policy on education:** support to development of curricula/programmes for out-of-school youth and those seeking continuing education opportunities (no reference to agriculture).
	CDB Policy on Governance:[89] citizen security through support for (1) police training; (2) youth services; (3) reducing gender-based violence; and (4) supporting regional cooperation on cross-border, organised crime.
	Support data collection on gender-based violence.
	Support youth resilience and social crime prevention.
Leadership and fiscal management.	**CDB Policy on Governance:** Leadership development, participatory governance planning activities, participatory and gender-sensitive inclusive budgeting.
Weaknesses in data collection, analysis and communication for effective gender equality decision-making and accountability.	**CDB policy on governance:** Supporting gender equality through (1) sex-disaggregated statistics for better policy-making, (2) gender budgeting, and (3) gender analysis in CPAs and CSPs.
	CDB policy on governance: Strengthen the process to identify gender-responsive Caribbean SDG priorities, targets and indicators, closely linked to the SAMOA pathway.

86 87 88 89

86 The Disaster Management Strategy and Operational Guidelines (2009), and the Technical Assistance Policy (2012) are not included, as they do not address issues of social inclusion, gender equality or youth empowerment.

87 CDB Private Sector Development Policy and Strategy (July 2017).

88 CDB Education and Training Policy and Strategy (October 2017).

89 CDB Governance and Institutional Development Policy and Operational Strategy (2017d).

Appendix 2

Good practices in rural employment for young women and men in the Caribbean[90]

Guyana: Women's Agro-Processors Development Network (WADNetwork)

Founded in 2011, the Women's Agro-Processors Development Network (WADNetwork) is a community-based network of small-scale, women's agro-processing groups in Guyana. WADNetwork is registered under the Friendly Society's Act and is an active member of the regional Caribbean Network of Rural Women Producers (CANROP). The group was formed as part of the 'Making Markets Work Project,' funded by Accenture, with technical and financial assistance from the Inter-American Institute for Cooperation on Agriculture (IICA). The network started when Volunteer Service Overseas (VSO) and IICA facilitated six agro-processing groups to form a network, which now consists of eleven small-scale agro-processing groups based in rural and indigenous communities across Guyana. In addition to producing a wide range of items, WADNetwork advocates for and empowers its member groups by providing them with entrepreneurial and business skills.

Haiti: Federation of Women's Associations of Maïssade Village

The Federation was created in 1998 and counts over 4 000 female members. They work together to develop advocacy strategies to encourage inclusion, participation, intergenerational dialogue and capacity building to create jobs and sustainable livelihoods. The Federation also works to develop skills needed by women to manage agro-processing businesses and creates strategic partnerships and alliances with the public and private sector to promote local fruit production and reduce wastage.

The group helps farmers and works together for the development of local youth, by giving them the opportunity to provide raw materials. It also provides nutritional food for children in schools in Maïssade village through the National School Feeding Programme. They organize field exchange visits with member associations and regularly offer seminars and knowledge sharing activities with other organizations with regard to capacity building and new technologies in the field of agro-processing. The Women's Federation has not only developed eight main value-added products, but it has also created 85 direct employment opportunities and over a thousand indirect employment opportunities. Value-added products include enriched cassava, moringa powder, raw sugar syrup, corn sham-sham, sweets, carapina, ground corn and corn milk.

Haiti: Committee for the Development of the Community of Arcahaie (CODCOA)

The Committee started its activities in 1998 and focuses on different areas of community development, such as literacy, education, agriculture and beekeeping. Having created a beekeepers' association – with over 80 (mostly young) beekeepers – the Committee aims to (1) promote beekeeping as an alternative source of income in the municipality of Arcahaie, (2) teach young farmers modern

90 The Good Practices and Local Champions Catalogue: A Caribbean example "Strengthening Decent Rural Employment Opportunities for Young Women and Men in the Caribbean" (PROCASUR, FAO and IFAD, 2017).

techniques in beekeeping, and (3) break with the traditional system that does not guarantee profitability. CODCOA provides training on all aspects of beekeeping (construction of boxes, hive collection and installation, maintenance, pest identification and control, nutrition, among others).

Grenada: Clozier Youth Farmers' Co-operative Society Ltd.

The Cooperative was formed between 2008 and 2009 by a youth group from the community of Clozier, in Grenada. The group currently consists of twelve young farmers who joined forces to access funds and resources, search for new market opportunities, and implement innovative activities in "smart agriculture," including the use of new technology tools. These young farmers are currently implementing a number of innovative practices, such as aquaponics, permaculture design, eco-tourism, beekeeping, compost production, niche market development, and the use of shade houses.

Grenada: Prison Reform Programme targeting young men

Upon leaving Her Majesty's Prison (HMP) – the only prison on the island – inmates are stigmatized and victimized, reinforcing their lack of self-worth and reducing their options of being integrated into the job market. Through Project Reach, a training vocational programme, HMP has provided vocational skills to over 30 youth (primarily men) in areas such as welding, crop production, building construction, poultry rearing, electrical installation, small engine repairs, and facilities maintenance. Through the 'Empowerment for the Disadvantaged' programme, youth were introduced to green collar jobs in areas such as beekeeping, baking and pastry making, aquaponics, waste to art, permaculture design as well as soap and lotion making. The prison farm also offers training opportunities, as inmates can learn practical, hands-on skills in areas such as livestock rearing (chicken, pig, rabbit), beekeeping, aquaponics, plant nurseries, and biogas digesters.

Appendix 3

Household methodologies for gender transformative impact

Household methodologies (HHMs)[91] are innovative in the development sector, as they tackle the underlying social norms, attitudes, behaviours and systems that represent the root causes rather than the symptoms of gender inequality. Household methodologies shift the prime focus of interventions from things (assets, infrastructure, value chains) to people, and specifically to who these individuals want to be, what they want to do, and how they can achieve their goals.

The tools (including targeted household mentoring) help to unite what are often disparate livelihood strategies pursued by women and men – young and old – in the same household or group, into a joint vision and practical strategy. To date, household methodologies have been implemented in a number of countries in Africa and Asia and are proving to be effective in key areas: stimulating positive behaviour change; transforming the lives of rural women and men, including in the areas of GBV; and in reaching those "left behind" and supporting their pathway out of poverty.

In view of these results, HHMs not only have the potential to bring about transformative change in rural areas, but they can also contribute to the ambitious targets set in Agenda 2030 for sustainable development. In addition, HHMs represent a good return on investment, as they deepen the impact and enhance the sustainability of development initiatives, benefiting women, men, families and whole communities, as well as companies and financial service providers.

In collaboration with Oxfam, IFAD[92] has been pioneering the promotion, replication and upscaling of HHMs for over a decade, mainly in Africa. Through the five-year joint programme, "*Accelerating Progress toward the Economic Empowerment of Rural Women,*"[93] HHMs have recently been expanded beyond Africa, including to the Latin America and the Caribbean (LAC) Region, with a pilot in Guatemala.

Two main approaches contribute to the delivery of HHMs supported by IFAD: (1) the *Gender Action Learning System (GALS),* which was developed through IFAD grant support with Oxfam Novib; and (2) *household mentoring,* which was part of the design of projects financed through loans in Uganda.

The GALS is a community-led empowerment methodology with the aim of giving women and men of all ages and levels of education more control over their lives. The main goal of the GALS methodology is to break through the gender-based barriers within families that prevent women and men from achieving their vision of wealth creation, gender justice and social empowerment. The GALS methodology and tools are applicable in different cultural and social contexts, within and outside households; therefore, they can be applied by both women and men to develop individualised road maps and visions for change, and ultimately, to move out of poverty. Thus far, the

91 www.ifad.org/web/knowledge/publication/asset/40253899

92 IFAD is the only international financial institution (IFI) that exclusively lends to agriculture and rural development with a clear poverty reduction focus and a corporate targeting strategy.

93 Jointly funded and implemented (since 2013) by UN Women, FAO, IFAD and WFP in Ethiopia, Guatemala, Kyrgyzstan, Liberia, Nepal, Niger and Rwanda. www.unwomen.org/en/news/stories/2012/9/un-women-fao-ifad-and-wfp-joint-programme-accelerating-progress-toward-the-economic-empowerment-o

GALS has been implemented in the following countries: Ethiopia, Guatemala, Kyrgyzstan, Malawi, Nepal, Nigeria, Rwanda, Sierra Leone, the Sudan, Uganda, and Zambia.

The household mentoring methodology is part of the wider component of community development in the District Livelihoods Support Programme (DLSP) in Uganda.[94] It is a partnership system created within the community: a locally trained mentor visits vulnerable households in order to share knowledge, experiences and skills that will advance the personal, social and economic growth of the members of the family. The scope is to solve the issues within the household, and the mentor's role is to support the family members along this path by guiding the household through an analysis of the situation, the setting of priorities, and the design of an action plan.

The power of these methodologies is that they help household members to communicate, moving from a "blame focus" to solutions through dialogue. Following the Uganda example, many other countries have seen the implementation of household mentoring, including Kenya, Malawi, and Zambia. The roll out of HHMs and the replication in similar contexts has been facilitated through South-South and Triangular Cooperation (SSTC) activities – such as learning routes, networking activities, knowledge products, videos and learning events.

The IFAD-funded *Community-led value chain development for gender justice and pro-poor wealth creation (GENVAD) grant programme* was instrumental in developing the application of the GALS in value chain development in Nigeria, Rwanda, and Uganda. More than 26 000 women reported notable changes at the household level, including a more equal distribution of labour as well as more decision-making power and control of assets. About half of these women also reported more secure access to land. In addition, fathers started including daughters in wills so they could inherit property. For about 70 percent of the beneficiaries, these changes translated into significant income increases; around 60 percent increased savings and resources for productive investments, with better production and marketing attributed to more equitable win-win collaboration with buyers. The activities, financed through the grant, led to the scale-up of HHM, which also helped to kick off the implementation of the methodologies in other projects. The result is that HHMs have now become mainstreamed into IFAD's corporate approach to addressing gender inequalities and are used in over 40 IFAD-supported projects worldwide.

FAO also reports positive HHM results in Africa and Asia, where it has been working with the following groups: cooperatives, producer organizations, income-generating groups, village savings and lending associations, natural resource management groups and water users associations, youth groups, and Farmer Field Schools.

94 See: www.ifad.org/documents/38714170/40205133/Household+Mentoring%2C+Uganda.pdf/fb332ae7-77ce-441c-9841-ac464d34ebf0

>> Box 3. Impact of household methodologies: A case study from FAO's experience in Zimbabwe

FAO, in collaboration with OXFAM, used household methodologies in an agricultural value chain project – for goats, paprika, sesame, and mung beans – in Zimbabwe[95] to encourage behavioural change at the household level. During the project's evaluation, beneficiary farmers (both men and women) reported transformative changes in a number of domains:

- ***Ownership of assets*** **–** (1) improvements in joint plot management were positively influencing the types of crops farmed, and the control over inputs; (2) stereotypes about gender-specific crop production were changing (men: cash crops versus women: household crops). This proved to have positive labour implications, with men offering their labour for both types of crops.
- ***Gender division of labour*** **–** not only did women take over typically "male" tasks, but men were also taking on care and household roles on a regular basis.
- ***Resource and income management*** **–** Joint resource and input management, inclusive of labour-saving subsidized technologies (shellers, water pumps, ripper tines, hermetic bags) improved productivity and yields (from 1 tonne of maize/ha to 3-5 tonnes/ha). Men were also handing over considerable parts of their income to their wives to manage, which they had not previously done.
- ***Gender-based violence*** **–** Household dialogue had a deep impact on men's understanding and appreciation of women's needs and work: not only was the violence reduced, but men reported that they felt relieved to share more tasks and to be able to make joint decisions about production and income management.

95

95 See www.trioss.global/zimbabwe-livelihoods-food-security-project

Appendix 4

Checklists for socially inclusive and gender-sensitive value chains

Table 2. Social criteria for value chain selection

Key criteria	Guiding questions
Opportunity for the inclusion of disadvantaged groups (e.g. the poor, women, youth, refugees, minorities, and the disabled)	• Do disadvantaged groups participate in the value chain? Which groups, with which function/role? • Do these population groups have the necessary skills to participate in and benefit from the value chain? If not, can they easily acquire the needed skills? • Do disadvantaged groups have access to and control over assets, equipment, and sales incomes from their activities along the chain? • What are the main barriers to entering the value chain that disadvantaged groups face?
Working conditions	• What are the working conditions that disadvantaged groups experience along the chain? • What are the health and safety risks for entrepreneurs and workers in the different stages or functions of the value chain? • How prevalent is freedom of association and how is it regulated? • Is child labour present in the value chain? If so, at what level and in which activities?
Impact of the value chain on surrounding communities	• Are the rights to food, health, property (land) and water (access and use) of surrounding communities respected? If so, how? • Is there a risk of the value chain causing or being subject to conflict(s) and tensions in society? If so, how? • Are there any other risks of human rights violations in the value chain? Do individual workers or communities have access to grievance mechanisms in case of human rights violations?

Table 3. Assessing the value chain potential to advance women's empowerment

Guiding questions:
Is the share of women involved in the value chain relatively high?
Are there many female entrepreneurs already active along the value chain?
What is the average size of existing women-led enterprises? Are they formal or informal businesses?
Does the value chain offer new employment or entrepreneurial opportunities for women? For youth? In which specific nodes?
Do women usually own and control equipment and assets used in their work?
Do women have (or can they easily acquire) the skills needed to upscale their business, e.g. through processing or product diversification?
Do women usually control the income earned through their business/economic activity?
Can the work be performed close to home? Do workers have to travel far from their household/ community?
Is this a value chain with low entry barriers for poor entrepreneurs (low start-up costs not requiring major capital investment, using low technological skills)?
Is this a value chain with low entry barriers for women in particular? Is the work compatible with women's time and mobility constraints? Is the activity or business acceptable for women according to prevailing cultural norms?

Table 4. Identifying barriers to the participation and voice of women and youth in rural organizations

Guiding questions:
• What are the criteria for membership in the association?
• What are the benefits for members?
• How many members are men? How many members are women? How many are young?
• How much are membership fees (registration and maintenance)?
• When and where are meetings held?
• What are the qualifications needed to become an association leader?
• What financial resources (financial, time, other) are required to be an association leader?
• What is the role and position of women within the mixed organization?
• What are female leaders'/groups' capacities to influence decision-making on value chain development?

Table 5. Innovative financial services/products for women-owned MSMEs in agrifood value chains[96]

Financial services/ products	Suitability for women-owned MSMEs in agrifood value chains
Women-only financial products and funds	Financial institutions (FIs) could be sensitized on the benefits of earmarking a proportion of credit lines specifically for women or creating investment funds accessible only to women-led MSMEs. An element that contributes to the effectiveness of this specific model is that, when available, these funds or programmes are usually accompanied by tailored and gender-sensitive modalities of service provision (e.g. women-only counter services with dedicated female staff and male staff specifically trained to effectively interact with clients with limited financial literacy).
Integrated package of services	Women-only products are often accompanied by an integrated package of services (financial and non-financial), including business development services (BDS) and financial literacy, legal advice and entrepreneurial training. In many contexts, this solution has proved to be highly effective in addressing common constraints affecting access to finance on the demand side (e.g. women's low educational level, limited time and mobility).
Modern collateral provision/Collateral regimes	Collateral regimes expand the type of assets that can be used as security for loans, including tangible assets (e.g. inventory, crops and livestock, jewellery, vehicles, machinery and equipment), and intangible assets (e.g. account receivables, deposit accounts). This serves to overcome one of the major gender-based constraints (GBCs) in accessing formal banking: women's common lack of ownership of land, housing and other household assets. Warehouse receipts are also a good example of alternative collateral. Receipts are issued to a named depositor (a farmer group, a processor or trader) as evidence that a specific commodity of stated quantity and quality has been deposited at a specified location. The holder of the receipt may pledge it to a lender (with the stored commodity being the collateral for a loan) or transfer it to a buyer (by way of a sale). The warehouse operator or collateral manager, who has custody of the stocks, guarantees delivery against the receipt and should be able to compensate for any value lost through theft, fire or other catastrophes.
Land loans	In some countries, central banks have created 'land loans' specifically for women who face more challenges in accessing property. With this product, women can purchase property or land that can later be used as collateral for loans.
Group guarantee/ group lending	Group lending schemes and assignment of co-guarantors, which is a model tested and promoted to date mainly by microfinance institutions (MFIs), provide a valid alternative to collateral requirements, based on trust and social cohesion. However, it is important to highlight that group lending is typically for small, short-term loans that might not be adequate or sufficient to support women's participation in agrifood value chains.
Investment clubs	Networking among female entrepreneurs can also facilitate joint fundraising, and the joint fund can then be made available to individual members. In some cases, these joint funds have been used as collateral in requesting an individual loan. Clubs are also highly effective in enhancing women's access to information on available financial products and services.

96 Adapted from Developing Gender-Sensitive Value Chains – Guidelines for Practitioners (FAO, 2018c): www.fao.org/3/i9212en/I9212EN.pdf.

Information and communication technology- (ICT) led services	Where infrastructure is available, ICT-led solutions have the potential to reduce the time and mobility constraints that rural women face accessing financial services. They can also help women save costs, lower the risks of violence and theft associated with carrying and managing cash, and ensure privacy, which is highly valued among women. At the same time, mobile money can represent a form of 'branchless banking', which can help to reduce the cost of service delivery for FIs and facilitate operations in rural areas. When salaries, payments and remittances are directly paid into their accounts, mobile money also contributes to increasing women's control over their own earnings and income.
Partnerships and bridging products between MFIs and formal FIs	The infrastructure created by MFIs and other value chain actors providing informal financial services (e.g. the provision of storage facilities for inventory credit) can be used strategically as a platform for delivering a wider range of services, possibly in partnership with more formal FIs. These partnerships would provide FIs with access to a client base they would not have otherwise been able to reach and give microfinance clients access to a wider range of products and services. This possibility to 'upgrade' is especially important when the financial needs of micro- and small-scale entrepreneurs become more complex, (e.g. when their businesses grow and they need more capital), or when they need additional services (e.g. payrolls, international transactions). Formal institutions need to be trained on risk management strategies tailored to agrifood value chains and specifically to different actors (both women and men) operating along them.

Table 6. Examples of innovative financial services/products for women-owned MSMEs in agrifood value chains[97]

Financial services/ products	Examples of good practices
Women-only financial products and funds	The International Finance Corporation (IFC), for instance, partnered with PT Bank International Indonesia (BII), one of the largest banks in Indonesia, to launch a savings product specifically for women, offering not only specific benefits (e.g. favourable lending terms, no monthly administration fee, bill payment services, and insurance protection), but also access to targeted advisory services (Global Partnership for Financial Inclusion and IFC, 2011). Access Bank PLC Nigeria is a leading African bank that, in 2005, decided to become an early mover in the niche market of SMEs, which in Nigeria is largely occupied by women. The Bank offers customized credit lines to female entrepreneurs as well as complementary services. Over a period of four years, the Bank had opened around 1 300 new accounts, disbursed over USD 33 million in loans, and trained more than 650 women entrepreneurs in business and management skills (AfDB, 2013).
Integrated package of services	SME Bank in Malaysia has created a type of incubation system that provides financing facilities, entrepreneurial guidance and training, and assists clients in marketing and promoting their products. SME Bank has adapted these different products to match the specific needs of women entrepreneurs who, in Malaysia, are heavily concentrated in manufacturing and tourism (Global Partnership for Financial Inclusion and IFC, 2011). Providing complementary services can also work as an incentive for women's access and actual usage of the services. ProMujer – a Latin America based MFI working in Argentina, the Plurinational State of Bolivia, Mexico, Nicaragua and Peru – currently offers a full range of microfinance and health services, and other human development services, through some of its centres (DFID and GIZ, 2013).

97 Adapted from Developing Gender-Sensitive Value Chains – Guidelines for Practitioners (FAO, 2018c). www.fao.org/3/i9212en/I9212EN.pdf

Modern collateral provision/ Collateral regimes	In Ghana, the establishment of the Collateral Registry by the Bank of Ghana, supported by the International Finance Corporation (IFC), has allowed financial and non-bank financial institutions, especially MFIs, to expand their lending operations to the MSME segment. More than 10 000 women entrepreneurs have been granted loans secured with movable property, mostly business equipment, household assets and vehicles (Chiquier, Daadouche Crum and Konidari, 2017). Also, in Nigeria, Access Bank has developed a system of flexible collateral options, specifically targeted to women, including the pledging of jewellery and equipment, and using debentures or bills of sale to enable female entrepreneurs to access loans.
Land loans	Uganda's Central Bank (DFCU) created this kind of loan to enable women to purchase property that they can use later as collateral for a business loan (Global Partnership for Financial Inclusion and IFC, 2011). Tanzania Women's Bank (TWB) has started lending registered plots of land to female entrepreneurs as a way to overcome their main constraints in accessing finance. Borrowers are required to deposit at least 30 percent of the plot's value and pay the rest in instalments until they have paid off the loan and own the land outright (Mayoke, 2016).
Group guarantee/ group lending	The group lending model is a cornerstone of the Grameen Bank methodology. In this model, individuals form a group and receive financial training before receiving the loan. SEWA Bank also gives loans to its members after they have owned a savings account for a certain period of time and saved a certain amount of money in their account (basically, credit history gives women some sort of a 'credit-score' to be used as an alternative to collateral).
Investment clubs	In Uganda, the Central Bank has promoted the creation of an Investment Club, a savings scheme through which women entrepreneurs can raise funds together to make a future business investment. Since its creation, over USD 20 million has been lent to women entrepreneurs as a result of participation in the Club (Global Partnership for Financial Inclusion and IFC, 2011).
Information and communication technology-(ICT) led services	Throughout East Africa, the non-profit organization One Acre Fund (OAF) provides inputs, such as seeds and fertilizer, and credit to smallholder farmers, most of whom are women. This service is complemented with specialized training on better crop management techniques. Since 2014, OAF has enabled farmers in Kenya to make loan repayments digitally using the mobile money service M-Pesa instead of in cash. This has increased economic opportunities and financial inclusion in some of the world's poorest farming communities. One of the benefits of this digitalization is a significant reduction in repayment frauds (benefitting female clients in particular) and in the time spent by OAF staff on repayment processing, which has freed up more time to provide training and advice on farming practices (Better Than Cash Alliance, 2017).
Partnerships and bridging products between MFIs and formal FIs	In the United Republic of Tanzania, Sero Lease, an MFI, partnered with Exim Bank to offer an opportunity for their female clients to open savings accounts. This provides clients with an excellent opportunity to start building working relationships and creditworthiness with the bank should they need to ask for larger loans. Some FIs provide both microfinance and SME finance, in many cases having grown from an MFI into a commercial bank. These FIs (as in the case of Cambodia's ACLEDA Bank, Mongolia's XacBank and Uzbekistan's Bank Ipak Yuli) are in a good position to offer a wider range of services to female entrepreneurs that have the potential to expand their business (ADB, 2014).

Appendix 5

The Women's Empowerment in Agriculture Index (WEAI)

The Women's Empowerment in Agriculture Index (WEAI)[98] is a survey-based index designed to measure the empowerment, agency, and inclusion of women in the agricultural sector. The Index is a significant innovation in its field as it aims to increase understanding of the connections between women's empowerment, food security, and agricultural growth. It can be used more generally to assess the state of empowerment and gender parity in agriculture, to identify key areas in which empowerment needs to be strengthened, and to track progress over time. Developed in a collaborative effort between USAID's Feed the Future Initiative, the International Food Policy Research Institute (IFPRI), and the Oxford Poverty and Human Development Initiative, the WEAI is an aggregate index, reported at the country or regional level, based on individual-level data collected by interviewing men and women within the same households.

As shown in Table 7, the WEAI comprises two sub-indexes. The first assesses the degree to which women are empowered in **five domains of empowerment** (5DE) in agriculture. It reflects the percentage of women who are empowered and, among those who are not, the percentage of domains in which women enjoy adequate achievements. The five domains of empowerment in the WEAI are as follows: (1) decisions about agricultural production; (2) access to and decision-making power about productive resources; (3) control over use of income; (4) leadership in the community; and (5) time allocation. The second sub-index measures gender parity. The **Gender Parity Index (GPI)** reflects the percentage of women who are empowered or whose achievements are at least as high as those of the men in their households. For those households that have not achieved gender parity, the GPI shows the empowerment gap that needs to be closed for women to reach the same level of empowerment as men.

The domain indicators are built on the following definitions:

- **Production**: Sole or joint decision-making over food and cash-crop farming, livestock, and fisheries as well as autonomy in agricultural production.
- **Resources**: Ownership, access to, and decision-making power over productive resources, such as land, livestock, agricultural equipment, consumer durables, and credit.
- **Income**: Sole or joint control over income and expenditures.
- **Leadership**: Membership in economic or social groups and comfort in speaking in public.
- **Time**: Allocation of time to productive and domestic tasks and satisfaction with the available time for leisure activities.

A woman is defined as empowered in 5DE if she has adequate achievements in four of the five domains or is empowered in some combination of the weighted indicators that reflect 80 percent total adequacy. A key innovation of the Index is that it shows how many domains the women are empowered in, while revealing the connections among areas of disempowerment. This enables

98 http://weai.ifpri.info/

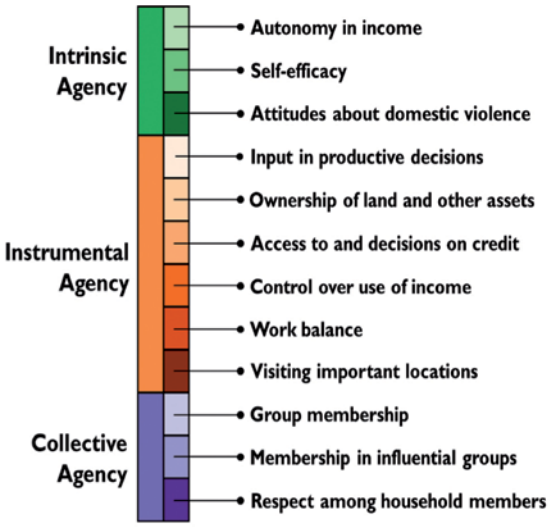
decision-makers to focus on improving the situation of the most disempowered women. In addition to tracking the nature of empowerment in five domains, the WEAI measures how empowered women are relative to men in the same household, which is critical to understanding the gender empowerment gap.

Table 7. The five domains of empowerment in the WEAI

Domain	Indicators	Weight
Production	Input in productive decisions	1/10
	Autonomy in production	1/10
Resources	Ownership of assets	1/15
	Purchase, sale, or transfer of assets	1/15
	Access to and decisions on credit	1/15
Income	Control over use of income	1/5
Leadership	Group member	1/10
	Speaking in public	1/10
Time	Workload	1/10
	Leisure	1/10

Since its initial release about a decade ago, several versions of the WEAI have been developed, including a recently adapted "lighter" version for projects: The Pro-WEAI. The Pro-WEAI is intended to measure changes in women's empowerment over the course of an agricultural development project, and it focuses on indicators of empowerment that a project could change. In addition, pro-WEAI includes optional add-on modules to look at women's empowerment in projects that focus on outcomes related to nutrition, health, and livestock.

Figure 3. Domains and indicators of the Pro-WEAI[99]



As shown in Figure 3, the **Pro-WEAI** is composed of 12 indicators of women's empowerment in agriculture: autonomy in income, self-efficacy, attitudes about domestic violence, input in productive decisions, ownership of land and other assets, access to and decisions on credit, control over use

99 IFPRI, Introducing pro-WEAI: A tool for measuring women's empowerment in agricultural development projects. http://weai.ifpri.info/2018/04/27/introducing-pro-weai-a-tool-for-measuring-womens-empowerment-in-agricultural-development-projects/

of income, work balance, visiting important locations, group membership, membership in influential groups, and respect among household members. These indicators are organized into three domains of empowerment: intrinsic agency (power within), instrumental agency (power to), and collective agency (power with).

The second phase of the *Gender, Agriculture, and Assets Project (GAAP2),*[100] led by the **International Food Policy Research Institute (IFPRI),** is currently working with a portfolio of agricultural development projects, to adapt and validate a measure of women's empowerment. This measure will be used by agricultural development agencies and project implementers to diagnose key areas of disempowerment, design appropriate strategies to address deficiencies, and monitor project outcomes related to women's empowerment; GAAP2 will also develop evidence-based strategies to target, engage and empower women through agricultural development projects.

Although the WEAI was not piloted in the Caribbean,[101] adapted versions of the Index may be useful to include in forthcoming national surveys in a selected number of BMCs – particularly in countries which score lowest on gender parity statistics. The results of the GAAP2 – although not implemented in the region – will be highly relevant for CDB's efforts to address current deficiencies in project M&E systems and improve the monitoring of project outcomes related to women's empowerment.

100 http://gaap.ifpri.info/

101 WEAI was piloted in Guatemala with good results.

Appendix 6

Sample poverty-targeting checklist for CDB agriculture sector projects[102]

Project design features	Guiding questions
Identification of the main target group	Has the identification of the main target group – those expected to benefit most from the project – been guided by CDB's poverty reduction goals? How many (in number and percent) qualify as poor or food insecure rural households?
Description of target sub-groups	Have target sub-groups been identified and described according to their different socio-economic characteristics, assets and livelihoods, considering gender and youth differences?
Evidence of feasibility for uptake of project services	Is evidence provided of interest in and likely uptake of the proposed activities by the identified target sub-groups? What is the evidence?
Operational targeting strategy	Does the design document describe a feasible and operational targeting strategy involving some or all of the following targeting methods:
Geographic targeting	• based on poverty data or proxy indicators to identify, for area-based projects or programmes, geographic areas (and within these, communities) with high concentrations of poor people
Direct targeting	• when services or resources are to be channelled to specific individuals or households
Self-targeting	• when goods and services respond to the priority needs, resource endowments and livelihood strategies of specific target groups
Empowering measures	• including information and communication, focused capacity- and confidence-building measures, and organizational support to empower and encourage the more active participation and inclusion in planning and decision-making of people who traditionally have less voice and power
Enabling measures	• to strengthen stakeholders' and partners' commitment to poverty targeting, gender equality and youth empowerment, including policy dialogue, awareness-raising and capacity-building
Procedural measures	• that could militate against participation by the intended target groups
Operational measures	• appropriate project/programme management arrangements, staffing, selection of implementation partners and service providers
Monitoring targeting performance	Does the project's M&E framework allow for the collection/analysis of sex- and age-disaggregated data, and are there gender-sensitive indicators against which to monitor/evaluate outputs, outcomes and impacts?

102 Adapted from the approach used by IFAD for project design screening. See more here: www.ifad.org/en/web/knowledge/publication/asset/40241536

Appendix 7

Key references and useful resources

Resources on gender in agriculture

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender analysis methods				
Social Analysis for Agriculture and Rural Investment Projects: Manager's Guide, Practitioner's Guide, Field Guide	Guide, toolkit or manual	FAO	www.fao.org/docrep/014/am293e/am293e00.htm	These three guides produced by FAO's Investment Centre demonstrate the application of social analysis to investment programmes and projects in agricultural and rural development. • The Manager's Guide addresses the needs of project managers and team leaders. • The Practitioner's Guide deals with the 'why and what' questions, building on the conceptual approach in the Manager's Guide. • The Field Guide provides guidance on the fieldwork aspects of social analysis, based on the Practitioner's Guide.
Gender and biodiversity				
Building on Gender, Agrobiodiversity and Local Knowledge: A Training Manual	Guide, toolkit or manual	FAO	ftp://ftp.fao.org/docrep/fao/009/y5956e/y5956e00.pdf	This Training Manual is based on experiences collected in many training workshops carried out under the FAO-LinKS project in Eastern and Southern Africa. The manual constitutes a conceptual guide for trainers to lead them through the issues of gender and local knowledge, which are important elements for agrobiodiversity management and food security.
Gender and climate change				
Training Guide: Gender and climate change research in agriculture and food security for rural development (2012)	Guide, toolkit or manual	FAO & CGIAR	www.fao.org/docrep/015/md280e/md280e.pdf	Aims to help agricultural development professionals in researching and catalysing gender-sensitive, climate-smart agricultural practices.
Gender and Climate Change Research in Agriculture and Food Security for Rural Development: New Research Methods and Training Materials	Policy brief, factsheet or backgrounder	FAO, CCAFS, CGIAR, Earth System Science	http://ccafs.cgiar.org/sites/default/files/assets/docs/fao-ccafs-brief-gender-web.pdf	

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender and fisheries/aquaculture				
Fisheries field manual: Mainstreaming gender into project cycle management in the fisheries sector (2011)	Guide, toolkit or manual	FAO	www.rflp.org/mainstreaming_gender/Mainstreaming_gender_handbook.pdf	This manual has been prepared to facilitate gender analysis and project planning in fisheries development projects. It is intended to be a toolkit to help project managers and implementing counterparts (such as extensionists, government and non-government field workers, and private- and public-sector development consultants, community organizers and leaders of local groups) to facilitate the integration of gender issues into the project cycle.
Gender policies for responsible fisheries – Policies to support gender equity and livelihoods in small-scale fisheries. New Directions in Fisheries (2007)	Policy brief, factsheet or backgrounder	FAO	www.fao.org/3/a-a0990e.pdf	
Good practice policies to eliminate gender inequalities in fish value chains	Policy brief, factsheet or backgrounder	FAO	www.fao.org/docrep/019/i3553e/i3553e.pdf	
Mainstreaming gender into project cycle management in the fisheries sector. Field manual	Guide, toolkit or manual	FAO	www.fao.org/docrep/014/ba0004e/ba0004e00.htm	
Sustainable fisheries and aquaculture for food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security	Policy brief, factsheet or backgrounder	FAO	www.fao.org/3/a-i3844e.pdf	
Gender and forestry				
Forests, food security and gender: linkages, disparities and priorities for action	Policy brief, factsheet or backgrounder	FAO	www.fao.org/docrep/018/mg488e/mg488e.pdf	

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender and land tenure				
Gender and Land Rights Database (GLRD)	Database	FAO	www.fao.org/gender/landrights/en/	Easy access to up-to-date information on gender and land rights. Gender differentiated rights to land affect rural food security and nutrition as well as the well-being of rural families and individuals. The database provides an easily accessible learning platform on different factors that relate to gender inequalities embedded in land rights. The database can present information on country profiles, gender and land-related statistics and the recently-developed legal assessment tool (LAT).
Gender and Land Rights: Policy Brief	Policy brief, factsheet or backgrounder	FAO	www.fao.org/docrep/012/al059e/al059e00.pdf	Topics include: women's access to land, disparities, enforcement and advocacy, legal provision, sustainability, and improving gender equality.
Governing land for women and men: A technical guide to support the achievement of responsible, gender-equitable governance of land tenure	Guide, toolkit or manual	FAO	www.fao.org/docrep/017/i3114e/i3114e.pdf	
Gender and legal rights				
CEDAW: a tool for gender-sensitive agriculture and rural development policy and programme formulation	Guide, toolkit or manual	FAO	www.fao.org/docrep/017/i3153e/i3153e.pdf	
Gender and law: Women's rights in agriculture (Revised 2007)	Flagship Publication	FAO	ftp://ftp.fao.org/docrep/fao/005/y4311e/y4311e00.pdf	This document analyses the gender dimension of agriculture-related legislation, examining the legal status of women in three key areas: rights to land and other natural resources; rights of women agricultural workers; and rights concerning women's agricultural self-employment activities, ranging from women's status in rural cooperatives to their access to credit, training and extension services.
Gender and livestock				
Understanding and integrating gender issues into livestock projects and programmes	Guide, toolkit or manual	FAO	www.fao.org/docrep/018/i3216e/i3216e.pdf	

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender and rural institutions /organizations				
CoOpequity tools for gender-sensitive organizational development in producers' organizations and cooperatives	Guide, toolkit or manual	FAO	www.foodsec.org/web/what-we-do/coop-equity/about/en/ www.fao.org/fileadmin/templates/dimitra/pdf/dim_24_e_p14-15.pdf	CoOPequity is an approach developed by FAO within the framework of the EU/FAO Global Governance for Hunger Reduction Programme to strengthen governance, equity and gender-equality within Producers' Organizations (POs). The CoOPequity toolbox includes: 1) gender-sensitive assessment tools for analysing the extent to which gender issues are taken into account in POs; 2) training modules for gender-sensitive organizational development, such as a Facilitator's guide for gender-sensitive organizational analysis of POs, a training module on Governance, Gender Equality and Equity within POs, a training module on development, management and marketing for women and youth groups, on leadership in rural organizations with a special focus on youth and women, as well as on negotiation skills for POs; and 3) guidelines and training modules on multistakeholder platforms for policy dialogue involving POs. The toolbox is accompanied by a series of case studies illustrating the use of each of the tools in different countries and contexts.
Rural women producers and cooperatives in conflict settings in the Arab States	Policy brief, factsheet or backgrounder	FAO, IFAD, ILO	http://labordoc.ilo.org/record/419912?ln=fr	
Gender and rural livelihoods				
Gender Dimensions of Agricultural and Rural Employment: Differentiated Pathways out of Poverty	Flagship Publication	FAO, IFAD, ILO	www.fao.org/docrep/013/i1638e/i1638e.pdf	This document gathers the most important data and issues presented and discussed at a technical workshop (held in Rome, in 2009), on the gender dimensions of rural employment. It combines empirical data and good practices based on national and international experiences on the gender dimension of rural and agricultural employment. Specifically, it presents an overview of the issues related to gender equality and rural employment for poverty reduction, including the construction of a gender analytical framework across regions and contexts. It also identifies appropriate policy responses and gender-based constraints to the achievement of decent work for all. Further, the document outlines and analyses key issues from the forty papers presented at the workshop, and provides abstracts of all those papers. A selection of six workshop papers are presented, covering thematic areas of particular relevance to discussions about gender and rural employment.
Women and Rural Employment: Policy Brief	Policy brief, factsheet or backgrounder	FAO	ftp://ftp.fao.org/docrep/fao/012/ak485e/ak485e00.pdf	Topics include: labour and pay, obstacles to women's employment, women's contributions, and redefining gender roles.

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender and Rural Employment Policy Briefs (1-7)	Policy brief, factsheet or backgrounder	FAO	www.fao-ilo.org/index.php?id=23862	This series of Gender and Rural Employment Policy Briefs complements these findings by addressing a range of issues faced by rural women in their work environment. Intended for various public and private stakeholders, the briefs were inspired by insights from the 2009 FAO-IFAD-ILO Workshop on "Gaps, trends and current research in gender dimensions of agricultural and rural employment: differentiated pathways out of poverty." • Policy Brief 1: Gender-equitable rural work to reduce poverty and boost economic growth • Policy Brief 2: Investing in skills for the socio-economic empowerment of rural women • Policy Brief 3: Rural women's entrepreneurship is "good business"! • Policy Brief 4: Agricultural value chain development: Threat or opportunity for women's employment? • Policy Brief 5: Women in infrastructure works: Boosting gender equality and rural development! • Policy Brief 6: Making migration work for women and men in rural labour markets • Policy Brief 7: Breaking the rural poverty cycle: Getting girls and boys out of work and into school
Decent rural employment for food security: A case for action	Policy brief, factsheet or backgrounder	FAO	www.fao.org/docrep/015/i2750e/i2750e00.pdf	
Gender and water				
Passport to Mainstreaming Gender in Water Programmes: Key Questions for Interventions in the Agricultural Sector	Guide, toolkit or manual	FAO	www.zaragoza.es/contenidos/medioambiente/onu/1018_eng_mainstreaming_gender_water_programmes.pdf	This booklet was developed for field staff involved in water management projects. The ultimate beneficiaries are women and men in rural areas who will profit from equal and efficient water distribution, leading to higher yields, improved food security and poverty reduction. The passport focuses on six main issues related to water programmes for agriculture: 1) access to land and water; 2) farming context; 3) multiple use of water; 4) management of irrigation systems; 5) water distribution, irrigation practices and maintenance; and 6) other environmental issues, with specific questions to guide the users in addressing the gender aspects.

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender in food and nutrition security, agriculture and rural development				
E-Learning Course on Gender in Food and Nutrition Security	E-learning course	FAO	www.fao.org/fsnforum/news/new-fao-e-learning-gender-food-and-nutrition-security	This course was developed by FAO with the support of the European Commission to meet the needs of policymakers in ministries, project staff, statisticians and other stakeholders, such as civil society, private sector organizations, university students and staff from international and national organizations wishing to update their knowledge and skills and to be able to formulate, implement and monitor gender-responsive policies, programmes and projects, and produce gender statistics. It features practical tools, case studies and lessons learned from past development and humanitarian interventions. The modular design allows for self-paced learning so that learners can pick and choose individual lessons to build specific skills depending on their work-related responsibilities, tasks and interests.
State of Food and Agriculture 2011: Women in Agriculture: Closing the gender gap for development	Flagship Publication	FAO	www.fao.org/3/i2050e/i2082e00.pdf	FAO's major annual flagship publication aims to bring balanced, science-based assessments of important issues in the field of food and agriculture to a wider audience. The 2011 edition focuses on the contribution of women to agriculture and provides up-to-date data on the situation between women and men across different regions.

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Gender in Agriculture Sourcebook	Flagship Publication	FAO, Word Bank, IFAD	http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook.pdf	The Sourcebook is a guide for practitioners and technical staff in addressing gender issues in: 1. Gender and Food Security 2. Gender and Agricultural Livelihoods: Strengthening Governance 3. Gender and Rural Finance 4. Gender Issues in Land Policy and Administration 5. Gender and Agricultural Markets 6. Gender Mainstreaming in Agricultural Water Management 7. Gender in Agricultural Innovation and Education 8. Gender Issues in Agricultural Labour 9. Gender in Rural Infrastructure for Agricultural Livelihoods 10. Gender and Natural Resources Management 11. Gender and Crises: Implications for Agriculture 12. Gender in Crop Agriculture 13. Gender in Fisheries and Aquaculture 14. Gender and Livestock 15. Gender and Forestry 16. Gender Issues in Monitoring and Evaluation
UN Joint Programmes: Integrating gender into food security, agriculture, and rural development	Guide, toolkit or manual	FAO	www.fao.org/docrep/013/i1914e/i1914e00.pdf	These guidelines provide practical guidance to support programme and operations staff in UN Country Teams to integrate gender equality concerns into Joint Programmes (JP) for food security, agriculture and rural development. The guidelines outline opportunities to incorporate gender into both the JP process (formulation, implementation and monitoring and evaluation) and project document. They include a general gender equality checklist as well as thematic checklists to mainstream gender in areas of cross-cutting importance for agriculture and rural development. A list of useful resources is also provided.
Good practices in building innovative rural institutions to increase food security	Policy brief, factsheet or backgrounder	FAO	www.fao.org/docrep/015/i2258e/i2258e00.pdf	

Title	Resource type	Organization/ author	Web address(es)	Summary content description
Strengthening Sector Policies for Better Food Security and Nutrition Results: Gender Equality	Policy Guidance Note	FAO and EU	www.fao.org/3/a-i7218e.pdf	The purpose of this guidance note is to support policy officers and other stakeholders in facilitating dialogue to sharpen the focus of gender equality policies for food security and nutrition. It does this by exploring the interrelationships between gender equality, food security and nutrition; interrogating how policies around gender equality and women's empowerment influence food security and nutrition outcomes; and identifying the policy changes that are needed to ensure greater synergy between the GEWE, and food security and nutrition policy agendas so as to accelerate progress on both fronts.
Gender in Agriculture website	Website/online platform	FAO, IFAD, World Bank	www.genderinag.org/	This online forum is designed to provide access to resources, tools and information, which can help practitioners and other stakeholders mainstream gender into agricultural development.
Gender in Agriculture	Guide, toolkit or manual	FAO, IFPRI, World Bank, ACDI/ VOCA, UNWOMEN	www.genderinag.org/content/e-learning-course	In a joint collaboration with Michigan State University, the Gender in Agriculture (GiA) Sourcebook (2008) has been transformed into an e-learning course. The course is composed of 17 modules, ranging from primary production to natural resource management and access to markets and services.
Gender in rural development and agricultural policy				
A tool for gender-sensitive agriculture and rural development policy and programme formulation: Guidelines for Ministries of Agriculture and FAO	Guide, toolkit or manual	FAO	www.fao.org/docrep/017/i3153e/i3153e.pdf	
Women's economic empowerment				
Expert meeting on "Enabling rural women's economic empowerment: Institutions, opportunities and participation"	Policy brief, factsheet or backgrounder	FAO, IFAD, WFP	www.un.org/womenwatch/daw/csw/csw56/egm/Report_EGM_RW_FINAL.pdf	

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Annex 4

Fisheries policy and investment strategy in the Caribbean region

Acronyms and abbreviations

APSP	Agricultural Policy and Strategy Paper
BII	Blue Innovation Institute
BMCs	Borrowing Member Countries
BNTF	Basic Needs Trust Fund
CARICOM	The Caribbean Community
CCCFP	Caribbean Community Common Fisheries Policy
CDB	Caribbean Development Bank
CDRRF	Community Disaster Risk Reduction Fund
CERMES	Centre for Resource Management and Environmental Studies
CFTDI	Caribbean Fisheries Training and Development Institute (
CIF	Climate Investment Fund
CLME	Caribbean Large Marine Ecosystem
CLME+ SAP	Caribbean Large Marine Ecosystem Plus Strategic Action Programme
CNFO	Caribbean Network of Fisherfolk Organizations
COPESCAALC	Commission for Inland Fisheries and Aquaculture for Latin America and the Caribbean
CRFM	Caribbean Regional Fisheries Mechanism
CS	Continental States
CSME	CARICOM Single Market and Economy
CSOs	Civil Society Organizations
CTCS	Caribbean Technological Consultancy Services
DFIs	Development Finance Institutions
ECROP	Eastern Caribbean Regional Ocean Policy
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FSMA	Food Safety Modernization Act
GEF	Global Environment Facility
ICCAT	International Commission for the Conservation of Atlantic Tunas
IFIs	International Financial Institutions
IUU	Illegal, Unreported, and Unregulated
JICA	Japan International Cooperation Agency
LIS	Large Island States
LMEs	Large Marine Ecosystems
MCS	Monitoring, control and surveillance of fisheries
MME	Mid-Market Enterprise
NAPs	National Adaptation Plans
NDRM	Natural Disaster Risk Management
OECS	Organisation of Eastern Caribbean States
OLDEPESCA	Latin American Organization for Fisheries Development
OSPESCA	Central America Fisheries and Aquaculture Organization
PM&E	Participatory Monitoring and Evaluation
PPCM	Permanent Policy Coordination Mechanism
PPP	Public-Private Partnership
R&D	Research and Development

RAA	Aquaculture Network of the Americas
RFBs	Regional Fishery Bodies
RFMO	Regional Fisheries Management Organisation
SDGs	Sustainable Development Goals
SIS	Small Island States
SME	Small- and medium-sized enterprise
TA	Technical Assistance
TCI	Investment Centre Division
UKCIF	UK Caribbean Infrastructure Fund
UNDP	United Nations Development Programme
WECAFC	Western Central Atlantic Fishery Commission

1. Background

Since its inception, the Caribbean Development Bank has identified the development of the agriculture and fishery sectors in its Borrowing Member Countries (BMCs[1]) as one of its main priorities. Consistent with the Bank's Charter, the approach to supporting the development of these sectors has been to lend directly to governments and private enterprises, or indirectly to private enterprises through national Development Finance Institutions (DFIs). Through its Technical Assistance (TA) programmes, the Bank also provides financing to governments, national and regional agricultural support institutions, and non-governmental organizations to implement a wide range of sector development activities.

The majority of the Caribbean Development Bank's BMCs have achieved key development milestones in the post-independence era, including relatively high human development indices and middle-income status. Nonetheless, as reflected in the CDB's Strategic Plan 2015–2019, BMCs continue to face significant socio-economic challenges. These include low and variable economic growth; unsustainable debt and weak fiscal management; high unemployment; high incidence of non-communicable diseases; vulnerability to the effects of climate change and natural hazards; environmental degradation; crime and increasing threats to citizen security; and persistent and extreme poverty and food insecurity. Gender imbalances are pervasive in most of these socio-economic challenges.

Currently, two strategic CDB documents address the fisheries sector: (1) the *Agricultural Sector Strategy*, launched in April 1981, which does not tackle the sector in detail and is currently under review; and (2) *Financing the Blue Economy: A Caribbean Development Opportunity* (2018) – a joint initiative between CDB and the United Nations Development Programme (UNDP) – which presents a comprehensive vision for the Blue Economy Strategy and its potential to drive sustained and inclusive economic growth, including the fisheries sector as one of the targeted industries.

In light of the above, CDB has requested the Food and Agriculture Organization's (FAO) Investment Centre Division (TCI) to assist the Bank in reviewing its current investment strategy for the fisheries sector as part of its larger agricultural investment strategy review.

2. Objectives and methodology

The overall objective of the Working Paper is to support CDB in the revision of its Agricultural Policy and Strategy Paper (APSP), including the fisheries sector. The APSP will focus on strategically prioritizing investment themes for CDB, based on identified sector development gaps and synergies

1 Anguilla, Antigua and Barbuda, Barbados, Belize, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, The Bahamas, Trinidad and Tobago, Turks and Caicos Islands.

with sector regulation, policies and governance bodies as well as the strategic approaches and interventions of other development institutions.

The work was done in two Phases:

- Phase 1 consisted of a literature review and general findings upon which further work was developed. The Draft Report from Phase 1 was completed in July 2018 and contributes to the formulation of the Terms of Reference for Phase 2.
- Phase 2 elaborates further on the findings of the Phase 1 report, and on the paper "Financing the Blue Economy: A Caribbean Development Opportunity." Where possible, Phase 2 aligns with strategic sector documents, such as the CLME+ SAP[2] initiatives on identified constraints and opportunities, so as to define strategic guidance that facilitates an environment conducive to sustainable fisheries sector development.

The investment strategy envisaged will adopt a comprehensive approach that addresses the constraints encountered by public and private stakeholders in the fisheries sector, as well as public institutions mandated to support sector development.

The Phase 1 Report and CDB and UNDP paper, *Financing the Blue Economy: A Caribbean Development Opportunity,* highlights key areas with the potential to inform the CDB's fishery sector investment strategy, including the following:

- developing regional and national level policy and enhancing implementation capacities, which directly impact sustainable resource management and the long-term viability of the sector, as well as climate-smart and mitigation strategies;
- developing aquaculture as a source of sustainable income and nutrition for local communities and a new source of sustainable economic revenue for the state; and
- improving value chain efficiencies and adding value to the artisanal fisheries sector through strategic and sustainable policies and initiatives.

This study provides an overview of the fisheries sector in the Caribbean, highlighting key investment opportunities to support sector development. The methodology is based on a review of background documentation and a series of in-country key informant interviews, both at regional and national levels.

The national level analysis highlights the key differences in strategic investment areas and approaches between the following sub-groups of countries:

- **Small Island States (SIS)**, such as Grenada;
- **Large Island States (LIS)** such as Jamaica;
- **Continental States (CS)**, such as Guyana; and
- a separate **focus on Haiti,**

2 For more information, see: www.clmeproject.org/category/clme-sap/

3. The fisheries sector as part of the Blue Economy paradigm

The fisheries sector is an integral part of the new Blue Economy paradigm. The Blue Economy concept is not about the rebranding of traditional sectors; rather, it is about fundamentally reforming the approach to managing and developing ocean resources in a holistic and comprehensive way. Specifically, the paradigm encapsulates all sectors and economic activities that take place within, or use resources from, the oceans or seas, and views them as interconnected activities that cannot be developed in isolation, or in a mutually exclusive manner. The economic value of the seas and oceans is central to the Blue Economy concept, which can allow for more comprehensive and holistic decision-making towards sustainable growth.

Although it is among the oldest traditional activities of the Caribbean island states, the fisheries sector is less economically dominant than the lucrative tourism, transport or mining sectors. As a result, the fisheries sector has often received less political and investment support. However, the emerging Blue Economy paradigm offers an opportunity to re-evaluate this balance.

In Financing the Blue Economy, CDB (2018) outlines the key challenges to transitioning to a new paradigm with regard to the following: institutions (integrated policy framework and valuation of resources); resources (skills and financing); output (negative spill-overs, such as the contraction of informal sectors and unemployment); and the integration of responsibilities and benefits (intensification of regional and national cooperation and coordination among industries).

The Fisheries Policy of CDB will tackle these challenges in a multisectoral and holistic manner that reflects the shift towards the Blue Economy paradigm, which calls for a broader economic valuation of the aquatic space and the prerequisites for sustainable operationalization of the economic shift.

By catalysing support for the fisheries sector in the region, the Blue Economy can strengthen the ability of the CDB's Borrowing Member Countries (BMCs) to achieve key Sustainable Development Goals (SDGs): poverty reduction/eradication (SDG 1); zero hunger (SDG 2); clean water and sanitation (SDG 6); affordable and clean energy (SDG 7); decent work and economic growth (SDG 8); climate action (SDG 13); and life below water (SDG 14).[3]

3.1 What tangible opportunities does the Blue Economy approach present for fisheries sector development across the region?

Shifting towards a sustainable Blue Economy has the potential to put the fisheries sector back on the region's political and economic agenda. What renders the fisheries sector unique is the transboundary nature of many harvested resources; thus, natural resource management in the sector requires both a national and regional perspective.

Fisheries sector development can be approached not only considering the interplay with other sectors (which also need to revise their models), but also as an economic activity that can only be developed sustainably in the context of closer regional collaboration and coordination. In this regard, the Blue Economy approach presents BMCs with tangible opportunities to collectively and simultaneously focus on regional and national level governance, institutional development, communication and

3 For more information on the SDGs, see: www.un.org/sustainabledevelopment/sustainable-development-goals/

coordination, as well as the value chain investment needs of specific sectors. The following principles can help BMCs unlock the potential of the fisheries sector within the context of the Blue Economy:

- Review the sectors economic value in a comprehensive way, assigning a more accurate worth to the harvested resources, linked industry and its dependents, as well its contribution to healthy diets and sustainable food systems;
- Build and strengthen sector governance institutions and mechanisms to ensure improved sector management, and increased participation in multisectoral planning and development;
- Leverage financing and technical expertise across sectors to address challenges while simultaneously ensuring investments and resultant actions are sustainable in the long term;
- Evaluate potential spill-overs and trade-offs, such as the contraction of informal sectors leading to increased unemployment and potential offset options through new or alternative industries or investment;
- Develop cross-sectoral targeting strategies to ensure that trade-offs do not represent gain for one at the expense of another, but maintain social and economic justice in the economic transformation process;
- Widen intersectoral integration and the sharing of responsibilities and benefits linked to the ocean economy by intensifying regional and national cooperation and coordination among industries.

The Blue Economy paradigm has the potential to raise the fisheries sector's profile: (1) increasing its visibility through a comprehensive valuation of the sector's inputs and outputs within the wider ocean economy; and (2) recognizing its overall contribution to economic and social stability. As part of an interlinked system of industries, the fisheries sector will also benefit from a wider range of investment and diversification options based on a holistic, economic and social approach.

The intersectoral nature of the concept further supports the need for an ecosystem approach to fisheries (EAF), which would allow the development of a comprehensive fishery management system. Specifically, the ecosystem approach to fisheries seeks the sustainable and equitable use of the entire system (both ecological and human) to best meet the community's needs and values; it is aimed at contributing to a more socially and economically balanced understanding of the trade-offs that the sector must consider to ensure sustained ecosystem health and form the basis for long-term fisheries sector development.

Governments across the Caribbean are gradually making the shift towards applying these new concepts. Grenada, for example, has established the Blue Innovation Institute (BII), which is a new and unique international entity with a mission to deliver, at speed and at scale, the innovations now needed to turn the tide on ocean health concerns, while delivering associated prosperity and food security. The Blue Innovation Institute operates on three levels across four thematic areas and two cross-cutting themes (UN Ocean Conference, 2017). Out of the four substantive themes that the Blue Innovation Institute will tackle, two are directly relevant to fisheries development: (1) Coastal and Marine Spatial Planning; and (2) Food Security, with specific emphasis on aquaculture. Although the institute is still under development, CDB could support the Blue Innovation Institute's work in the thematic areas, providing technical assistance and promoting targeted investments across the region.

Barbados offers another regional example of the shift toward a Blue Economy, becoming the first country to create a new Ministry of Maritime Affairs and the Blue Economy, which will pioneer a new governance approach to conserving, managing and developing ocean resources.

These new institutions – centred on the Blue Economy approach – require support in creating effective multisectoral policy platforms, where sector silos are broken down, thus ensuring cohesiveness and

strong linkages between sectors and issues that concern fisheries, tourism, maritime transport, renewable energy and climate change.

In view of these priorities, CDB should focus both public and private sector financing towards the effective advancement of the Blue Economy agenda.

3.2 What type of strategic and targeted investments within the Blue Economy context can best ensure fisheries sustainability and growth?

Scaling up Blue Economy activities through strategic and targeted investments can ensure long-term, sustainable fishery sector growth in BMCs. The Caribbean Development Bank is well positioned to support BMCs in their efforts to not only embrace the Blue Economy approach, but to also target key development bottlenecks, constraints and opportunities in order to ensure maximum investment impacts.

Promoting the shift from traditional sector and governance models towards the more comprehensive and holistic model of the Blue Economy will be based on a number of guiding principles, including the following:

Marine spatial planning and sector valuation

- Support efforts to promote integrated (participatory) marine spatial planning, which not only serves to stocktake and delimit activity areas, but can also be used as the basis for resolving issues regarding tenure, rights of access, and the sustainable use of marine resources by multiple users.
- Conduct a comprehensive valuation of the economic and social benefits of the fisheries and aquaculture sector to support long-term, sustainable development plans and ensure inclusive social and economic growth.

Regional and national level support for representative governance mechanisms and intersectoral coordination

- Strengthen and create processes and mechanisms for sector planning at both regional and national levels, such as representative and multi-stakeholder platforms to inform and support policy development and sector plans.
- Extend financing and support efforts and initiatives to promote and strengthen co-management arrangements that govern resource use and share, as well as determine, rights and responsibilities among stakeholders. Despite some efforts to this end, the fisheries sector across the region faces challenges due to insufficient coordination and limited sector representative bodies, which enable industry and other stakeholders to engage in policy discussion with a single strong voice. Support for the creation and capacity-building of such representative bodies is an important strategic intervention that CDB should consider so as to promote equitable and just growth.

Investment in economic valuations and the design of fair and targeted trade-offs

- Conduct comprehensive economic valuations with linked in-depth socio-economic research and value chain assessments to characterize the various Blue Economy sectors.
- Identify opportunities for growth and their respective sustainable investment opportunities, with the support of CDB financing and technical assistance. This type of support is aimed at ensuring the well targeted and fair design of economic and sustainable environmental trade-offs between sectors, envisaged under the Blue Economy interlinkages. For example, initiatives that limit fishing activities can be offset by the tourism industry through marine parks, high-value and

inclusive recreational fishing, visitor attractions, and other land-based and community events that engage the same target communities (CDB, 2018).

Promotion of public-private partnerships as a means of enhancing overall governance and sustainable investment

- Create multi-stakeholder platforms that cut across sector silos and offer holistic and comprehensive solutions to development challenges.
- Target support towards innovative public-private partnerships, which are aimed at complementing public and private sector strengths in delivering sustainable results-based policy, supporting research and research-informed practices, as well as collaborating on improving governance capacity along the value chains – from stock management to trade and food security enablers. Such partnerships could also include key civil society organizations (CSOs) as a means of enhancing governance and investment.

Innovative intersectoral partnerships and value networks

- View the sectors within the Blue Economy as part of a value network or an economic ecosystem, where members rely on each other to foster growth and increase value, and where weakness in one node can affect the entire network. For example, if maritime transport linkages are weak, regional fisheries trade linkages and exchange will remain fragmented.
- Support initiatives for intersectoral partnerships – with sustainability at their core – which are aimed at improving current sector inefficiencies, such as improved energy use, greening options, and optimised transport linkages (that are in line with regional fisheries trade needs or innovative tourism packages incorporated into the fishing industry and vice versa).
- Create national level intersectoral coordination mechanism linking all the different sectors and stakeholders to ensure the successful implementation of the Blue Economy approach.
- Promote innovations that offer a holistic regional or national level economic approach to the sustainable management of the environment, thus improving social and economic resilience and societal well-being.

4. Caribbean fisheries – Issues and root causes

The Caribbean fisheries sector faces a number of challenges, including unsustainable fisheries practices, habitat degradation, pollution, and climate change. However, identifying key sector constraints – along with their root causes – can help inform CDB's investment policy and strategy for the fisheries sector, and strengthen strategic areas of intervention through further targeted and strategized financing support.

Many guiding regional fisheries analysis and plans highlight the issues facing the fisheries sector, including the Caribbean Large Marine Ecosystem Plus Strategic Action Programme (CLME+ SAP), produced by the Caribbean Large Marine Ecosystem (CLME) Project; the Caribbean Regional Fisheries Mechanism (CRFM) Strategic Plan; and the Blue Innovation Institute. FAO (2018) research supports the

view that unsustainable fisheries, habitat degradation, and pollution not only have a negative impact on the fisheries sector, but they are also exacerbated by the impacts of climate change.

Numerous root causes for these challenges have been identified, including:

- inadequate knowledge and understanding of core dynamics, such as climate change impacts on marine resources and the environment;
- ongoing political pursuits of short-term harvest gains through unsustainable fishing capacity developments;
- limited political prioritisation of sector development needs;
- lack of data for adequate stock assessments;
- significant illegal, unreported, unregulated (IUU) fishing in the region;
- inadequate consideration of the long-term value of self-replicating ecosystem goods and services;
- lack of effective regional collaboration of the management and development of an intrinsically shared natural and economic space;
- weak governance of marine, coastal and fishery resources;
- limited human, technical and financial resources;
- inadequate public awareness and participation in the governance process; and
- inadequate trade and development policies incorporating the fisheries sector (UNDP and GEF CLME+ Project, 2013).

Much like agriculture, fisheries suffers from an outdated vision of a subsistence sector that does not offer attractive opportunities to youth and industry (Romuld and Bammann, 2018). There is a fundamental need to modernise the sector narrative in parallel with tackling the root causes of its development constraints.

5. Regional fisheries governance and collaboration

The wider region constitutes one of the most geopolitically diverse and complex sets of large marine ecosystems (LMEs) in the world, being shared by 26 independent states and more than 10 dependent territories. Its geopolitical fragmentation is at loggerheads with the management and development needs of the highly transboundary marine resources as well as of the problems affecting them.

It is therefore of crucial importance to transcend this fragmentation by enhancing the cooperation among countries and stakeholders in the identification and implementation of solutions for the key issues affecting the sector and their root causes.

In order to ensure sustainable societal benefits – at regional, national and local levels – it is therefore imperative that the region continues to progress towards the stepwise implementation of an

integrative regional framework for shared living marine resources governance and management, based on the ecosystem approach (UNDP and GEF CLME+ Project, 2013).

5.1 Regional institutions mandated to manage sector development

The drive towards regional collaboration is in line with CDB's Charter and its commitment to supporting regional economic integration. Various financing and lending mechanisms as well as technical support services can be made available to assist in the creation of a regional level management framework that guides and supports national level investment and development.

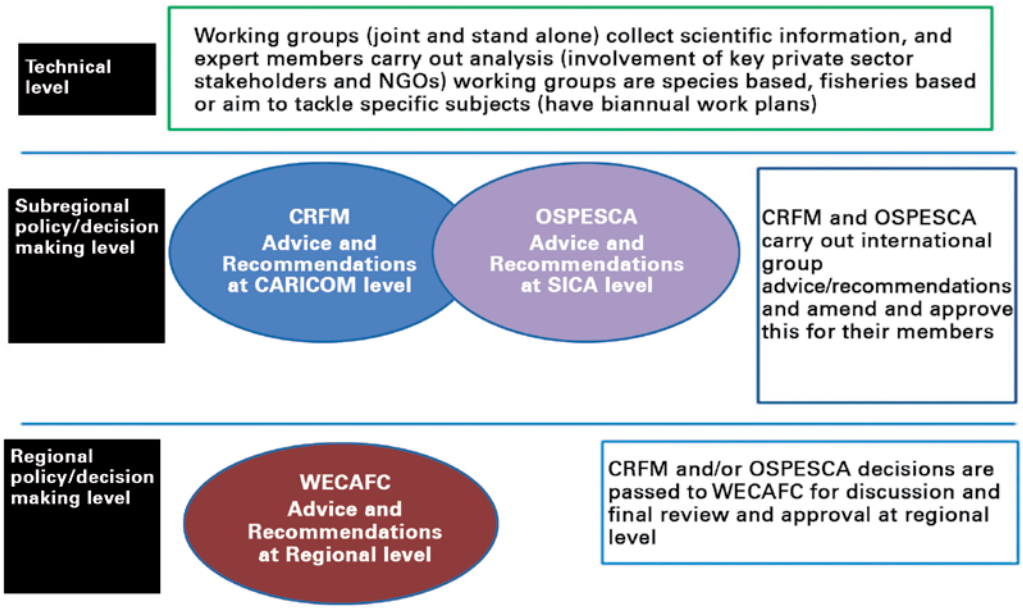
Efforts for integrated regional solutions have been underway for a number of years and with various financial and technical support. Among the various regional fishery bodies (RFBs), the key active entities in the region include the following:

- Western Central Atlantic Fishery Commission (WECAFC);
- Central America Fisheries and Aquaculture Organization (OSPESCA);
- Latin American Organization for Fisheries Development (OLDEPESCA);
- Aquaculture Network of the Americas (RAA);
- Commission for Inland Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC);
- Caribbean Regional Fisheries Management (CRFM); and
- Caribbean Network of Fisherfolk Organization (CNFO).

The CLME+ Strategic Action Program (CLME+ SAP) recommends the establishment of an interim arrangement for sustainable fisheries, such as the creation of a regional fisheries management organisation (RFMO). FAO has assessed the possibilities of forming the WECAFC into an RFMO and found it both feasible and necessary to ensure sustainable fisheries in the region. However, countries have not yet approved the formation of this RFMO.

The interim arrangement between CRFM, OSPESCA and WECAFC – which is currently being tested – and a transformation of WECAFC into an RFMO, would build on the on-going collaboration that has been established through a Memorandum of Understanding (MoU) between CRFM, OSPESCA and FAO/WECAFC on CLME+ Interim Coordination for Sustainable Fisheries. The establishment of an innovative RFMO, maintaining strong ties with CRFM and OSPESCA, would be in line with the CLME+ SAP (FAO, 2016).

Figure 1. Interim Fisheries Management Framework.



Source: FAO (2016).

A technical report including a proposal for a regional governance framework (RGF) and an overview of key regional organisations with a shared stake in sustainable living marine resources management has been prepared for the CLME Project by the Centre for Resource Management and Environmental Studies (CERMES) (UNDP and GEF CLME+ Project, 2013). Efforts by BMCs to deliver on the RGF proposal should be considered as a strategically important investment in fisheries development across the region.

In addition, CLME+ has recently proposed a Permanent Policy Coordination Mechanism (PPCM), which is aimed at coordination across sectors. The Caribbean Development Bank should therefore consider the strategic importance of investing in the financing and technical support needed for the establishment of an RFMO and a PPCM, which can drive the regional development agenda.

5.2 Regional regulatory mechanisms

In order to capitalize on potential institutional synergies and build on existing experience and progress, CDB policy and investment for the fisheries sector should be aligned, as much as possible, with the objectives and activities agreed in the key regional strategies and policies. Specifically, CDB investment guidance will draw upon the priorities highlighted in the following agreements, while lending should be aimed at supporting the implementation and effectiveness of regional commitments.

Key guidance for CDB sector support

CLME+SAP

The Strategic Action Programme (SAP), produced by the Caribbean Large Marine Ecosystem (CLME) Project, is a key strategic document endorsed by the region, designed to guide fisheries policy and investment.

Caribbean Community Common Fisheries Policy (CCCFP)

The CCCFP is an effort to establish a Common Fisheries Policy and Regime at the Caribbean Community (CARICOM) level. It is a policy that is in line with international and regional best practices and other instruments and agreements on fisheries and aquaculture. Therefore, the CCCFP will make a major contribution to the efficient management and sustainable development of marine and other aquatic resources (CRFM, 2013).

Castries (Saint Lucia) Declaration on Illegal, Unreported and Unregulated Fishing

The Declaration on Illegal, Unreported and Unregulated Fishing was issued by the CRFM Ministerial Council, held in Castries, Saint Lucia on 28 July 2010. The declaration stressed that IUU fishing is practiced by both local and foreign vessels and recognized that national, regional and global cooperation is necessary to effectively prevent, deter and eliminate IUU fishing (CRFM, 2013).

Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines)

The SSF Guidelines address the diversity of development issues surrounding small-scale fisheries in an integrated manner, including the consideration of social protection mechanisms for fisherfolk – an issue commonly overlooked in past sector development plans (FAO and CDB, 2018).

Eastern Caribbean Regional Ocean Policy – Organisation of Eastern Caribbean States (OECS)

The Eastern Caribbean Regional Ocean Policy – put forth in 2013 – is to promote and guide the future sustainable use and development of the region's marine waters and resources. The document outlines the key threats and challenges faced by policymakers and managers; the basis for the national policy; a future Vision for the ocean; and a suggested set of principles, and goals for ocean governance in the Eastern Caribbean Region. The document also highlights a number of options for institutional reform towards implementing the regional policy (OECS, 2013).

The CARICOM Single Market and Economy (CSME)

In the Grande Anse Declaration and Work Programme for the Advancement of the Integration Movement, Heads of Government expressed their determination to work toward establishing a single market and economy. The CARICOM Single Market and Economy is intended to benefit the people of the region by providing more and better opportunities to produce and sell goods and services, and to attract investment. One large market will be created among the participating member states with the following objectives:

- full use of labour (full employment) and full exploitation of the other factors of production (natural resources and capital); and
- competitive production leading to a greater variety and quantity of products and services to trade with other countries.

It is expected that these objectives will in turn provide improved standards of living and work and sustained economic development. A key element of the Single Market and Economy is the free movement of goods and services – through measures such as eliminating all barriers to intra-regional movement and harmonizing standards to ensure the acceptability of goods and services traded (CARICOM, 2018).

Finally, CDB support should be considered to directly promote the implementation of the regionally endorsed fisheries management plans for flying fish, conch, billfish, and lobster. Specifically, CDB financing should respond to the regional and national needs for support in implementing the vision and effective mechanisms set forth in these strategic commitments.

5.3 Current state of fishery sector resources, research and monitoring

Sustainable fisheries sector development requires a deep understanding of the state of the resources, the factors that impact them, and the management responses needed to ensure long-term, sustainable growth. According to an FAO (2011a) global review, the Caribbean region had the highest proportion of overfished stocks, and the regional harvest trend has continued to decline over the past 30 years (FAO, 2016). These concerning statistics highlight the urgency to secure fishery sustainability in this region.

Stock assessments for some commercially valuable species are available, though only under certain programmes, projects and initiatives. Data collection on general fish stocks is lacking and there is no clear system in place for the consistent collection of key data across the region. However, a data collection strategy would facilitate long-term monitoring, and could clearly link regional and national level data sets into a coherent picture.

In addition to stocktaking, it is important to understand the environments that support marine resources. There are three main types of marine ecosystems in the region – reefs and associated ecosystems, the pelagic ecosystem, and the continental shelf ecosystem. The reefs are of great importance to the sector and they are the source of high-value species, such as spiny lobster and queen conch, as well as groupers and snappers. The pelagic ecosystem supports small and large coastal and oceanic species, such as tunas, sharks, billfish, turtles, and mammals; the continental shelf supports shrimp and groundfish fisheries, including red snapper and seabob shrimp (FAO and CDB, 2018).

According to FAO and CDB (2018), the fisheries sector in the Caribbean is mostly dominated by near-shore artisanal fisheries, which are generally fully exploited or overfished, and as a consequence, the activities have moved on to selected offshore fishing grounds.

In addition, important commercial species, such as red snapper (*Lutjanus campechanus*) and the Atlantic bluefin tuna (*Thunnus thynnus*) are now threatened according to the red list report by the International Union for Conservation of Nature (FAO and CDB, 2018). The International Commission for the Conservation of Atlantic Tunas (ICCAT) is mandated to manage the highly marketable tuna stocks, as well as the pelagic billfish and sharks also influenced by tuna targeting fleets. Stocks-related research is, however, deficient and does not always answer the needs of the sector. Much of this downfall relates to the lack of data reporting from members of the commission, and in particular, the lack of responsiveness to data requests by some Caribbean states in the commission's last independent performance review (Spencer, Maguire and Molenaar, 2016).

Overall, there is a significant shortage of fisheries and biological data, as well as technical capacities to conduct stock assessments for many commercially valuable species. Despite these industry challenges, there are no regional institutions that carry out systematic and comprehensive analysis of the state of marine stocks or monitor their status. As a result, there is inadequate knowledge and data to inform sector decision-makers.

In addition, research is lacking on the impacts of climate change on regional stocks, species dynamics, and the marine environment. Climate change is expected to affect species behaviour, production and abundance, which may lead to general ecosystem changes; food security, the safety of fisherfolk, and catch per unit of effort are also expected to be negatively affected. The large influxes of sargassum has brought to the fore the impacts of climate change on the marine environment and the lack of understanding of these changes, and how to mitigate related risks or adapt to them.

Considering the challenges facing the fisheries sector in the context of climate change, CDB should give financing priority to research focusing on the impacts of climate change on the marine environment as well as research on potential management measures for sargassum. Financial support should also be given to support the work of WECAFC/OSPESCA/CRFM working groups dealing with the assessment of key resources, such as conch, lobster, shrimp, and flying fish.

6. Key challenges and opportunities for sustainable Caribbean fisheries development

6.1 Challenges and opportunities for investment support and innovation

The sustainable development of the fisheries sector will require coordinated investment support at both regional and national levels. Various lending mechanisms can be employed to address public or private sector needs to enhance current efforts in policy and trade integration, coordination between various institutions and planning efforts. The challenges and opportunities for public sector support are clearly outlined in the regional regulatory mechanisms discussed above and provide guidance for investment priorities.

For example, financing support for CLME+ SAP implementation will help strengthen and expand regional, subregional and national level collaborative governance and living marine resources management efforts. Prioritising SAP financing will also unlock the development and integration of regional, subregional and national projects and initiatives, as well as National Action Plans (NAPs) that can be embedded in and fit under this "Programmatic approach to SAP implementation" (UNDP and GEF CLME+ Project 2013). The formulation of NAPs is under the guidance and support of the CRFM, while lending is focused on the design, adoption and implementation of regulatory policies and mechanisms so as to provide the basis for sector management.

Caribbean Development Bank sector investment planning should be closely aligned with CLME+ SAP financing, consolidating regional multistakeholder efforts and reducing investment risk through the co-financing of endorsed sector development plans and activities. The CLME+ SAP can thus guide both countries and CDB towards priority investments. At the same time, the integration of multiple (donor) efforts under a single Strategic Action Programme is expected to substantially increase the rate of return on such investments, whether these occur at the regional, subregional, national or even local/grassroots level (UNDP and GEF CLME+ Project 2013).

Innovation and experience at subregional level should be communicated and scaled up across the region. Examples include the experience of OECS in advancing the Blue Economy Agenda through its Eastern Caribbean Regional Ocean Policy (ECROP), and the results and impacts of the Blue Innovation Institute in Grenada.

In parallel to the creation and strengthening of regional and national sector representative and management bodies, there is need to improve communications both vertically and horizontally along the fisheries sector as a whole, as well as between the various sectors partaking in the Blue Economy dynamic. Support for a regional communication strategy to this effect would offer an important strategic contribution by CDB in advancing regional integration and coordination efforts.

6.1.1 Investment in closing the gap between international, regional and national policies and strategies for sector development

Investment in regional-level initiatives is important, but it must also be mirrored by national-level lending.

At national level, CDB should extend public sector lending to legal and institutional development that enables the creation of a participatory, coordinated and effective sector management platform.

Public lending will be extended to support countries in the region to formally develop and implement fishery policies, management plans, and laws and regulations; countries will also receive support to put in place capacity for the effective enforcement of these regulations.

Investment and technical assistance priority should be given to the process of strengthening and/or creating representative bodies and effective consultative mechanisms that lead the policy and regulatory development process at the regional and national level.

Important partners in this process include the Caribbean Network of Fisherfolk Organizations (CNFO), and national level organisations (National Fisherfolk Organisation), which are mandated to represent fishers at local and national levels, thus enabling them to take part in sector forums and policy discussions. Apart from the strengthening of fisherfolk organizations, CDB should also target its financing and technical support to sector bodies that bring key stakeholders to the table, such as processors and traders, thereby creating a balanced approach to discussions on different aspects of value chain priorities and needs.

Lending to private sector entities and public-private sector partnership arrangements will be priorities in view of the alignment with national Blue Economy and fisheries sector strategies, and the potential for innovation, demonstration value, replicability and the upscaling of the lessons learned.

Public and private sector lending mechanisms can also focus on financing the creation of fisheries management information systems, which provide the required data and information to inform policy and decision-making (FAO and CDB, 2018).

Strengthening national technical capacity is essential to closing the gap between regional and national implementation. Support is needed for financing mechanisms which not only create opportunities for human resource development, but also correspond to the evolving needs of the sector. This may require dedicated financing mechanisms that offer educational scholarships, and facilitate peer to peer exchange initiatives as well as work experience grants, which jointly contribute to the professionalization of the industry and the strengthening of public sector support services. Such support could include developing appropriate Blue Economy-oriented programmes in tertiary regional institutions, such as UWI-CERMES, for ongoing capacity development and research.

6.1.2 Investment in sector research and capacity development

Investment support for scientific research and capacity building is paramount to sector planning and development, and is crucial for responsible investment. Solutions to resource management involve building capacity and knowledge, which in turn require support for research and development (R&D), and overall capacity development in line with sector needs and absorption capacities.

Reliable research is necessary for the adoption of an evidence-based approach to policy planning and development. In this context, research capacity must go hand in hand with the strengthening of institutional coordination and cross-sector collaboration. The Caribbean Development Bank could support and facilitate such collaborative efforts and promote the creation of a regional science-policy management interface.

At the CARICOM level, members have identified a Priority Commodity Group including marine fish and aquaculture. These priority commodities and associated value chains are to receive special attention and strategic support. For example, CDB would be well positioned to support the financing of the Fishery Industry Analysis and Valuation – solicited by CARICOM to be carried out by CRFM – which will feed into the National Fisheries Plan and value chain development effort (also largely guided by CRFM and CDB financing).

Similarly, regional partners, such as the Caribbean Fisheries Training and Development Institute (CFTDI) in Trinidad and Tobago – which offers seafood technology and maritime courses – should also be supported by CDB to harmonize and upgrade training curricula across the Caribbean.

Lending for the establishment of innovative public-private partnerships is a vehicle for the professionalisation and upgrade of the sector, and should therefore be encouraged. These partnerships can create private sector buy-in, raising the credibility and relevance of the information generated as well as its incorporation directly into industry behaviour, decision-making and operations.

In addition to fisheries and environmental science research, the current gap in socio-economic research and analysis must be prioritised. An important partner for CDB in addressing this issue can be CERMES, as the centre is equipped to lead efforts in this direction and can network with other institutions, such as Saint George's University in Grenada.

In addition, new and growing fields, such as the use of sustainable technologies and renewable energy along fishery value chains, are essential for unlocking the sector's potential. The greening of the sector is in line with the CDB Renewable Energy Policy and Division objectives, and should therefore be supported.

6.1.3 Aquaculture development support

According to the CRFM's assessment of aquaculture, the sector is not well developed in the CARICOM region, with significant development limited to certain countries, such as Belize and Jamaica. Other countries – including Guyana, Haiti, Trinidad and Tobago, and Suriname – have begun placing more emphasis on aquaculture as an area for development. The practices mainly involve the use of ponds to culture such species as penaeid shrimp, tilapia, carp and cachama (pacu). There is also long-line culture for algae in Saint Lucia and the mangrove oyster in Jamaica. Overall, total aquaculture production in Caribbean countries is very small, estimated at 28 500 tonnes in 2011, with a declining trend over the years (CRFM, 2013).

Aquaculture requires a different approach from fisheries, as it is a fundamentally different type of industry. It presents a range of opportunities for technical and economic diversification in various activities, such as land-based fish production, or the mariculture of seaweeds and other marine species (CDB, 2018). The many different marine or land-based production systems require access to various resources and support facilities. Different production systems target different producer groups, with land-based systems traditionally attracting more farmers than fishers and having to be considered as part of a different household economic portfolio.

There are many technical solutions to aquaculture development, some of which are in the pilot stage. Therefore, support is needed to analyse these potential solutions, considering their economic viability. Two types of investments in particular need to be considered: (1) small-scale systems that address food-security issues; and (2) larger, more profitable investments that can become economic drivers and a source of gainful employment as well as a contributor to the food economy.

Most current aquaculture systems are freshwater based, using non-native species (dominated by tilapia) and developed in the country context of the larger and more water-abundant territories, such as Belize, Guyana, and Jamaica. According to CDB (2018), limited technical expertise and high infrastructure and input (feed) costs have been cited as major constraints to larger investments in freshwater aquaculture.

Marine aquaculture, while being less vulnerable to the constraints of freshwater aquaculture, has received considerably less financing in the region. This is largely due to a lack of R&D as well as limited understanding of the impacts of climate change on key indicators, such as water temperature

and acidity, which determine the productivity and viability of such production systems. Furthermore, Belize and Guyana have invested in coastal shrimp production, which has had a negative impact on coastal ecosystems, causing additional adaptation challenges.[4]

Some alternatives, such as marine shellfish (molluscs, clams, oysters and crustaceans), and seaweed could be considered in specific contexts, as they involve lower investment and operating costs, and less technical expertise than for marine fish species. However, further economic analysis must be conducted to identify the potential demand market size and requirements to clearly calculate potential returns on investment, as well as the contribution of some of these species to local food security based on local diet preferences. In addition, larger investments should consider risks related to climate change impacts, thus making CDB support for this type of research paramount to stimulating private sector investment.

Similarly, the newly introduced aquaponics system, which integrates vegetable or plant production with fish production, requires further analysis of its cost-benefits at different scales. The following would need to be determined: At what production scale are investments made to meet food security concerns? And at what scale of the operations would they become a sustainable commercial enterprise? When considering aquaculture investment proposals, CDB can determine the bankability of such loans by reviewing the economic and environmental/climatic viability, the availability of production inputs, technical expertise, and private co-financing options.

Any development of aquaculture on a sector scale would require the development of an enabling aquaculture policy and legal framework to address key issues: land titles, coastal zoning and use, environmental impacts, climate vulnerability/exposure, technical knowledge, and capacity to support investors of all scales. In view of the above, CDB should support the creation of an enabling environment that would permit private sector investment in aquaculture development. In particular, CDB could facilitate public-private partnerships, where industry investment and risk are shared, and entry barriers reviewed.

In 2013, CARICOM/CRFM/JICA carried out a Study on the Formulation of a Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean. The Study proposes a strategy and plan for small-scale aquaculture development, including the development of a CARICOM/CRFM network of aquaculture organizations; it also identifies the following major challenges for aquaculture development in the Caribbean:

- Availability of freshwater (for land-based aquaculture systems) in the Small Island Developing States (SIDS), in view of climate change and variability.
- Technology transfer (e.g. through the Aquaculture Network of the Americas).
- Feed access, availability and relative cost effectiveness (considering that feed and electricity often represent the main consistent costs of aquaponic systems).
- Small-scale farmers – "new" technical assistance.
- Governance and political willingness (e.g. in terms of developing and implementing policy and legal frameworks in support of sustainable aquaculture development and management).
- Application of the Ecosystem Approach to Aquaculture (CRFM, 2013).

4 Full climate change impact analysis is provided in the separate paper on Climate Change Adaptation in the Caribbean Region, which is part of the overall CDB policy development document.

These challenges outline the key priority areas on which CDB support should focus its aquaculture policy and strategy.

Further to this, in 2012, the CRFM established a Working Group to Promote Sustainable Aquaculture Development, with the objectives of the group being to promote sustainable aquaculture development at national and regional levels, mainly for the purposes of: increasing food production and security; improving rural income and employment; diversifying farm production; increasing foreign exchange earnings and savings; and advising the Forum on policies, programmes and projects to promote the development of aquaculture (CRFM, 2013).

In order to consolidate regional efforts and achieve impacts of scale, CDB could support the working group to ensure the delivery of its proposals for sector advancement at regional and national levels.

Finally, CDB should consider investments to develop and promote national aquaculture plans that factor in climate change trends and projections, and consider assistance for the design of an economically viable and sustainable regional hatchery facility, which engages stakeholders, private investors and the science community (FAO, 2011b).

6.1.4 Climate change and risk mitigation

In line with CDB's policies on climate change and programmes, such as the Natural Disaster Risk Management (NDRM) Programme, CDB will finance, and where possible, offer technical support for research that examines the impacts of climate change on ecosystems. This includes research on stock behaviour impacts, the potential mitigation of damages, and on the creation of new diversification opportunities.

Particular focus will be on research concerning risk mitigation and potential processing for the use of sargassum seaweed, which has negatively impacted the region and is still relatively poorly understood.

In terms of risk mitigation, public sector support will focus on mitigating the impacts of climate change on fisher communities. The livelihoods of these communities are particularly at risk with regard to the following: (1) damage to infrastructure and property; (2) decreasing catches as a result of changing fish migration patterns and fewer suitable days for fishing; and (3) declining fisheries stocks, such as conchs, urchins and sea cucumber, due to ocean acidification.

In this climate, it is becoming increasingly imperative to secure insurance for investments in fisheries and aquaculture. Therefore, CBD can consider the testing and upscaling of innovative insurance mechanisms that can support private sector involvement by reducing investment risks. Such insurance tools will be considered in conjunction with prevention and early warning mechanisms, such as weather-related information services; initiatives could be pursued in collaboration with national commercial banks and insurance bodies.

Another risk mitigation and adaptation measure that can be supported by CDB is the climate-proofing of key infrastructure, such as ports, shipyards and boat dry-docks, which can be strengthened to minimize damage and protect property.

Risk mitigation mechanisms and adaptation measures, designed to target the needs of vulnerable groups, could be supported through instruments such as the CDB's Natural Disaster Risk Management (NDRM) Programme, the Basic Needs Trust Fund (BNTF), and the Community Disaster Risk Reduction Fund (CDRRF).

6.1.5 Upgrading fisheries technologies, value chain infrastructure and standards

The upgrading of technologies should focus on improving efficiencies, reducing waste and greening the various activities along the sector value chains. These types of initiatives should be priority investments for CDB. For example, the promotion of fuel saving technologies, such as the use of four-stroke outboard engines, has already produced clear profitability for the fleets and should be supported across the region.

Emphasis should also be placed on R&D in fisheries technologies, supported by communication campaigns linking the research community with the sector stakeholders. The costs and benefits of new technologies need to be presented clearly to help individuals and investors assess the feasibility of adopting upgrades.

Investments aimed at enhancing the stock and fishing management capacity of the sector can be considered alongside the introduction of new technologies reducing the cost per unit effort – limiting the time at sea through more effective and efficient ways of tracking stock movements. However, investments promoting the profitability of fisheries must be coupled with effective management mechanisms to prevent the overexploitation of harvested stocks.

Further to this, the use of solar energy, championed by Barbados, is also an important step in upgrading and greening the fisheries value chain and improving its efficiencies. Investments in alternative energy by processors, markets and storage facilities could potentially be supported through mechanisms, such as the UK Caribbean Infrastructure Fund (UKCIF), and government-supported initiatives to move away from fossil fuel use.

This type of infrastructure upgrade brings another advantage to the sector, which is its capacity to 'bounce-back' faster following natural disasters. Traditional systems, such as the national grid, take longer to be restored in post-emergency situations compared to alternative energies, which can restore the sector's operations more quickly and efficiently, and thus improve sector resilience and reduce the vulnerability of its stakeholders.

Finally, investments in the introduction of, or compliance with, various standards need to be assessed in view of the target market and food safety requirements in place. To support improved food standard compliance, CDB should promote the analysis of domestic market requirements regarding food safety and food handling and provide financing for necessary upgrades to meet modern market requirements and protect consumers. The involvement of all stakeholders should be promoted in order to set targets, secure buy-in from industry, and gain market recognition.

Export markets, on the other hand, present different challenges. For example, the potential effects of the Food and Drug Administration (FDA) Food Safety Modernization Act (FSMA) on Caribbean food exports to the United States of America need to be considered, as this country is likely to continue being an important market for Caribbean exporters. The FSMA will impose food safety requirements, such as traceability and third-party certification, which will need to be met. In addition, sanitary standards of the United States apply to all food products and ingredients entering the country. Hence, both certification and traceability will be of paramount importance in implementing and overseeing the new law (Mosquera *et al.*, 2013). Despite the limited volume of exports from the Caribbean to the United States of America, high-value export species are an important earner for the sector; therefore, lending should be extended to assist efforts for compliance with tighter foreign market rules.

Similarly, standards for compliance with markets of the European Union – mainly targeting the sale of tuna – must be assessed to determine the extent to which investments would have a positive cost-benefit outcome, especially in cases where there is a limited volume of fish that is available for export, but the requirements for compliance entail large investments.

The tightening of food safety standards could also be seen as an opportunity for regional exports to compete differently in foreign markets, with emphasis placed on quality as opposed to price. In this regard, CDB should target investments towards the promotion of particular products or fisheries that can capture the value offered by further certification and branding.

6.1.6 MCS and IUU enforcement, monitoring and reporting systems

Monitoring, control and surveillance of fisheries (MCS) as well as illegal unreported and unregulated fishing enforcement are complex and costly systems for most small states to be able to operationalize. The lack of effective regional frameworks and cohesive enforcement at national level leads to conflicts over resources and fishing grounds, as well as the lack of enforcement of exclusive economic zone (EEZ) access rights.

Compliance with the responsible fisheries code of conduct requires not only a legal and regulatory framework in place, but also the capacity to implement and enforce agreed measures. The ability of the state to regulate the activity is an essential part of the capacity to meaningfully manage the sector, and therefore investment in creating such capacity across the region must be fully supported. For example, CDB should focus its support towards the WECAFC/OSPESCA/CRFM working group dealing with IUU, which aims to develop a Regional Plan of Action against IUU fishing.

Two and a half years after the *Declaration on Illegal, Unreported and Unregulated Fishing,* few CRFM members have a National Plan of Action on IUU fishing, and very limited progress has been made with the ratification of the international instruments. Moreover, none of the CRFM members has so far accessed the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, which was approved by the FAO Conference at its Thirty-sixth Session on 22 November 2009 (CRFM, 2013). Accession to this commitment is a necessary step towards combating IUU fishing and should also be among the priority areas of CDB's public sector support.

In addition to these policy challenges, regional fisheries are largely artisanal and informal, which adds to the complexity of sector governance and resource management. For example, FAO and CDB (2018) estimate that there are up to 10 000 unlicensed fishers operating in Jamaica.

The Caribbean Development Bank can help strengthen the region's capacity to manage and control resources by channelling strategic investments towards enhanced regional cooperation and interstate collaborative efforts, such as joint patrols and subregional or regional agreements on joint operations. This would allow for the creation of a comprehensive and more powerful monitoring, control and surveillance system, and reduce costs by co-financing patrol efforts.

In addition to financing regional agreements and mechanisms, targeted investments at national level should be extended to facilitate dialogue between the government and stakeholders. This would not only increase public support for the improved MCS of fisheries, but would also allow countries to explore different modalities for public-private sector partnerships, where sector self-regulation and direct reporting mechanisms are in place to facilitate voluntary compliance and independent reporting.

Financing should therefore follow two key lines of intervention: (1) support the implementation of the regional mechanisms in place and the establishment of collaborative arrangements that allow states to share the cost of patrolling the Caribbean Sea, and thus protect and manage their resources; and (2) promote dialogue, at national level, between government institutions and sector stakeholders to ensure the long-term benefits of effective management and industry support to self-regulate and monitor in a joint effort with the government.

6.1.7 Access to markets and trade – barriers and opportunities

The Caribbean region is a net importer of fish and fish products. Despite its diversity, the region as a whole has a population that consumes relatively high volumes of fish and economies that benefit from a developed tourism sector, which fuels overseas market demand for fresh fish. It can therefore be generalized that domestic demand for fish outstrips supply.

While the potential for increasing the volume of supply for key species is uncertain, the fisheries sector can focus on optimizing the value of its catch. This can be largely pursued by accessing new higher-priced markets or by diversifying and introducing new products to existing markets. In both cases, an economic analysis of the investment in market or product diversification has to be understood for such initiatives to be viable in the long run.

Under the CARICOM Single Market and Economy (CSME) initiative, CDB should offer financing and technical support for the design and implementation of an in-depth analysis of (1) the CARICOM fisheries trade and industry, and (2) the appropriate and viable opportunities that lay ahead within the region and internationally. The results of the analysis will inform industry and policy and serve as guidance to further investment.

Calls for the increase in exports as a means of improving incomes are to be considered in view of the national market demand and the potential economic gain of reaching more distant – and possibly costly to access – foreign markets. Arguably, many of the Caribbean countries benefit from a large and vibrant tourism sector that de facto brings the foreign target market home. However, in some cases, access to these markets is not well supported by contradictory policies, which for example, promote tourism sector tax free import wavers, over ensuring maximised market linkages with national fisheries.

Despite the consistent demand for fish, domestic markets are not well understood in terms of market stratification, consumer characteristics, preferences, price elasticities and dietary requirements. Further to this, the informal and unregulated nature of the artisanal sector often prevents fishers and traders from integrating into the formal retail markets, such as supermarkets that service high-end consumers. Although investments are needed to improve these market linkages, they must be considered in relation to the country context and balance producer needs with those of consumers. Therefore, investments should ensure food affordability and availability necessary for maintaining food security and healthy diets for the local population.

Currently, the vast majority of local trade is based on direct sales at primary sites or fresh/wet markets, keeping value chains short and the transformation of products to a minimum. A limited number of processing companies exist, with the largest player, Rainforest Foods, based in Jamaica. In addition to sourcing nationally, processors across the region import primary material due to (1) insufficient quantities of local catch, and (2) seasonal variations that cannot be compensated for through storage. Nonetheless, for the fishing industry, access to processing and value adding is an important aspect of optimising returns.

Value addition is particularly relevant in the discussion of import substitution. While there is no comprehensive analysis of fish and fish product imports, affordable canned and processed fish (salted and dried) have become widely available throughout the retail market. Import substitution alternatives need to be the subject of economic analysis before being widely promoted, as competing with cheap imports may not be the best way to optimise sector gains. However, with CDB financing and technical support, the industry can better understand the potential returns of such investments and facilitate financing for such initiatives.

Considering the supply-demand dynamic and the dominance of fresh fish sales, efforts to enhance sector returns should consider new product development, based on the optimisation of by-catch and fish 'waste', such as cut-outs, innards, heads, bones and skins. This type of value addition would typically be captured by processors in the value chain and would not automatically trickle down to fisher communities. However, when such 'pilot' investments demonstrate their bankability, CDB should promote their financing and upscaling, as well as the establishment of local supply linkages that accelerate economic trickle-down from industry.

Financing and technical assistance should also be aimed at improving the understanding of national markets and the value-addition opportunities they present for the sector. In Guyana, for example, links have been established between artisanal fishers and industrial processors.

Processing industry concerns regarding the reliability, quality and volumes of local supply can be mitigated through the promotion and facilitation of regional trade linkages. Within the Blue Economy sector framework, the enhancement of shipping line connections – facilitating regional fisheries trade and the further development of the processing industry – would partly answer the need to optimise resource use beyond national boundaries, by capitalizing on joint regional trade relationships.

The tariff free CARICOM trade regime encourages the free movement of goods. However, it falls short of a move towards a single market space, which in fisheries will require a single, coordinated regional resource management strategy at the other end of the value chain.

Investments should enhance the intersectoral linkages between fisheries trade and transport services, and cross-country partnership opportunities that extend value chains across the borders, in competition with outside imports.

Finally, international markets also present barriers and opportunities, which are partly reflected in the discussion on standards. One opportunity for CDB to strategically impact export trade is through the promotion of high-end niche products, which are branded and recognised so as to capture premium prices in lucrative and competitive markets. Investment support in R&D on the identification of, and opportunities for such products may unlock further economic returns.

6.1.8 Inclusion of youth and women in sector development opportunities

The inclusion of youth and women in sector development opportunities is high on the agenda of both governments and donors. There are two sides of the issue of inclusion: (1) young people's and women's level of interest in the sector; and (2) the barriers that prevent youth and/or women to fully and effectively benefit from sector involvement. Targeting also presents an issue: who are such investments aiming to reach? How will they reach them? What are the expected outcomes?

In tackling the first type of issue, where sector opportunities seem not to correspond to needs and expectations – particularly of youth (both young men and women) – there is a much reiterated need to revise the 'occupational narrative' of the sector. Similar to agriculture, fisheries needs to break away from the association with poverty, hard labour and low pay (Romuld and Bammann, 2018). New fields and professions, such as biotechnologies, marine biomass harvesting, and aquaponics are needed to attract the youth as scientists, entrepreneurs and sector managers.

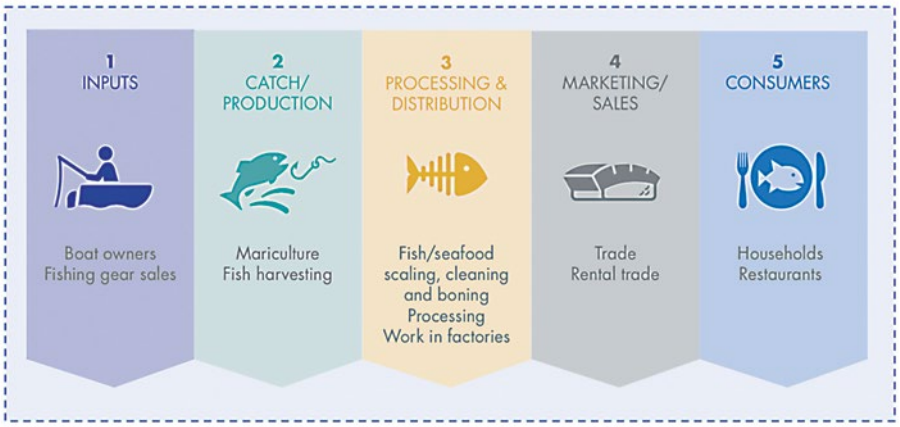
In this regard, CDB investments should target the linkages between university and professional courses and industry promoting applied research, thus promoting industry buy-in for innovation and young people's exposure to the sector. In addition, CDB could actively assist the establishment of innovative Public-Private Partnerships (PPP's) at regional and national level, which facilitate the linkages between research, industry, policy dialogue and communication, most of which could be assisted and driven by enabled youth.

Young entrepreneurs interested in professionalising and modernizing the fishery sector will require access to affordable investment capital. In line with CDB's VYBZING: CDB and Youth, the bank can support young entrepreneurs by working with financing partners to develop targeted financial products that can lower the entry barriers for youth into the fishing industry. In particular, CDB can facilitate professional internships and other opportunities of 'on the job' training, which expose young adults to different aspects and job opportunities along fishery value chains.

For the bank to maximise the positive impact of investments on women and youth, a targeting strategy for these types of financing must be considered and put in place in order to ensure fair and equitable outreach.

Targeted investments to further youth participation and address gender-related imbalances can be made along the entire fisheries value chain, as well as to support policy processes, sector management and decision-making. Figure 2 features basic examples of the role that women traditionally play in fisheries across the region.

Figure 2. Examples of women's traditional roles related to fisheries.



Source: CDB (2018).

Each of these steps presents a set of particular constraints and opportunities to enhance women's participation and equality within the sector.

In addition to the above, an important constraint that CDB sector policy must reflect is the need to promote legal and regulatory instruments that ensure youth and women's access to productive resources. For example, an overlapping issue shared between agriculture and fisheries (aquaculture in particular) is the right and access to land titles and capital. In both aspects, women and youth (especially young women) are at a considerable disadvantage in comparison to their male peers.

Further to issues related to assets and participation in production activities, CDB investments should promote equal opportunities for men and women to participate in management and policy processes. Specifically, CDB could provide resources to promote the integration of global voluntary instruments, such as the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines), and guidelines dealing with governance of tenure, which address gender and other matters in regional and national policies. The CRFM has recently approved a protocol on the SSF Guidelines as part of the Caribbean Community Common Fisheries Policy.

The Caribbean Network of Fisherfolk Organization (CNFO) is a good example of the involvement of women in community organizations and positions of leadership. Bank investments should ensure that gender considerations are integrated into all partner representative sector bodies.

6.2 Diversity of national level challenges and focused investment support

The Caribbean is a highly diverse region in terms of ecosystems, culture, and political economies. Therefore, CDB's broad regional development approach should take subregional and national development needs into account when assessing and promoting collaboration opportunities on the ground.

For example, in the OECS subregion, investments will have to align with the policies and strategies adopted by member states. The Revised Treaty of OECS has established a single financial and economic space within which goods, people and capital move freely, monetary and fiscal policies are harmonized, and countries continue to adopt a common approach to trade, health, education and the environment, as well as to the development of critical sectors, such as agriculture, tourism and energy.

The OECS is an eleven-member grouping comprising the full Member States of Antigua, Barbuda, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, with the British Virgin Islands, Anguilla and Martinique as associate members (OECS, 2018).

In relation to the shift towards a Blue Economy and the development of the fisheries sector as part of that new economic space, the OECS subregion is a pioneer in the Caribbean. Therefore, investment needs must reflect these capacities and target interventions appropriately. For example, CDB could assist the region in capitalizing on the subregional experience by promoting opportunities for learning among states through exchange visits, constructive policy dialogue and discussion of the replicability of selected innovative ideas and experiences. The Blue Innovation Institute in Grenada can be a valuable and strategic partner for CDB in this endeavour.

To exemplify differences in investment contexts at the national level, CDB member states can be grouped into Continental States (CS), Small Island States (SIS), and Large Island States (LIS). Each group reflects countries' environmental assets, and in some cases, their proximity and easy access to larger foreign markets, all of which influence the development direction and viable financing options for both the fisheries and aquaculture sectors.

Investment in Haiti is reviewed separately, with emphasis on post-conflict and post-disaster management strategies, and interventions targeting food security and nutrition in the context of poor and under-resourced communities.

6.2.1 Continental States (CS)

Continental States are by definition endowed with different natural resources and production possibilities. Their economic linkages with neighbouring countries are also the subject of a different dynamic when compared to the island states. For example, most CARICOM states have limited land and freshwater resources; however, countries such as Belize, Guyana and Suriname have ample supplies, making the commercial development of land-based aquaculture more viable in these country contexts. The development of the aquaculture sector is currently held back by the lack of clearly defined policies, plans and regulations for sector development. In addition, the lack of industry support in terms of the regulatory and fiscal enabling environment, as well as limited support industries such as feed and specialised technical assistance, increase investment risks. Strategic CDB support for a policy and regulatory upgrade of the aquaculture sector across the region will help address these shortcomings.

Guyana offers another example of how CDB can tailor investment support to country contexts. The newly found deposits of gas and oil are driving the development of a new industry within the Blue Economy space, which will have impacts on the fishing industry. The CDB's Technical Advisory Unit can extend expert support to help the country undergo the necessary process of drawing-up its comprehensive and multisector exploration and management plans and upgrading the sector's compliance skills, as well as implementation, monitoring and control procedures. The diversification of Guyana's fishery sector towards deep-sea fish exploration also highlights the need for both research and management policy review and elaboration.

6.2.2 Small Island States (SIS)

Small Island States, such as Grenada, have larger expanses of marine space than land mass, which offer the potential for the promotion and development of mariculture, such as sea moss, crabs and lobsters. However, research and development in the area of mariculture is insufficient to promote these activities at commercial scale, and CDB technical assistance or facilitation of regional capacity building initiatives would be a critical turning point for the sector.

The greening of the value chain and alternative energy solutions are also of critical importance to these countries in order to reduce costs and improve resilience.

Investment support for individual states must be considered on the basis of the structure and type of fishery sector in each country. For example, Grenada is a small island that has a long-line professional fleet with access to valuable and relatively rich tuna stocks. This has provided the justification for Grenada to continue to comply with import requirements of the European Union, as the income generated from these exports justifies the heavy costs of compliance.

As a result of its focus on tuna and export requirements of the European Union, the Government of Grenada is becoming increasingly conscious of the need to develop a specific fisheries policy, which would not only provide the fundamental tools for managing the sector, but would also allow the government to revisit the open access fishery regime traditionally practiced and re-evaluate its sustainability.

This highlights additional requirements, including institutional resource needs assessments, the development of human resources – both in terms of capacity building and technical knowledge and skills – as well as the recruitment of new public servants to work in the sector.

6.2.3 Large Island States (LIS)

Large Island States often have natural production assets for both capture and culture fisheries development. However, in the case of Jamaica for example, despite the conducive natural environment, both aquaculture and fisheries are in decline. This is mostly attributed to the lack of an enabling policy or regulatory framework as well as inadequate support services.

Capture fisheries, which are dominated by an unregulated, artisanal fishing fleet, have been strongly impacted by a continuing decline in landings, due to overfishing of nearshore reefs and the lack of fisheries management frameworks in place to provide guidance and help create an inclusive and community-led stewardship of the resources. It is therefore now a government priority to create and implement sector management plans that provide a road map for the sustainable development of national fisheries.

The creation of a regulatory environment is also needed in the face of new fisheries development, such as sea cucumber and live lobster harvesting and trade. While private sector-led investments are already in place to exploit these resources, public sector support is lagging behind in terms of

providing the necessary regulation and monitoring frameworks needed to ensure the long-term sustainability of such activities.

Strengthening the capacity of stakeholders to participate in fishery sector management and co-management initiatives goes hand in hand with raising their awareness of environmental issues and sustainable natural resource management.

The experience of Jamaica in tilapia farming demonstrates the importance of understanding key management issues, the profitability of target markets, the competitiveness of local products, and the importance of inputs, such as the quality of genetic stocks. The cost of production, especially energy costs, and the development of hatcheries, are areas that require further R&D efforts in order to drive profitability in the industry.

The nature of CDB's support for LIS in many ways reflects the complexity of challenges facing countries across the region; however, it brings into focus the importance of governance and competitiveness to long-term sector growth. Furthermore, economies with the largest private investor in the fisheries trade and processing in the region, such as Jamaica and Rainforest Seafoods, should be the focus of both public and private financing tools. In these country contexts, support from CDB could build PPPs for sector management and inclusive development.

6.2.4 Separate focus on Haiti

Haiti presents different challenges and opportunities for sector interventions. More programmatic and comprehensive financing and technical support is needed to address the lack of regulatory, institutional and human resource capacities, which prevent the public sector from assuming its role of leading and facilitating sector development. Support for the development of a national sector policy and action plan are paramount to initiating sustainable sector development.

Fisheries and aquaculture growth in Haiti is constrained by sector-specific governance, production and value chain limitations. It is also faced with many persistent problems, such as pollution: the lack of solid waste management impacts beaches and landing sites. Erosion has also become an increasingly urgent issue, affecting nearshore waters and reducing productivity by impacting stocks and breeding grounds.

The Government of Haiti aims to promote tourism sector development as a means of diversifying and strengthening the national economy. However, coastal tourism will have to operate within the same resource environment as fisheries and potentially mariculture development. Currently, Haiti is short of a comprehensive approach to coastal and marine management, such as the one presented by the Blue Economy. Therefore, CDB and regional partner support could be instrumental in helping Haiti to address these complex issues while joining the rest of the region in following this development paradigm.

In Haiti, CDB financing and technical support should have two clearly differentiated types of intervention objectives: (1) focus on food security as the primary goal of the intervention and promote production systems that may need initial investment subsidies or donative financing, but are designed to ensure household food security and self-sufficiency; (2) focus on mid-market enterprise (MME) and small- and medium-sized enterprise (SME) development, whereby production and other economic activities are assessed on the basis of their economic, financial, social and environmental sustainability, and thus ultimately contribute to income generation and overall economic growth.

While the two types of interventions may be seen as being part of the same continuum, investment needs and cost-benefits have to be considered differently for both scenarios and may result in the adoption of different production systems.

For aquaculture development, one of the key impediments to establishing production activities is individuals' and companies' difficulty in accessing and securing land titles. In this regard, CDB support for land titles and access rights for the development of fish farming is a precondition for sector development. Once land access issues have been addressed – through for example the establishment of aquaculture parks on public land – investment and technical support can then focus on testing and promoting production systems that best suit the local socio-economic and natural landscape. For example, low-input, integrated production systems may be appropriate in meeting the food demand of resource and landless poor households. Larger-scale production activities may be set up by small- or medium-sized private enterprises or PPPs to exploit the water resources of existing government-constructed reservoirs, which can provide an opportunity for the development of mixed capture-culture systems. Similar enterprises could be developed in brackish or marine water bodies. Additional impediments that will need to be addressed include the development of upstream industries – such as feed and hatcheries – and access to financing, especially by women and youth.

Artisanal capture fisheries, on the other hand, have long dominated Haitian fisheries. However, due to the lack of appropriate boats, motors and skills, nearshore fishery persists, despite the depletion of stocks. As a result, supply falls short of satisfying local demand for fish, pushing prices up beyond the purchasing power of most local consumers and reducing fish consumption rates to the lowest in the Caribbean, at 4 kg per year.

While artisanal fisheries landings continue to drop, the country is offering fishing rights to foreign vessels, without the means of regulating or managing the effort. In addition, off-shore illegal fishing is also believed to impact the status of the national fishery and its future potential. In order to address this, CDB can consider strategic lending to update and elaborate fisheries MCS-related policy and regulatory frameworks, and offer financial and technical support in creating collaborative regional mechanisms for fishery control and management.

Once fishery management is in place, including for the artisanal sub-sector, investment needs to be directed towards enabling off-shore fisheries by financing the improvement of the fleet and its capacity to travel to further fishing grounds, as well as capacity building for fishers to ensure their safety at sea.

Finally, CDB financing should consider investing in reconstructing and climate-proofing coastal infrastructure as well as infrastructure along the entire value chain – storage, processing, marketing, among others. A number of CDB financing mechanisms can be considered: The Natural Disaster Risk Management (NDRM) Programme; the Basic Needs Trust Fund (BNTF); and the UK Caribbean Infrastructure Fund (UKCIF).

7. Overview of sector investments by International Financial institutions (IFIs), donors and development partners

When compared to other sectors, fisheries and aquaculture have often received less attention and resources. Currently there are many regional and national level projects that are aimed at enabling the sustainable development of the Caribbean fishery sector, as shown in Table 1.

For example, a number of regional projects, currently supported by donors and development partners, focus on regional fisheries management frameworks and capacity building efforts, as well as the management of commercially valuable fisheries. Over USD 67 million has been invested by various donors in regional level project interventions: USD 50 million of which is a single GCF project on Mainstreaming Coral Reef Resilience and Restoration as an Ecosystem-based Adaptation Strategy to Climate Change in the Caribbean Region; and USD 16 million of which has been invested among the other initiatives.

Table 1. Ongoing fisheries development projects in the Caribbean (2018)

Country	Donor/IFI	Ongoing Project	Budget USD million
Regional	IDB (Inter-American Development Bank)	Agricultural policy, fisheries and climate change analysis in Latin America and the Caribbean	0.35
	KFW (German Development Bank)	Coastal protection for climate change adaptation in the Small Island States in the Caribbean	n/a
CARICOM	USA/NOAA (National Oceanic and Atmospheric Administration)	Support to the Caribbean Regional Working Group on Illegal Unreported and Unregulated fishing (RWG-IUU)	0.04
	EU DG Mare (European Commission's Directorate-General for Maritime Affairs and Fisheries)	Improving the governance of fisheries in the Western Central Atlantic (16th Session of WECAFC-Guadeloupe)	0.13
	World Bank/ GEF (Global Environment Facility)	Caribbean billfish project (pilots in Grenada and the Dominican Republic)	1.95
Subregional (Eastern Caribbean)	GEF	Climate change adaptation in the Eastern Caribbean Fisheries Sector	5.4
WECAFC	USA/NOAA	Conservation and management of sharks and rays in the wider Caribbean Region	0.05

WECAFC	EU DG Mare	Workshop on Illegal, Unreported and Unregulated (IUU) fishing in the Western Central Atlantic Fishery Commission	0.1
WECAFC	EU DG Mare	Support to the creation of a regional database and associated transversal WECAFC, CRFM, OSPESCA, IFREMER and CFMC Working Group on fisheries data and statistics (WECAFC)	0.09
WECAFC	UNOPS (United Nations Office for Project Services)/ GEF	Support to the implementation of an EAF for the Shrimp and Groundfish Fishery and regional fisheries governance co-implementation within the CLME+ project	1.3
WECAFC	EU DG Mare	Support to the establishment of a regional fisheries management organization (RFMO) for WECAFC	0.11
Barbados, Belize, the Dominican Republic, Jamaica, Saint Lucia, Saint Vincent and the Grenadines	GCF (Green Climate Fund)	Mainstreaming Coral Reef Resilience and Restoration as an Ecosystem-based Adaptation Strategy to Climate Change in the Caribbean Region (MaCREAS)	50
Brazil, Colombia, Costa Rica, Mexico, Suriname, Trinidad and Tobago	GEF	Sustainable management of by-catch in Latin America and Caribbean trawl fisheries (REBYC-II LAC)	5.7
Antigua and Barbuda, Bahamas, Barbados, Saint Kitts and Nevis	FAO (Food and Agriculture Organization of the United Nations)	Towards a Caribbean Blue Revolution	0.47
Antigua and Barbuda, Barbados, Belize, Guyana, Jamaica, Saint Lucia, Saint Vincent and the Grenadines	GEF IW (International Waters)	Developing organizational capacity for ecosystem stewardship and livelihoods in Caribbean small-scale fisheries (StewardFish)	1.78
Haiti	IDB	Artisanal fisheries development programme	15
Jamaica	IDB	Aquaponics: Increasing access to climate-smart agriculture in Jamaica	0.97
	CIF (Climate Investment Funds)/ World Bank	Promoting community-based climate resilience in the fisheries sector of Jamaica	4.8

	AF (Adaptation Fund)	Enhancing the resilience of the agricultural sector and coastal areas to protect livelihoods and improve food security	10
	FAO	Capacity building in resource assessment and management of the Jamaican sea cucumber fishery and potential for aquaculture development	0.29
The Bahamas	IDB	Revitalization of the sponging industry	0.54
Suriname	FAO	Updating Suriname's capture fisheries legal framework	0.12
Trinidad and Tobago	GEF	Improving forest and protected area management in Trinidad and Tobago	2.7
	FAO	Strengthening fisheries legislation in Trinidad and Tobago – focus: IUU fishing	0.1
Saint Vincent and the Grenadines	FAO TCP (Technical Cooperation Programme)	Strengthening fisheries legislation in Saint Vincent and the Grenadines – focus: IUU fishing	0.1

A key partner in terms of investing in regional fisheries management capacity is EU DG Mare. The European Union finances institutional development, and Global Environment Facility (GEF) funding is directed towards stocks management activities.

Overall, the key intervention currently guiding development is CLME+, established under the Resolution of the General Assembly of the United Nations: "*Towards the sustainable development of the Caribbean Sea for present and future generations*" – Caribbean Sea Initiative. Through the CLME + SAP, donors and countries are coming together to provide international and region-wide support for the implementation of the SAP. Financial requirements for implementation will be determined as the specific activities are being defined. At that stage, potential sources of funding will be identified for the implementation of the CLME + SAP, which are expected to include the following:

- GEF co-financing support for the overall coordination and for the execution of high-priority Strategies and Actions of the CLME+ SAP
- Potential contributions from multilateral institutions and bilateral partners
- Commitments and financial contributions from the CLME+ countries and regional stakeholders (including, if feasible, the private sector)

A consolidated, donor financing approach is needed to fundamentally shift development. Therefore, CDB contributions to the implementation of the SAP are of utmost strategic importance for the Caribbean fishery sector. In addition, IDB and FAO could be relevant partners to strengthen investment synergies, as both are present at national level and are involved in artisanal fisheries development and aquaculture development efforts.

8. Policy and investment strategy recommendations

► Support sector governance transition towards processes based on the Blue Economy paradigm

Investments should be aimed at supporting the transformation of the island economies, using the Blue Economy paradigm to develop an innovative ocean economic space. This effort should go beyond rebranding, and instead aim to redraw traditional sector boundaries. This paradigm shift presents new opportunities for the fisheries sector; it upholds the principles of environmental, economic and social resilience as well as sustainability. In this regard, while the fisheries sector policy and strategy is part of the overall Agriculture Policy of CDB, it must also be viewed as an integral part of CDB's Blue Economy Paper and align with its vision of the way forward.

The CDB's Fisheries Sector Policy should attribute particular attention to the inclusiveness of new institutional and economic models within the sector, as part of the wider Blue Economy framework. The investment policy should primarily endorse and facilitate the sustainable implementation of existing regional commitments to the Blue Economy, including fisheries sector development.

► Align policy and investment support with strategic regional sector initiatives and management bodies

Financing must be strategically targeted, with priority considerations given to investments that have the potential to upscale, replicate and multiply impacts. Where possible, CDB's policy should support existing mechanisms for sector governance and collaboration, and enhance regional and national level capacity to deliver on fundamental commitments by strategically targeting interventions and financing.

► Support national sector policy and implementation strategy development

This involves providing technical and financing support to governments to create a clear national policy and regulatory framework for both fisheries and aquaculture development; it also involves creating a road map for its implementation, recognizing the roles and responsibilities of all sector stakeholders.

► Promote and support public-private partnerships and stakeholder engagement in sector governance

For sector governance, the agenda should focus on enhancing regional integration and collaborative efforts to co-manage the ocean environment, and strengthen the ability of national governments to implement critical commitments to this effect. This should entail capacity-building support for representative bodies and consultative mechanisms to ensure that all stakeholders are effectively involved.

Public sector support should be creatively combined with private sector lending to maximize public-private sector partnership arrangements for investments in climate-proofing and upgrading value chain infrastructure and inclusive sector management modalities.

► Support key environmental, socio-economic and market research to inform evidence-based decision-making processes

Another key enabler for developing sustainable governance capacity is CDB financing and technical assistance for research and the incorporation of science and research into policy and industry decision-making. A deeper understanding is needed of the impacts of climate change on the fishery sector and fisher communities. Similarly, socio-economic analysis of the sector and stakeholders – as well as industry and market/demand analysis – would inform appropriate response strategies and help target economically and socially sustainable investments.

Also, CDB should extend financial and technical assistance to facilitate a comprehensive economic valuation of the fisheries sector. This valuation is to become the basis for the recognition of the contribution of the sector and the extension of appropriate political and financing support.

► Support economically, socially and environmentally sustainable and beneficial innovations

Private sector lending for new product development and value adding should not only focus on the primary production level, but also on the assessment of the competitiveness and marketing strategy that is required to generate positive returns on investment. This approach should be adopted for all sizes of investment in order to ensure their potential for income generation and sustained positive impacts. The Caribbean Development Bank's support for value chain innovation should include financing and technical guidance for an in-depth analysis of the fisheries sector's domestic and external market demand characteristics, competitiveness and opportunities.

Market and competitiveness analysis should also guide the cost-benefit assessment of investing in capacity (human, processes and infrastructure) for compliance with foreign trade standards and requirements.

For industry, priority should be given to the development of new, economically viable technologies that can address bottlenecks and cost inefficiencies along the value chain, and ensure the sustainability and profitability of fisheries and aquaculture. Examples of such cost-cutting technologies include the introduction of 2-stroke boat engines and other improved fishing technologies that reduce cost per unit effort.

Various aquaculture production systems should be considered on the basis of their investment requirements and expected returns. An economic evaluation should also be done for investments that target household food security issues and not only commercial level proposals.

► Build regional and national level institutional and human resource capacities

The fisheries sector has multifaceted development needs. Thus, strategic investments are needed to build regional and national level institutional and human resource capacities, in particular, through the creation of an effective network of peer exchange, institutional collaboration and learning. The dynamic changes that impact the fisheries sector, both in terms of the natural and socio-economic environments, require public sector and research support that is currently inadequate in many BMCs.

► Investment in improved sector resilience to the risk of natural disasters

Investment support for climate-proofing sector infrastructure has become increasingly important in the face of intensifying climate-related risk. Strategic CDB investments are needed to improve existing infrastructure and to create new facilities which will protect key public and private assets. Improving resilience can also include investments in alternative energies, which can support key value chain hubs and reduce their dependency on national power grids. This power supply transition would allow for quicker recovery in the aftermath of potential natural calamities and contribute to the greening of the sector as a whole.

Finally, CDB's policy and investment strategy should recognize the importance of tailoring support to the different needs of BMCs, considering the dual sector goals of ensuring local subsistence and household food security and nutrition. Creating an enabling environment is essential for the sustainable enhancement of sector economic returns.

8.1 Monitoring and evaluation tools and indicators

Monitoring and evaluation targets can be aligned with those set out in the regional and national fisheries sector action plans, which are the cornerstone of CDB's sector policy and support, such

as the CLME+ SAP and CRFM Strategic Plan. Progress will also simultaneously be measured on the basis of national commitments made against CDB financing and technical support. Participatory monitoring and evaluation (PM&E) and tools, such as project impact evaluations, national statistics and reports from regional and national level bodies, should be considered when collating information on progress.

Key impact indicators must be carefully identified to reflect the commitments made by CDB and BMCs. Depending on the nature of the investments made to support sector development, suggested indicators may include some of the following:

Governance – policy and regulatory environment development

- Level of regional and national level adoption of the Blue Economy and ecosystem approaches to ocean resource management
- Number of BMCs which have adopted/upgraded their National Fisheries and Aquaculture Policies and Management Plans
- Number of BMCs which have national fisheries MCS plans and implementation strategies in place
- Number of BMCs which have National Plans of Action on IUU fishing
- Number of BMCs which have acceded to and are implementing measures under the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
- Number of regional or national level operations conducted to monitor and control fisheries

Institutional Development

- Number of consultative and inclusive (gender and youth) multistakeholder and multisector forums embedded into national policy and decision-making processes

Capacity Development

- Number of regional or national institutions supported in the upgrade and development of educational and training curricula that reflect sector needs
- Number of fisheries staff available to support sector development needs
- Number of fisheries sector stakeholders trained in relevant skills (by gender and age)

Research and Development

- Number of fisheries and aquaculture climate change impact studies concluded
- Number of innovative solutions or pilots conducted to assess the effectiveness of mitigation strategies or viability production systems
- Number of innovations taken up by the private sector (including fishers and fish farmers – segregated by gender and age) for subsistence or commercial purposes

Infrastructure Development

- Number of fisheries sites made climate-proof
- Number of installations or processes along fishery value chains made more energy efficient or greened

Youth and Gender

- Number of young men and women entering the sector

- Balanced representation and decision-making power between men and women involved at all stages of fisheries and aquaculture value chains

Markets and Trade

- Value of fish and trade of fishery products at domestic and international markets
- Regional and international trade agreements signed

8.2 Potential partnerships within CDB corporate structures and with other financial institutions and development partners

When engaged in development dialogue on the Ocean Economy – in which the fisheries sector plays a key role – CDB's divisional structures and dedicated financing mechanisms should, where possible, be designed to mirror the intersectoral approach of this new paradigm. This approach has recently been adopted by IDB, which has embraced the Blue Economy as a key driver of its investment agenda.

A holistic and multisectoral investment approach to fisheries development on the part of CDB will further enhance government efforts to see fisheries as an integral part of the wider ocean and coastal economy. For example, the different divisions under CDB's Project Department – such as Economic Infrastructure, the Social Sector Division and the Private Sector Development Unit – should all collaborate on fisheries and aquaculture sector investment designs and evaluations in order to reflect value chain support needs, and a multisectoral perspective in terms of social and private sector approaches and development.

The Projects Department plays a lead role in the Bank's programmes, providing – among other things – technical assistance to personnel involved at the local level in the BMCs where relevant programmes operate. The Caribbean Development Bank uses the following programmes to serve the needs of its BMCs:

- Special Development Fund (Unified)
- Caribbean Technological Consultancy Services (CTCS)
- Natural Disaster Risk Management (NDRM) Programme
- Basic Needs Trust Fund (BNTF)
- UK Caribbean Infrastructure Fund (UKCIF)
- Community Disaster Risk Reduction Fund (CDRRF)
- Regional Public-Private Partnership (PPP) Support Facility
- VYBZING: CDB and Youth

All of these funds could be tailored to address the diverse needs of the fishery and aquaculture sectors through public or private financing mechanisms and through support for regional or national public-private partnerships.

Outside of CDB, other financing institutions, such as the IDB and the World Bank, would be strong strategic partners that can ensure coherent and consistent financing for the sector. Furthermore, regional academic and research institutions, such as the University of the West Indies, Centre for Resource Management and Environmental Studies (UWI-CERMES), as well as international bodies including the European Commission's DG Mare and FAO, also have considerable and extensive technical capacity to support and guide CDB investments.

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10. Annex: Institutions and people met

Date/Day	Time	Institutions	Persons met	Position	Contact email
Tuesday, 14 August 2018	Skype 09:00 hours	• CRFM	• Susan Singh-Renton	• Deputy Executive Director	susan.singhrenton@crfm.net
Monday, 20 August 2018					Arrival Barbados (15:00 hours)
Tuesday, 21 August 2018	09:00 hours 14:00 hours	• FAO • National Fisheries Authorities	• Fisheries/Aquaculture team • Stephen Willoughby	• FAOR and Technical staff • Chief Fisheries Officer	
Wednesday, 22 August 2018	10:00 hours 14:00 hours	• CRFM • UWI-CERMES	• Dr Maren Headley • Patrick McConney • Dr Hazel Oxenford	• • Director • Professor of Marine Ecology and Fisheries	maren.headley@crfm.int patrick.mcconney@gmail.com hazel.oxenford@cavehill.uwi.edu
Thursday, 23 August 2018	10:00 hours 16:00 hours	• CDB • • • • CNFFO	• Jéanelle Murray-Noel • Luther St. Ville • Claudia James • Paul Sanders • Vernel Nicols	• Operations Officer (CTCS) • Agriculture • CDRRF • ESU • President Barbados Network	noelj@caribank.org stvilll@caribank.org jamesc@caribank.org saundep@caribank.org vernel.nicholas@gmail.com
Friday, 24 August 2018	Skype 10:00 hours Skype 11:00 hours 13:00 hours	• FAO Haiti • CRFM • BioGenBioTech	• Hishamunda, Nathanael • Milton Haughton • Mark Hill	• FAOR • Executive Director • Director	Nathanael.Hishamunda@fao.org milton.haughton@crfm.int
Saturday & Sunday		Team meeting TCI			
Monday, 27 August 2018	10:00 hours 11.45 hours 16:00 hours	• Ocean Fisheries • CDB • CNFFO	• Frank Jordan • Tessa Williamson Robertson • Mitch Lay	• Director • EERE • Regional Coordinator	mitchlay@yahoo.co.uk

Date/Day	Time	Institutions	Persons met	Position	Contact email
Tuesday, 28 August 2018	10:00 hours 12:00 hours 14:00 hours 16:00 hours	• Morgan Fish House • FAO • CDB • IICA Barbados	• Kyle Harris • Bree Romuld • Wayne Ellis • Raquel Frederick • Amos Peters • Roger McLeod • Ena Harvey	• Director • Value Chains and Agribusiness • Blue Economy team • Representative	elliotw@caribank.org frederr@caribank.org petersa@caribank.org mcleodr@caribank.org ena.harvey@iica.int
Wednesday, 29 August 2018	13:30 hours	• FAO Team Debriefing			Departure (5 pm)
Wednesday, 5 September 2018	Skype 17:00 hours	• IDB	• Gerard Alleng	• Climate Change Senior Specialist	GERARDA@iadb.org
Tuesday, 13 September 2018	Skype 16:00 hours	• Ministry of Agriculture, Lands, Forestry, Fisheries and the Environment	• Crafton Isaac	• Chief Fisheries Officer	crafton.isaac@gmail.com
Thursday, 21 September 2018	Skype 16:00 hours Skype17:00 hours	• Ministry of Agriculture and Fisheries • Rainforest Seafoods	• Gilbert Kong • Benjamin Jardim	• Chief Fisheries Officer • Business Development Manager	gakong@MICAF.GOV.JM benjardim@rainforestseafoods.com

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Annex 5
Horticulture in the Caribbean region

Acronyms and abbreviations

ACP	African, Caribbean, and Pacific Group of States
CAP	Common Agricultural Policy (of the European Union)
CARICOM	Caribbean Community
CDB	Caribbean Development Bank
CROSQ	CARICOM Regional Organisation for Standards and Quality
CSME	CARICOM Single Market and Economy
DFID	Department for International Development (of the UK)
EPA	Economic Partnership Agreement
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practices
GCNA	Grenada Cooperative Nutmeg Association
GDP	Gross Domestic Product
GHP	Good Handling Practices
GIS	Geographic Information System
GiZ	German Aid Agency
GMP	Good Manufacturing Practices
GPS	Global Positioning System
HACCP	Hazard Analysis Critical Control Point
IDB	Inter-American Development Bank
IFAD	International Fund for Agricultural Development
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
NGO	Non-Governmental Organization
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
SPS	Sanitary and Phytosanitary
TBT	Technical Barriers to Trade
USAID	United States Agency for International Development
USD	United States Dollar
WTO	World Trade Organization

Executive Summary

Horticulture is an important and specific component of agriculture that can be a powerful catalyst for economic growth, overcoming poverty, enhancing food security and raising incomes. High-value horticulture is consistently more profitable for small-scale growers than alternatives, such as cereal or root crop production. Caribbean countries generally lack a conducive enabling environment for innovation, investment, production, and trading in horticulture, which subsequently restricts (1) technology adaptation, generation, and transfer that focuses on addressing productivity and quality constraints; and (2) the ability of small-scale producers to adopt and successfully apply improved horticultural technologies. Improving smallholder competitiveness can be achieved by ensuring access to finance, suitable land, markets and market information, technical assistance, input providers, research services, production technologies and sustainable cropping systems.

Value Chains and Trade

Global horticultural supply chains have changed rapidly. Supermarkets have displaced smaller markets as the main outlets for the year-round supply of fruit, vegetables and other horticultural produce. They demand: year-round supplies to allow consumers continuity of access to specific items of produce; a wide range of interesting products to challenge the existing product range and to entice and retain consumers; the best cultivars; the highest possible quality with regard to flavour, appearance, and condition; products that are convenient to eat; and competitive pricing. The question for Caribbean horticultural sectors is whether they can establish their industries in these modern global supply chains, which are highly specialised and sophisticated. They require considerable input from a range of technologies, many of which are designed to operate at a large scale, and which are not readily adaptable by small-scale holdings.

Caribbean governments have implemented different trading strategies primarily to support rural welfare through national trade policies, negative lists to promote import substitutes, guaranteed prices for some produce, and marketing boards to facilitate exports. The bulk of trade by most Caribbean countries takes place under preferences, due to their dependence on a few agricultural export products and markets. While export subsidies and high import tariffs have contributed to enabling rural areas to achieve improved levels of competitiveness, most Caribbean agricultural sub-sectors remain uncompetitive and policies regarding import substitution have had mixed success. Caribbean countries lack capacities in scientific research, testing, conformity and equivalence, and thus face difficulties in meeting international safety and quality standards. Rising consumer concerns in affluent countries over food safety and quality compound the difficulty for Caribbean countries in meeting ever higher standards. Therefore, more financial and technical assistance is needed to enable Caribbean countries – focused on increasing their horticultural exports – to raise their food safety standards.

Nutrition

For the past two decades, consumers have changed their eating patterns by increasing their intake of calories, sugar, saturated fats and animal protein, while reducing consumption of vegetables and fruits. When this type of diet is combined with lack of activity, the prevalence and frequency of diseases, such as obesity, diabetes, and cardiovascular pathologies also increases. Vegetables and fruit are important for human health because of their vitamins, minerals, phytochemical compounds, and dietary fibre content. Adequate vegetable and fruit consumption can be protective against some chronic diseases, such as diabetes, cancer, obesity, metabolic syndrome, and cardiovascular

diseases; healthy diets also improve risk factors associated with these diseases. Globally, rural people tend to be disadvantaged relative to their urban counterparts, with rates of poverty and malnutrition increasing, particularly in more remote rural areas with less access to social services.

Productivity

Average horticultural yields in Caribbean countries are skewed downwards due to the predominance of smallholder farmers (less than 2 ha plots) growing several different horticultural, root and cereal crops. In Caribbean countries, the contribution of increases in productivity to agricultural growth has been limited. Horizontal expansion, by bringing more land under cultivation, remains the dominant source of growth. Given the increasing pressure on agricultural resources, however, faster agricultural growth, particularly in countries with limited scope for land expansion, will require sustained increases in agricultural productivity.

Pests and disease

The Caribbean region is already contending with several critical horticultural diseases, which represent major challenges for horticultural farmers and lead to considerable economic damage. Environmental scientists predict an increase in the variety and severity of disease and pest populations due to climate change. With warming climates, export-destination countries in temperate climates will become more concerned about tropical diseases and pests currently found in the Caribbean region.

Plant quarantine measures depend on the ability of plant quarantine officials to detect pests and pathogens. But plant quarantine services throughout the Caribbean are underfunded and lack resources to adequately detect harmful pests and diseases affecting key horticultural crops. Thriving tourism industries exacerbate the risks associated with the inadvertent introduction of serious pests and pathogens, along with the planting of imported material without adequate safeguards. Plant quarantine services are forced to be reactive to harmful pests and diseases rather than expending resources to establish prevention and early detection programmes, including educating farmers about possible disease and pest intrusions into their crops.

Climate

The Caribbean region is highly susceptible to variable weather-related events (excess or reduced rainfall; higher or lower temperatures) and natural disasters. Climate change is causing more frequent and intense weather events, changing and less clearly defined wet and dry seasons, periods of heavy rainfall and drought, increased ambient and sea surface temperatures, and rising sea levels. The poorest and most marginalised communities are especially vulnerable and often live in areas most heavily affected by flooding and erosion from storms and sea level rise.

The most topical issue facing horticultural production is the availability of water. Pressure on water resources for urban, industrial, recreational, conservation and other uses all appear to have higher priority within society than the availability of water for horticultural crop (food) production.

Most fruit and vegetable varieties grown by small-scale farmers were introduced into the region more than 30 years ago. Although some testing for the disease resistance of commercial vegetable varieties is being conducted in the region, it is not sufficient to address the broad range of diverse pathogens present in the Caribbean. Genetic diversity and plant breeding are the key elements in enhancing the value of crops for improving nutrition and health while adapting new cultivars to prevailing agroecological zones of the Caribbean region. Fruits and vegetables are sufficiently diverse to allow breeding for higher, more reliable yields for greater availability and affordability.

Market Access

For smallholders, accessing markets can be an immediate barrier to the production and sale of crops. Lack of knowledge of current prices, market expectations, quality standards, and availability of reliable transportation all act as disincentives to production and expansion. Most smallholder growers sell to brokers because they have no other options or market channels. These intermediaries deliver services related to finance, aggregation, grading and transport, and should be important partners to future development.

In many horticultural value chains in the region, there is a lack of transparency in the seller-buyer relationship, and breaches of contract (both formal and informal) are common by both buyer and seller. There is a prevalence of weak organizational structures (both horizontally and vertically) and dysfunctional value chains with undefined rules and roles. A lack of quality standards, few contracts, little transparency, and limited knowledge of market information adversely impact smallholder farmers. But these informal systems provide much needed cash to small-scale farmers and cater to the unpredictable nature of horticulture production. Many smallholder farmers develop long-term relationships with traders and intermediaries that go beyond simple buying and selling.

Food Safety

In Caribbean countries, food production, processing, and marketing systems are fragmented and dependent on many small producers, as large quantities of food pass through a multitude of food handlers and intermediaries, thus the risk increases of exposing food to unhygienic environments, contamination and adulteration. Problems occur due to inadequate facilities and infrastructure, such as the absence or shortage of safe water supplies, electricity, storage facilities (including cold stores), and transport facilities and networks. Most Caribbean food producers and handlers lack appropriate knowledge and expertise in the application of modern agricultural practices, food hygiene, and good food handling practices. Yet, internationally recognised food quality standards are becoming increasingly important; they lead to more formal and complex methods for monitoring quality, and to growing implementation, compliance and certification costs, which are mainly incurred by producers.

Constraints to Growth

Formal financial institutions need support and incentives from governments and donors to enter the rural microcredit sector. Different approaches and strategies are needed for the microcredit sector to be effective within the agricultural sector, particularly at the microenterprise or smallholder level. Government or donor support could help train staff at financial institutions to understand horticulture better, develop suitable products and modes of operation, and extend outreach programmes to farmers. Precise information is important in every phase of production in horticulture, from initial planning to post-harvest stages. For example, spatial and temporal data on the crop, soil, pests, topography, and weather are vital during the field production phase; a host of other parameters are important during the post-harvest phase, such as temperature, humidity, and moisture.

A constant theme among smallholder farmers in Caribbean countries is their risk aversion towards new technologies and opportunities. Smallholder farmers maintain their production mindset based on their traditional cropping systems and they either do not understand or choose to ignore market information and data affecting their farming output. This leads to a number of constraints to growth: a lack of investment in improved inputs and machinery; production systems dependent on manual labour; limited production records and accounting; and a failure to honour contracts.

Basic approaches to maintaining the safety and quality of horticultural produce are the same, regardless of the targeted market of the produce. Stakeholders at each stage of the supply chain

need various skills and capacities to deliver high-quality produce along the chain, which are often lacking in Caribbean horticultural value chains.

Challenges

Post-harvest deterioration is a major issue for high-value crops and poses a major challenge to maintaining quality through the supply chain to the consumer. For example, tropical and subtropical fruit, most vegetables, and herbs are perishable and have a limited storage and shelf life. They are not only susceptible to physical damage and heat injury, but they also generally produce (and are susceptible to) ethylene gas, which induces ripening. This means that most export crops have to be transported to destinations by expensive airfreight.

An important element of a national food control system is its integration in a national food safety system so that links between food contamination and food-borne diseases can be established and analysed. Access to reliable and current intelligence on the incidence of food-borne illness is critical. It is essential that effective linkages are established between food control agencies and the public health system, including epidemiologists and microbiologists. In this way, information on food-borne diseases may be linked with food monitoring data and lead to appropriate risk-based food control policies. This information includes annual incidence trends; identification of susceptible population groups; identification of hazardous foods; identification and tracing of causes of food-borne diseases; and the development of early warning systems for outbreaks and food contamination.

Research and development should be ongoing to select and evaluate improved varieties of high-value crops that are suited to specific microclimates. Similarly, local underutilised species should be evaluated and manipulated to generate new sources of income, either for fresh or processed products. Technology transfer from both university and government sources in many developed countries to horticultural sectors in developing countries has markedly declined over the past two decades and has been replaced with a greater provision of services from the private sector. However, the rudimentary private sector in the horticultural industry in most Caribbean countries cannot deliver such services. Paradoxically, the demand for information from public providers has increased, as providers of information in the private sector seek to stay abreast of the latest developments, and producers seek to secure the best advice possible. Although the provision of knowledge from both private and public sectors may be poorly developed in Caribbean countries, the demand for useful and relevant information is growing as enterprises become more sophisticated and often more focused on exporting their produce.

Recommendations

Keeping pace with the increasing domestic demand for food, meeting requirements for enhancing competitiveness and ultimately raising rural incomes necessitate substantial investment in irrigation and rural infrastructure, human development and institutions. Recommendations to promote horticultural production are as follows:

- Promote the clustering of smallholders based on a product of common interest or common infrastructure.
- Improve the performance and sustainability of plant quarantine services.
- Support the development of national food safety strategies.
- Support initiatives to address pertinent risks and opportunities associated with food safety.
- Develop capacities in both the public and private sector in new technologies.

- Support deployment of a weather forecast system that reaches all small producers.
- Pilot weather-indexed crop insurance schemes.
- Develop long-term national development strategies for key horticultural products.
- Establish incentives to attract more private investment into local horticultural sectors.
- Support research programmes to develop, test and implement climate change adaptation and mitigation strategies.
- Develop and support a research agenda focusing on sustainable production systems.
- Develop mechanisms to coordinate and enhance the marketing of horticultural products.
- Create incentives and an attractive enabling environment to develop rural business services.
- Promote interventions for women to participate more actively in horticultural value chains.

1. Introduction

Horticulture[1] is an important and specific component of agriculture that can be a powerful catalyst for economic growth, overcoming poverty, enhancing food security and stimulating growth in all sectors of community and regional economies. High-value horticulture is consistently more profitable for small-scale growers than alternatives such as cereal or root crop production. Horticulture creates more jobs and produces higher income, but at the same time is more demanding in terms of technology, infrastructure, pre- and post-harvest management, finance and knowledge. Horticulture can contribute to national economies through export-related activities and the sophistication associated with all elements of the supply chain. This is becoming increasingly important in developing countries that contribute to the food supply of developed countries, especially in Europe and North America. Finally, horticulture often sustains the socio-economic viability of rural communities directly through employment and the sustainability of service provision, such as health and education.

Caribbean countries generally lack a conducive enabling environment for innovation, investment, production, and trading in horticulture. As a result, this restricts (1) technology adaptation, generation, and transfer that focuses on addressing productivity and quality constraints (for both fresh or processed produce); and (2) the ability of small-scale producers to adopt and successfully apply improved horticultural technologies. Changing the focus of smallholders from growing basic commodity crops to higher value horticultural crops or mixed cropping systems requires a developed enabling environment that readily delivers the proper technologies, research and extension support, affordable finance, and markets.

Caribbean horticulture production is dominated by smallholder farmers (less than two hectares) and therefore, improving their competitiveness is essential, in particular with regard to access to finance, suitable land, markets and market information, technical assistance, input providers, research services, production technologies, and sustainable cropping systems. Developing horticulture production chains offers the dual advantages of expanding domestic markets and benefiting local consumers, as horticultural crops are a critical part of a heathy, balanced diet.

2. Value Chains

Horticultural value chains are complex, regardless of country or specific product. There are linkages and impacts of different actors (producers, service providers, input suppliers, researchers and extensionists, buyers, consumers, and regulators) on the production and flow of fresh produce into diverse markets (informal, intermediary, formal markets, and processing) that influence the benefit sharing among stakeholders. Different markets require different levels of sophistication in the presentation and quality of the final product, spanning from informal markets requiring minimal

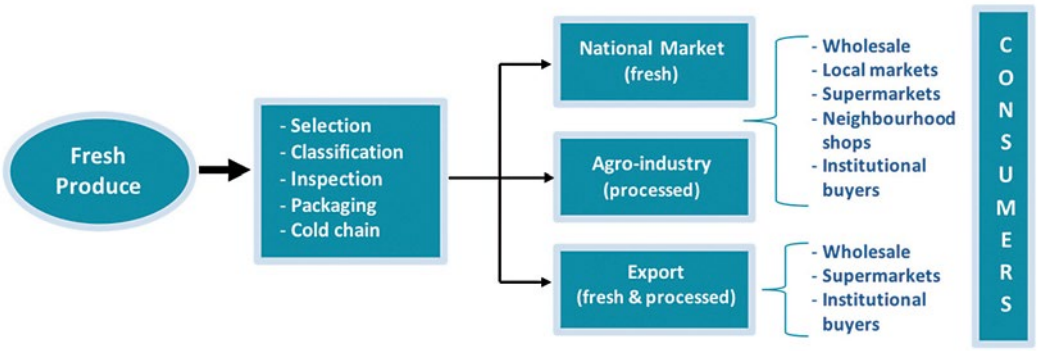
1 Horticulture in this paper deals with intensively cultured and high-value crops, rather than staple crops (cereals, root crops, etc.). Horticultural crops include the vegetables, fruits, herbs, spices and nuts that are directly used by people for food as well as flowers and other plants used for medicinal purposes and for aesthetic uses or visual enjoyment.

refinement, to advanced export markets with onerous quality standards. The effectiveness and efficiency of the value chain to benefit different links of the chain, requires a degree of coordination, transparency, flexibility, and shared goals. If one or more links are either inoperative or absent, the chain will not function effectively.

Global horticultural supply chains have changed rapidly during the past two or three decades. As described in the Background Report for the CDB Agriculture Sector Policy and Strategy, supermarkets have rapidly displaced smaller markets as the main outlets for the year-round supply of fruits, vegetables and other horticultural produce. Furthermore, the number of major supermarket brands is fairly static, and their buying power is powerful, affecting both primary producers and buyers. They demand: year-round supplies to allow consumers continuity of access to specific items of produce; a wide range of interesting products to challenge the existing product range and to entice and retain consumers; the best cultivars; the highest possible quality with regard to flavour, appearance, and condition; products that are convenient to eat; and competitive pricing.

Each demand, however, presents an opportunity for horticultural producers and for horticultural science to develop appropriate production methods, new cultivars and products, and to demonstrate the benefits of fruit and vegetable consumption and the use of plants in various environments. Yet, these options may no longer be viable for some markets due to the high costs of energy for transport and storage, changes in consumer consumption preferences, and changes in consumer concerns – such as those expressed through carbon footprints schemes.

Figure 1. General processes in horticultural supply chains.



The competition amongst supermarkets has, however, introduced complexities that go well beyond these more generic characteristics. Modern supermarkets attempt to deliver to the perceived needs of consumers through responding to concerns as broad and complex as the management of rainforests, the rights of smallholder farmers in developing countries, and the rights to produce genetically modified crops. The objectives also indicate the extent to which supermarket companies are integrating back into horticultural production systems through their direct involvement with production practices (sustainable production systems, pest and disease control, post-harvest management, and others).

As equally significant, in countries in the Caribbean and across the globe, the value of land, the loss in profitability of family farms, and the loss in interest by family members to remain in farming, is seeing aggregations into much larger productive units that are often owned by corporate companies who manage such holdings in much the same way as any other investment. These changes are strongly affecting factors such as the proprietary ownership of new cultivars and the expectation

that such cultivars will be restricted solely for exclusive use by one supermarket chain or by one corporate farmer. The changes in land ownership are also markedly changing the need for traditional, community-based horticultural extension services.

Globally, an increasing proportion of the world's population is living in urban environments where interest in and knowledge of farming, and therefore of food production, is becoming increasingly deficient. In all developed countries, there is a growing expectation and dependence on the supply of a low-cost, year-round supply of premium quality fruit and vegetables. Paradoxically, these same urban-based consumers have become increasing vocal about issues such as carbon taxes, buy-local campaigns, the use of pesticides, labour conditions for farm workers, and the sustainability of production methods. These are often driven as "matters of conscience" and are in isolation from the reality of current production methods or of the opportunity to realistically meet these consumer demands. Urbanisation is also impacting significantly on the availability of labour for farming activities in general.

Other important issues in high-value markets in developed countries affect global horticultural supply chains, including the following:

- The overall unavailability of low-cost labour and the escalating cost of land have led to a decline in horticultural production in many developed countries. Consequently, production has shifted to countries where land and labour allow cost competitiveness. Examples include the growth in horticultural industries in Kenya, and the expansion of apple production in China.
- Genetically modified organisms are now widely used in a number of countries for the production of large-scale agronomic crops (e.g. maize), but this is not the case for horticultural crops, where concerns and debates about the safety and the wider justification of genetic modification prevail. What is of concern in horticultural production is the lack of awareness about the role that conventional plant breeding plays in the production of new cultivars, and the confusion that often prevails between conventional breeding and plants produced using gene transfer technologies.
- Many governments world-wide have scaled back funding for food production (at least in the applied areas of research). But the challenges for modern horticulture have increased in complexity given current consumer demands for affordability, safety and continuity of supply; increasing needs to achieve sustainable practices; and the need to deal with challenges arising from a more variable climate, the loss of productive soils through urban encroachment, and the loss of low-cost labour.

2.1 Product Quality

Quality attributes for a product that fulfils needs and expectations of consumers (and other actors in the chain) belong to two main categories: attributes relating directly to the product, called **"***product* attributes**"**, and attributes relating to production and processing, called "*process* attributes". The first include those relating to taste, appearance, texture, consistency, smell, safety and some functional characteristics, such as post-harvest life and convenience. Process attributes, on the other hand, include among others, organic production, genetic modification, environmental concerns and origin.

For as long as product quality continues to be defined according to the needs of consumers, it will remain strongly influenced by the principles, values, culture, ethics and religious values of individuals. Consumers may choose products not only based on "product attributes", but also on "process attributes", involving the way in which they are produced and processed – origin, environmental impact of production practices, and more. Consumers may also be willing to pay a higher price for products conforming to these requirements or attributes.

Some quality attributes may be grasped by the consumer through the senses, while others cannot be assessed directly. Consumers may use taste, smell, and size to judge the attributes (particularly

taste and texture) of the product they intend to buy. Other quality attributes, such as microbiological and chemical contaminants or nutritional value, are in general not grasped through the consumer's experience or perception of the product, and can only be conveyed by external indications, such as certifications or quality labels. Similarly, some process attributes, such as environmental impact, can only be identified with attached labels or marks.

The general concept of quality is complex and global as a result of the diversity in horticultural produce and the interrelations between links in the chain. The concept includes all attributes, characteristics and values that the consumer or buyer would expect of the product according to its use. A good quality product would certainly fulfil the expectations of the consumer or of the end user.

The question for Caribbean horticultural industries is whether these sectors can locate their industries into these modern global supply chains that are highly specialised and sophisticated. They require considerable input from a range of technologies, many of which are designed to operate at a large scale and which are not readily adaptable by small-scale holdings. The horticultural industry is also highly integrated along the supply chain with many private and public sector parties contributing to different facets, from the development of new cultivars and production methods, to establishing grade standards and market entry protocols, to the actual marketing of produce.

Caribbean smallholder growers need to respond to the volume and quality demands of end users (i.e. formal markets, domestic and export), but they are vulnerable because of their low bargaining power, lack of technical knowledge, and difficulties accessing capital. Therefore, special attention is needed to support Caribbean smallholder farmers and to provide the tools and enabling environment necessary to facilitate access to the economic benefits of more profitable horticultural markets that are likely to be high-value, low-volume niche markets in developed countries rather than seeking to supply modern supermarket supply chains.

>> Box 1. Case Study: Jamaican Blue Mountain Coffee

While Jamaica is a relatively small player in terms of global coffee production volume, its Jamaica Blue Mountain coffee has a distinguished history, developing a reputation for premier quality before specialty coffee became a prominent niche in the global industry. The low level of supply combined with consistent demand from developed markets has allowed the Jamaican coffee industry to earn the highest unit value for its exports for any coffee producer in the world.

There are, however, constraints that threaten Jamaica's competitiveness – productivity is low, yet the costs of production are high; infrastructure is weak, and the industry is too dependent on one export market: Japan. Campaigns to expand export partnerships in the United States of America, Europe, and other potential markets are limited, hindering the ability to diversify end markets. The global coffee industry places a premium on third-party verifications of sustainability and environmental considerations. Many actors in Jamaica are either not in compliance with industry standards or cannot generate the necessary documentation. Large aggregators and processors do not differentiate their supply, limiting their ability to sell into the supply chains of lead firms.

Furthermore, the Coffee Industry Board's shrinking capacity means the institutions active in the sector generally only represent interests at one stage of the value chain, leaving the industry with limited supportive services. Many of these challenges are surmountable; however, they will require a concentrated effort by all value chain stakeholders.

Source: Adapted from Daly *et al.* (2018).

3. Production and Trade

Developing countries that manage to upgrade and diversify their export base experience faster growth and enjoy greater welfare gains than those that do not upgrade their base.[2] Some countries manage to change their export profile via the success of indigenous entrepreneurs. In the contemporary period, however, developing countries are more likely to transition their economies by attracting foreign direct investment into novel sectors. They use foreign investment to link into global supply chains, and then build backward linkages to local firms and workers in the host economy.

Caribbean governments have implemented a number of different trading strategies primarily to support rural welfare through national trade policies, negative lists to promote import substitutes, guaranteed prices for some produce, and marketing boards to facilitate exports. Due to their dependence on a few agricultural export products and markets, the bulk of trade by most Caribbean countries takes place under preferences. Many of the trade policies implemented by Caribbean governments were aimed at providing market space and time to achieve competitiveness for many segments of the domestic agricultural sector. While export subsidies and high import tariffs have contributed to enabling rural areas to achieve improved levels of productivity and competitiveness, many Caribbean agricultural sub-sectors remain uncompetitive and policies regarding import substitution have had mixed success. More developed countries contribute cheap food imports that have helped increase food security in most Caribbean countries.

Supply chain creation in horticulture – in particular, raw, packaged and processed vegetables and fruits – offers opportunities for the region. It is doubtful Caribbean countries will be able to compete in bulk commodity markets, such as those for their traditional horticultural crops of banana and citrus, but opportunities exist in niche markets of high value, low volume products that adequately cover expensive logistical costs from the region.

A traditional crop grown by most Caribbean countries is cocoa, and the region is recognised globally as a producer of fine cocoa. Several Caribbean countries are classified as exclusive producers of fine cocoa: Dominica, Grenada, Jamaica, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago. Belize is also recognised for the production of high-quality, fine cocoa with a large percentage of its production being labelled as organic cocoa. Despite the price premiums cocoa producers receive, returns to Caribbean producers (and cocoa producing countries in general) are relatively modest. Typically, Caribbean countries only export raw materials, especially dry, fermented cocoa beans. The importers in developed countries reap the rewards through value- added processes, blending, processing, branding, marketing and distributing premium and dark chocolate.

The Background Report on the CDB Agriculture Sector Policy and Strategy describes the global marketplace and the challenges for small countries and countries with minimal comparative advantages to compete in higher value global markets. The economies of Caribbean countries now have to compete in a more competitive world market. The gradual removal of trade barriers, rising demand for higher quality products and higher standards, the continuous erosion of trade preferences and the costly compliance with new trade rules are particular problems that hamper the competitiveness of Caribbean producers in both global and domestic markets. Due to globalisation and liberalisation, Caribbean countries are also becoming more vulnerable to changes in world market conditions, on account of their small economic size and their increasing reliance on imports for food supplies. The decline in their commodity terms of trade has reduced both the incentives to engage

2 Theodore H. Moran, *FDI and Supply Chains in Horticulture (Vegetables, Fruits, and Flowers, Raw, Packaged, Cut, and Processed): Diversifying Exports and Reducing Poverty in Africa, Latin America, and Other Developing Economies* (Working Paper 475, Washington, USA: Centre for Global Development, 2018).

in the production of tradable goods and the gains and economic stimulus from such production. The emerging threats due to climate change will further worsen their situation.

Since the mid-1980s, Caribbean countries have tried to diversify their farming activities to offer non-traditional agricultural products to the market. Their goal was to focus production efforts to offer tropical and subtropical horticultural products into local and export markets to both offset costly imported fruits, vegetables and nuts, and exploit higher value export markets. Despite their proximity to the large markets of the United States of America and Canada, and free access to numerous products in North America and the European Union, Caribbean exporters face significant hurdles. The small size of the countries, high production and especially transport costs all hamper their export competitiveness. In destination countries, public food safety regulations for trade in fruits and vegetables have become more stringent. In addition, private food standards focusing on food quality and safety, or ethical and environmental aspects of food production and trade have spread in horticultural sectors, with GlobalGAP as one of the most important food safety certification schemes.

Small-scale horticulture producers therefore face a combination of rising compliance costs from both government regulations and private standards, tightened control over the supply chain by private standard setters and a shift towards supply contracts with a small number of large-scale producers and retailers. These trends have resulted in a significant degree of industry concentration. Producers who lack the capacity to make the transition from traditional to high-precision production and quality assurance methods are particularly vulnerable. This has significant development implications, as those in greatest need of the increased incomes offered by horticultural exports to high-value markets in developed countries, such as smallholder farmers in Caribbean countries, are being squeezed out of the market by the effects of ever-increasing compliance requirements. Stringent quality, safety and other requirements in the horticultural sector may therefore be weakening the link between a successful export sector and poverty reduction.

Table 1. Production of top five horticultural products

(Thousand tonnes)		2014	2015	2016
Jamaica	Coconuts	234.3	261.5	255.4
	Citrus	140.4	147.3	151.6
	Bananas and plantains	90.9	93.2	95.7
	Pumpkins, squash and gourds	48.4	44.6	53.5
	Cabbages and other brassicas	32.0	32.2	37.7
Haiti	Mangoes, mangosteens, guavas	677.3	711.8	670.9
	Bananas and plantains	502.9	516.2	508.9
	Citrus	147.9	151.0	151.2
	Pigeon peas	90.3	114.8	114.4
	Beans, dry	100.6	103.5	111.9
Grenada	Coconuts	6.3	6.3	6.3
	Nutmeg, mace and cardamoms	2.9	3.1	2.5
	Bananas and plantains	3.6	3.0	2.9
	Mangoes, mangosteens, guavas	1.6	1.7	1.7
	Avocados	1.5	1.6	1.6
Guyana	Coconuts	35.3	91.0	170.7
	Bananas and plantains	61.4	85.1	92.5
	Eggplants (aubergines)	10.1	37.7	44.6
	Pumpkins, squash and gourds	16.4	36.1	39.0
	Chillies and peppers	13.2	35.4	33.5

Source: FAOSTAT (2018).

>> Box 2. Case study: Bananas in Jamaican horticulture

Jamaica provides an example of the changing trade trends in Caribbean countries and the effects of globalisation. The country's traditional export crops – sugar, bananas, coffee, and citrus, which dominated export earnings in the past, have declined by 28 percent over the last two decades. Meanwhile, the values of non-traditional food crop exports, such as alcoholic beverages, have been increasing.

Jamaica is a major net food importer and was severely impacted during the global food price crisis of 2008. Food imports comprise over 14 percent of total imports, mainly for cereals, dairy and meat. Traditional crops are still important, as they have structured supply chain systems with various support services, as well as grower, trader and processor associations (e.g. the Banana Board currently maintains over 150 varieties at the gene bank at the Bodles Breeding Research Banana Station).

From the late 1990s onwards, weather events and disease decimated the banana industry in Jamaica. The removal of preferential trade arrangements with the European Union for banana exports further impacted incomes and prompted producers to grow more non-traditional crops, such as vegetables.

In 2015, the government supported by funding from the European Union's (EU) Africa, Caribbean and Pacific (ACP) Banana Accompanying Measures (BAM) programme, sought to restore the industry. The programme was aimed at boosting production and exports by reversing a decline in Jamaica's banana industry, for example by providing technical support and direct inputs to build infrastructure, assisting farmers to obtain GlobalGAP certification, and helping the Banana Board produce around 120 000 new plants of high genetic potential each year for growers.

Nevertheless, Jamaica has been unable to revitalise its banana export industry and traditional markets are now lost to cheaper producers in Latin America and Africa. However, Jamaica has managed to stabilise its banana production: all produce is now consumed in local markets, where bananas are one of the cheapest fruits available.

Sources: Adapted from Fairtrade Foundation (2014); European Commission (2018); Mather (2008).

In 2016, Caribbean Development Bank (CDB) member countries produced a total of 4.3 million tonnes of horticultural produce on an area of about one million hectares (FAOSTAT, 2018). Caribbean countries are net exporters of fresh fruits that are underpinned by traditional crops such as bananas, mangos, citrus, and some spice varieties to long-established markets in the United Kingdom of Great Britain and Northern Ireland and the United States of America. Many non-traditional crops are now reaching economies of scale within Caribbean countries.

In addition to the crops listed in Table 1, Jamaica now produces substantial quantities of carrots, chillies, peppers, cucumbers, pineapples, spinach, tomatoes, and watermelons. Haiti has become a major producer of avocados, coffee (green) and groundnuts. Citrus has expanded in Grenada and in Guyana watermelons, beans, tomatoes, pineapples and okra are becoming important crops. The intra-regional trade of horticultural products is vibrant in the Caribbean. However, most countries are in a trading deficit with regard to both fresh and processed horticultural products. For example, in 2017 Jamaica exported almost USD 0.5 million of cocoa beans, but this was surpassed by over USD 9.6 million of imported chocolate and other cocoa products.

Overall, the lack of value-adding enterprises in Caribbean countries detracts from the economic potential of the horticulture industry in the region. Although, pursuing agro-industrial policies for the

horticulture industry in Caribbean countries would be unrealistic and most countries would only be capable of targeting low-volume, but high-value niche markets.

Across the Caribbean, banana production is important for smallholders. Mostly produced on small plots that rely on family labour, bananas are the only cash crop for many households. They are also easy to cultivate on the hilly terrain common to these areas. Thus, banana production continues to play an important socio-economic role in smallholder farming enterprises and local communities: providing employment for a large cross-section of the population; generating income on a more regular basis; and contributing to the improved welfare of rural communities.

Banana farmers in many Caribbean countries, particularly Small Island States, have been reluctant to grow alternative crops, giving preference to the short-term nature of the banana crop cycle, the existing marketing organization and structures, and the year-round weekly cash flow from sales. Efforts to increase the commercial production of other crops have had limited success. The main challenge for the agricultural sector over the short to medium term is to be competitive in existing markets, and to identify new areas for development.

Threats to the income-earning capacity of rural communities as a consequence of fluctuations in the economic performance of the banana industry have often precipitated periodic social agitation in rural areas. Heavy dependence on the banana industry had a ripple effect on other sectors of the economy, inducing many Caribbean countries to try to revitalise their banana industries.

Table 2. Horticultural trade balance

(USD million)		2013	2014	2015	2016	2017
Jamaica	Vegetables	4.97	5.12	3.20	15.45	18.48
	Fruits, berries, nuts	5.23	1.88	0.58	4.89	3.92
	Coffee, tea, spices	17.44	12.58	21.85	29.42	24.15
	Cocoa/products	-10.35	-8.56	-9.07	-8.54	-9.20
	Processed products	-48.04	-43.80	-50.92	-45.24	-47.97
Haiti	Vegetables	-41.55	-34.02	-50.29	-57.72	-31.48
	Fruits, berries, nuts	5.88	-1.48	4.17	2.03	6.73
	Coffee, tea, spices	-0.88	-1.61	-1.20	-1.10	-1.85
	Cocoa/products	1.02	1.66	2.62	9.20	3.570
	Processed products	-21.72	-19.37	-15.09	-18.80	-10.91
Grenada	Vegetables	-0.96	-1.48	-1.71	-1.37	-1.48
	Fruits, berries, nuts	0.22	0.24	1.80	1.66	2.92
	Coffee, tea, spices	14.85	7.93	7.78	8.32	9.53
	Cocoa/products	1.66	1.15	3.35	1.15	2.29
	Processed products	-3.76	-4.20	-4.35	-2.62	-2.20
Guyana	Vegetables	-13.42	-12.70	-13.66	-15.77	-15.38
	Fruits, berries, nuts	1.90	4.99	3.67	6.52	9.80
	Coffee, tea, spices	-1.99	-1.78	-2.11	-2.65	-2.25
	Cocoa/products	-2.94	-3.13	-2.62	-2.37	-3.61
	Processed products	-7.61	-7.55	-9.57	-12.97	-12.32

Source: UN Comtrade (2017).

The regional import food market is large and growing, propelled by growth in population, expansion in real incomes and in tourism activity. Regional food imports were estimated at USD 3.2 billion in 2014 (FAOSTAT, 2018) and growing in real terms at the rate of 2.4 percent per annum. Therefore, it is often ironic that the Caribbean struggles to export to sluggish markets abroad to the neglect of steadily expanding domestic markets. Given the dynamism of domestic food markets, all Caribbean countries should, to the extent possible, engage in some level of competitive import replacement as a means of enhancing food security, increasing incomes, and reducing poverty. Due to the increasing use of Sanitary and Phytosanitary (SPS) barriers in destination countries and low export prices for some horticultural commodities, production for domestic markets – rather than exports – is a more effective strategy for increasing the incomes of smallholders and alleviating poverty.

While the relative importance of large-scale plantation crops destined for export markets, such as sugar and bananas, have declined throughout Caribbean countries, small-scale horticultural production has potential for growth, particularly in terms of displacing high-cost imports in domestic markets. Smallholders, however, tend to be at a comparative disadvantage in accessing higher value markets for horticultural produce, as they are faced with the following constraints: a lack of market information; inefficient production practices and outdated technologies; limited production of value added products; lack of economies of scale for storage and packing; and high logistics costs.

Although a substantial level of import substitution is unlikely for Caribbean countries, even a relatively small level, given the size and dynamism of the import market, can make a significant difference in terms of contribution to economic growth, foreign exchange savings and employment. There is the additional competitive advantage, particularly given high fuel costs, that transportation costs will be less of a constraint in the pursuit of such a strategy, compared to exports. Table 1 highlights the potential business opportunities for import substitution in key sub-sectors of the horticultural industry in the local markets of the four sample Caribbean countries.

3.1 Trade Agreements and Trends

The CARICOM Single Market and Economy (CSME) was established in 2006 to provide more and better opportunities to produce and sell goods and services, increase competitiveness, provide employment, and improve standards of living for the people of the Caribbean Community. The CSME now boasts some successes in the areas of functional cooperation, economic integration, and foreign policy coordination. Within these categories, the implementation of the common external tariff, free movement of skills, and the establishment of regional quality and research institutions are of significance to horticulture.

Despite these achievements, challenges remain in intraregional trade. Technical Barriers to Trade (TBT) are technical regulations, minimum standards, and certification systems for health, safety and environmental protection, which affect manufacturers, exporters and service providers in CARICOM countries. Most TBTs are related to infrastructural and institutional limitations in the CARICOM region, which restrict market access and impede participation in intra-regional trade.

These challenges have not only impacted intra-regional trade, but have also constrained access to international markets, especially those liberalised through the EC-CARIFORUM Economic Partnership Agreement (EPA). For example, sauces from the CARICOM region were denied entry into European markets due to the presence of a banned chemical additive; they were returned based on non-compliance with standard and conformity assessment requirements of the importing country. The inability of countries in the Caribbean to test for such banned additives resulted in the exporting CARICOM member countries needing to perform the necessary analytical tests at accredited facilities external to the region at higher costs.

A major challenge faced by Caribbean countries is raising the SPS and TBT standards of their exports to at least internationally recognised levels. Due to their limited capacities in scientific research, testing, conformity and equivalence, Caribbean countries face difficulties in meeting international safety and quality standards. The task is even more daunting when the destination countries, on risk assessment grounds, adopt higher standards than those currently recognised by international standard-setting bodies. Moreover, rising consumer concerns in affluent countries over food safety and quality compound the difficulty for Caribbean countries in meeting ever higher standards.

Caribbean countries have neither the institutional capacity nor the human resources to face all the challenges or take full advantage of the opportunities flowing from the multilateral trading system, and to participate fully as equal partners in World Trade Organization (WTO) negotiations on agriculture. Therefore, Caribbean countries require technical and financial support to strengthen and develop their capacity, especially in the following areas: (1) institutional capacity to meet international standards, such as food safety and quality; (2) in multilateral negotiations, to better manage problems in honouring their WTO commitments (including follow-up of decisions in their favour), and take advantage of trading opportunities; and (3) the capacity to analyse trade issues in the context of the continuation of the reform process.

3.2 European Union Trade Liberalisation

Historically, those Caribbean countries with large plantations of sugar cane, bananas, tobacco, etc. were able to export their raw and partly processed produce to the European Union. Special protocols of the European Union granted ACP countries guaranteed preferential prices, allowing Caribbean countries to utilise these protocols to export raw produce to the European Union at a high price and import the same produce for domestic consumption at much lower prices.

In 2009, this Protocol was replaced by the ACP Economic Partnership Agreement, which reduced the difference between ACP and world market prices. Additionally, under pressure from the WTO, reforms to the European Union's Common Agricultural Policy in March 2013 abolished guaranteed agricultural quotas for each country. In October 2017, the European Union ended the preferential treatment that ACP producers had enjoyed since 1975. Under this new regime, Caribbean countries would have to compete with other, more efficient, food-producing countries. In addition to losing their preferential access to the European Union market, Caribbean countries have been faced with unstable domestic demand, and limited access to neighbouring markets, including the United States of America. As a result, some countries in the Caribbean, such as Jamaica, are currently exploring increasing exports to more attractive markets within CARICOM as well as to markets in Asia and Eastern Europe.

The EPA signed by CARIFORUM countries with the European Union opens new prospects for cooperation and trade development. For the first time, Caribbean countries are participating in a reciprocal trade liberalisation scheme with a major and economically stronger trading partner.

4. Nutrition

Of all the crops that are cultivated by smallholder farmers in Caribbean countries, the most important have been staple cereal and tuber crops, providing carbohydrates and calories to deliver essential energy requirements. In many cases, yields are low, with productivity far below the potential that could be attained with appropriate technological inputs. The financial position of smallholders in Caribbean countries could be improved if the balance of crops they grew was expanded to include a greater proportion of fruits, vegetables, aromatic plants, nuts, spices and herbs.

The prevalence of cereal and tuber cropping among smallholder farmers has implications for the nutritional status of farming households. The primary motivation for smallholders is to grow crops for their household consumption, with excess produce sold locally. Due to lack of storage facilities, these farmers are forced to sell their excess produce during peak season when crop volumes in local markets are high and prices are correspondingly low. This impacts smallholder incomes and restricts their food buying habits for the remainder of the year. These farming households also grow some vegetables and other food crops for their household use and sales. During low production periods, however, they will need to purchase fresh produce locally.

For the past two decades, consumers have changed their eating patterns, by increasing their intake of calories, sugar, saturated fats and animal protein, and reducing the consumption of vegetables and fruits. When this type of diet is combined with lack of activity, the prevalence and frequency of diseases – such as obesity, diabetes, and cardiovascular pathologies – also increases. Fruits and vegetables are important for human health because of their vitamins, minerals, phytochemical compounds, and dietary fibre content, especially antioxidant vitamins (vitamin A, vitamin C, and vitamin E). Adequate vegetable and fruit consumption can be protective against some chronic diseases, such as diabetes, cancer, obesity, metabolic syndrome, and cardiovascular diseases; a well-balanced diet including fruits and vegetables can also improve risk factors associated with these diseases.

As illustrated in Table 2, most Caribbean countries have a trade deficit in vegetables. Therefore, local markets are dependent on imported vegetables to compensate for the shortfall. This drives up local prices and impacts rural food security and nutrition, forcing local consumers to pay more for imported vegetables. The unavailability of affordable vegetables in local markets in most Caribbean countries hinders rural households' ability to diversify their diets, as their low income levels restrict their purchasing power of essential food items, such as fruits and vegetables. However, with banana supply chains now targeting local markets, bananas are relatively cheap for Caribbean consumers compared to other fruits.

Malnutrition in all its forms remains a global concern, particularly affecting highly vulnerable populations in several regions of the world, including the Caribbean (see Table 3) and other Small Island Developing States (SIDS).

Table 3. Prevalence of malnutrition

	Malnourishment (%)							Overweight/Obesity (%)			
	Undernourished (Total Pop.) Wasting		Children (< 5 yrs)			Women (15-49) Anaemia		Adult (>18 yrs) Obesity		Child (<5 yrs) overweight	
			Wasting	Stunting							
	2006	2016	2016	2005	2016	2005	2016	2005	2016	2005	2016
Grenada	27.8	25.5	n.a	n.a	n.a	n.a	n.a	15.7	21.8	26.4	23.5
Jamaica	6.9	8.4	3.0	5.6	5.7	25.6	22.5	18.2	24.1	6.1	7.8
Guyana	9.1	8.5	6.4	18.2	12.0	39,9	32.3	15.4	21.3	6.8	5.3
Haiti	57.1	46.8	5.2	29.7	21.9	49.8	46.2	7.4	10.7	3.9	3.6

Sources: FAO, IFAD, UNICEF, WFP and WHO (2017).

The excessive intake of energy-dense food, which is a form of malnutrition, together with reduced physical activity, has led to an epidemic of obesity and overweight populations. While a notable increase in the intake of animal protein, mainly in the form of meat and milk products, has contributed to the rise in average daily calorie consumption in the Caribbean region since the early 1960s by about 27 percent, and since the early 1990s by 12 percent, the largest proportion of the increase in average daily calorie intake in Caribbean countries was due to an increase in the intake of sugar and other sweeteners (FAO, 2017).

Disparities between rural and urban areas are on the rise, particularly in many developing and transitional countries, including those in the Caribbean. Globally, rural people and rural places tend to be disadvantaged relative to their urban counterparts, with rates of poverty and malnutrition increasing in more remote rural areas. Rural communities tend to have less access to social services, exacerbating the effects of rural poverty and malnutrition.

5. Constraints

Horticultural crop production not only varies from year to year, but also from season to season. Taken as a group, horticultural crops show seasonality, both in price and availability. In semi-tropical areas such as the Caribbean, high temperatures and humidity, frequent and intensive flooding, and poor field drainage reduce yield and supplies of horticultural produce during the wet season.

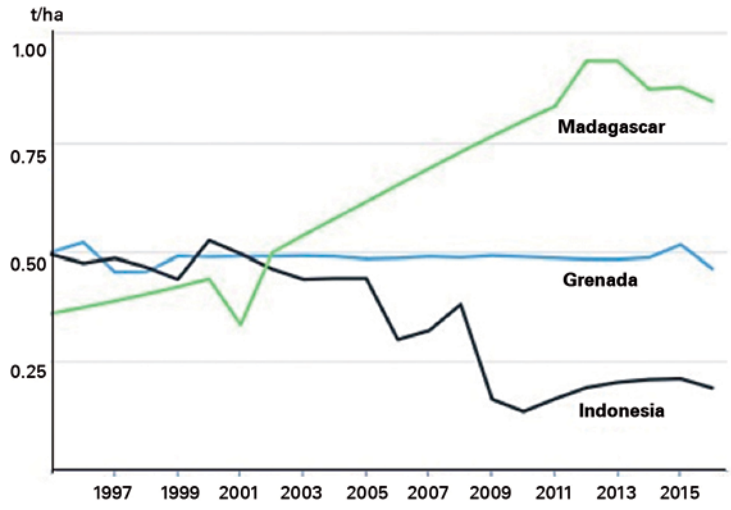
5.1 Productivity

Productivity is a measure of the rate at which an industry converts inputs (such as labour, land, water and energy) into outputs. For growing horticultural crops, it is not about levels of production, but how efficiently growers can produce a crop. Higher levels of productivity are a result of producing the same levels or greater output from fewer inputs. As a result, productivity is often associated with competitiveness and, ultimately, profitability. Productivity growth is thus important in building a sustainable and profitable horticultural sector. Low productivity growth reduces the industry's long-term ability to compete, grow new markets and improve a country's natural capital. Understanding what

impedes productivity growth and how to solve these problems is critical to the success of farmers and other industry stakeholders. Benchmarking against leaders in selected crops helps gauge potential in major Caribbean horticultural crops and monitor progress towards improvements in the industry.

- Citrus is a major horticultural crop for Jamaica, with the government trade support agency (JAMPRO) actively promoting the production and export of mostly grapefruit and sweet oranges. Jamaican citrus farmers consistently produce yields of about 10 tonnes per hectare, but these yields lag behind South Africa, which has one of the most productive citrus industries in the world, with about 41 tonnes per hectare. South Africa has consistently increased citrus yields since the late 1990s, from about 20 tonnes per hectare to 41 tonnes per hectare today.
- Mangoes, a major export crop for Haiti, have regularly yielded about 7.6 tonnes per hectare, which are low compared to Israel with a high yielding mango industry of about 22.5 tonnes per hectare. Israel's yields fluctuate between 15 and 38 tonnes per hectare, depending on weather and water availability.
- Grenada is the seventh largest producer of nutmeg in the world and the second largest exporter (supplying about 20 percent of global supply), with yields of about 0.46 tonnes per hectare, but compares unfavourably to yields in Madagascar of 0.85 tonnes per hectare (see Figure 2). Before 2000, Madagascar's nutmeg yields were below Grenada's; however, since then yields have consistently increased to current levels. Grenada's nutmeg productivity has always been around current levels.
- For Guyana, eggplant (aubergine) has become an important crop for local farmers, yielding about 0.65 tonnes per hectare. However, these yields are low compared to a mid-range producing country, such as Mexico, which produces eggplants at 67.4 tonnes per hectare.

Figure 2. Nutmeg productivity of industry leaders.



Source: FAOSTAT (2018).

Average yields in Caribbean countries are skewed downwards due to the predominance of smallholder farmers (less than 2 ha plots) growing several different horticultural, root and cereal crops. Conversely, global market leaders in various horticultural industries are dominated by large-scale, often industrial-level production systems. While Caribbean countries are unlikely to achieve the yields obtained by global industry leaders, benchmarking demonstrates the possible productivity gains and aspirational targeting with effective support to growers and other stakeholders in the different horticulture value

chains. In Caribbean countries, the contribution of increases in productivity to agricultural growth has been limited. Horizontal expansion, in other words, bringing more land under cultivation, remains the dominant source of growth. Given the increasing pressure on agricultural resources, however, faster agricultural growth, particularly in countries with limited scope for land expansion, will require sustained increases in agricultural productivity. Available evidence from global horticultural industry leaders shows that the potential productivity gains could be considerable.

>> Box 3. Case study: Nutmeg productivity gains

Following political and economic reforms during the 1990s, Madagascar turned its focus to its agricultural sector. With about two-thirds of the population dependent on agriculture, improving the sector was identified as a means to reduce poverty, enhance economic growth, and generate rural employment. From 2000 onwards, the Ministry of Agriculture first developed a strategy to target the herbs and spices sectors. Although Madagascar has a thriving spices sector, it was considered capable of being more productive and generating more trade with multiple spice crops. Through support from the World Bank, the German aid agency (GiZ), the Japanese International Cooperation Agency (JICA), and several other international development agencies, assistance was directed at improving local spice varieties, supporting farmers to use improved production inputs and technologies, and building the technical capacity of the extension service. Although Madagascar remains a relatively minor nutmeg producer and exporter compared to the industry leaders (Grenada and Indonesia), the productivity of its nutmeg-growing farmers continues to increase and outpace these countries.

Source: Adapted from FAO, ITC and CTA (2001); OECD and WTO (2013); van Rutha et.al. (2018).

The following factors are important in influencing changes in agricultural productivity:

1. **Business environment** – This relates to the wider macroeconomic context in which farming and horticulture businesses operate. Factors include regulation, taxation, inflation and growth, planning, and infrastructure. Favourable, stable economic conditions provide a foundation on which businesses, including horticultural growers, can invest and grow.

2. **Natural capital** – This includes topography, soil condition, access to water and climate. These are factors that can place certain physical limitations on the ability to increase productivity. However, improving natural capital, such as the condition and quality of soil, can make an important contribution to long-term growth in productivity and sustainability.

3. **Competitive pressures** – Greater exposure to competition spurs businesses to innovate and reduce costs. Food systems need to be open and competitive to drive productivity gains.

4. **Policy** – Specific policy incentives can play a part in increasing productivity growth through promoting incentives for new entrants, incentivising uptake of new skills and harnessing new technologies. Many researchers argue that direct support payments hinder productivity growth in developing countries; however, the same policies help explain why some countries in the European Union, such as the Netherlands, have increased productivity at fast rates.

5. **Ideas** – The right innovation can push the frontier of productivity growth, but it is essential that the means exist to transfer and exchange knowledge. According to the Organisation for Economic Cooperation and Development, innovation and research and development (R&D) are the main

source of agricultural productivity growth in the long run, delivering a return on investment of between 20 and 80 percent per annum.[3]

6. **People** – Improving the skills of the workforce and the ability to harness them via effective leadership are critical to productivity growth. A correlation exists between business performance and levels of skills and education.

5.2 Pests and Diseases

Pressure from pests and diseases is a major concern in the Caribbean region as more countries introduce new regulations to prevent the spread of virulent diseases and pests, which will be especially relevant to export agriculture. The region is already contending with several critical horticultural diseases, which represent major challenges for horticultural farmers, and lead to considerable economic damage. Environmental scientists predict an increase in the variety and severity of diseases and pest populations due to climate change – with warming climates, export-destination countries in temperate climates will become more concerned with tropical diseases and pests currently found in the Caribbean region. The following are examples of such pests and diseases:

- The Caribbean fruit fly, *Anastrepha suspensa*, is a pest of many tropical and subtropical fruits; certified fly-free zones must be created to produce fruit for export.
- The avocado industry has great potential for the region. As is common in many developing countries, avocado seedlings are sold through non-certified nurseries, and commercial varieties are grafted onto rootstocks that are not resistant to plant pathogens, such as *Phytophthora cinnamomi,* which can spread easily and cause disease.
- The citrus industry is important to several Caribbean countries, but has been severely affected by Huanglonbing (HLB) or citrus greening disease, which has caused the decline of once prosperous industries. There are no known cures, and efforts are needed to plant healthy, disease-free stock with strict biosecurity measures during production.
- Begamoviruses have become widespread in several Caribbean countries, causing estimated yield losses of 50 to 60 percent in tomato, pepper and eggplant crops, among others.

Research into the effective management of pests and diseases will become a more urgent priority for Caribbean countries, as high-value markets instate more rigorous biosecurity measures, which will increasingly lock out lesser quality, uncertified food produce. Therefore, current issues such as integrated pest and disease management, the development of biological control agents, the commercialisation and accessibility of biological control agents, low-cost tissue culture systems, the development of endophytic organisms to counter pests and disease, and the identification and management of viruses will become progressively more important to smallholders and the entire industry for some Caribbean countries dependent on certain horticultural crop exports.

3 see www.oecd.org/tad/fostering-productivity-and-competitiveness-in-agriculture-9789264166820-en.htm

>> Box 4. Case study: Frosty pod rot in cocoa beans

Frosty pod rot is a disease of cocoa caused by the fungus, Moniliophthora roreri, that can destroy between 30 and 90 percent of pods depending on weather conditions. It is found in Central and South America but was first detected in some cocoa growing areas of Jamaica in August 2016, including the prime cocoa growing areas that produce the hallmark flavour for Jamaican cocoa (premium cocoa flavour), which generate the highest prices for Jamaican cocoa. Drought initially helped suppress the spread of the disease, but it became more widespread during the 2017 wet season and now threatens the local industry. An emergency plant quarantine response was activated to try and curtail the spread of the infectious fungus. Several activities were also conducted, including stripping, pruning and spraying, while more than 500 farmers were sensitised in the affected areas. The disease has effectively stalled cocoa exports from Jamaica and the country is losing markets. Other Caribbean countries with cocoa industries have heightened their alert status, warning farmers of the disease.

Sources: Adapted from Johnson et al. (2017); IPPC (2018); MICAF (2016).

Plant quarantine measures depend on the ability of plant quarantine officials to detect pests and pathogens that may be associated with the introduced planting materials. These include pests and pathogens with high multiplication rates, such as certain pycnidial fungi, downy mildews, bacteria and viruses when the insect vectors are efficient. However, plant quarantine services throughout the Caribbean are underfunded and lack sufficient resources to adequately detect harmful pests and diseases affecting key horticultural crops. Once a destructive pest or disease is detected, expensive programmes are enacted to try and control the disease, but these actions are usually "too little too late", and the pest or disease becomes established.

The risks involved in the inadvertent introduction of serious pests and pathogens, along with the planting material imported without adequate safeguards, are compounded by thriving tourist industries in Caribbean countries and inadequate checks of luggage and arriving tourists. Quarantine services weigh the costs of the pest or pathogen establishment and usually accept the inevitable that the pest or disease could not be eradicated. Plant quarantine services are forced to be reactive to harmful pests and diseases rather than expending resources to establish prevention and early detection programmes, including educating farmers about possible disease and pest intrusions into their crops.

Exotic pests and pathogens pose a serious threat to a country's or region's agricultural production and natural environment. These organisms may include races and biotypes of indigenous pests and pathogens. For quarantine services, any pest risk analysis should take the following into account:

- benefits that are likely to accrue from the introduction of the planting material concerned;
- effective detection techniques;
- quarantine inspection costs;
- treatment, including detention in the post-entry quarantine facility;
- cost of eradication, should an exotic pest become established;
- availability of trained personnel;
- modes of transmission and factors favouring the establishment and spread of pests and pathogens;

- availability of safeguards (necessary labour resources, chemicals and equipment to contain and eradicate the pests; and
- adequate survey and surveillance programme.

There are serious shortcomings in phytosanitary information and reporting from Caribbean countries; there exists virtually no coordinated national programme for pest and disease surveillance. The lack of effective surveillance and up-to-date pest lists, together with minimal capacities to carry out pest risk analysis prevent Caribbean countries from providing a scientific justification for their own phytosanitary measures and weaken their credibility when providing phytosanitary information to (potential) trading partners. Field and border post operations are constrained by insufficient staff training, absence of up-to-date manuals, and lack of effective transport. A poor pay structure and lack of other incentives make it difficult to recruit and retain capable staff.

5.3 Climate

The Caribbean region is highly susceptible to variable weather-related events (excess or reduced rain; higher or lower temperatures) and natural disasters. Climate change is causing more frequent and intense weather events, changing and less clearly defined wet and dry seasons, periods of heavy rainfall and drought, increased ambient air and sea surface temperatures, and rising sea levels. Caribbean nations are highly sensitive to these changes due to their small geographic size, low coastal elevations, and fragile landscapes. These changes have already escalated coastal erosion and coastal flooding, saltwater intrusion into freshwater aquifers, soil salinization, loss of topsoil from intense rainfall events, and the proliferation of insect vectors (such as mosquitoes), which transmit tropical diseases. These changes have implications for regional economic growth and sustainability, impacting food security, public health, the availability of fresh water, and infrastructure. The poorest and most marginalised communities are especially vulnerable and often live in areas most heavily affected by flooding and erosion from storms and sea level rise.

Climate change will have a multitude of impacts on horticulture, affecting production, soil fertility, flowering cycles, and vulnerability to pests and diseases. These impacts may lead to major losses in agriculture, disproportionately affecting small-scale farmers, who have low livelihood resilience. In addition, the severity and frequency of economic losses caused by pests and diseases will be exacerbated by changes in weather conditions. Crop losses due to extreme events – lack of rain, excess moisture (too much rain or flooding), unusually hot or low temperatures – are frequent in the Caribbean region and are likely to become more prevalent as weather patterns change. Farmers can adopt different strategies to minimise risk, such as planting a diversified group of crops and owning livestock for ready cash insurance. However, these strategies are less viable in small areas dedicated to commercial horticulture, as farmers become more specialised in monocropping.

The Caribbean Development Bank, together with any other investor or financial institution, needs to adopt a climate risk management approach that aims to reduce risks resulting from climate change to investment projects in the Caribbean. Such a framework would help identify climate change risks to project performance in the early stages of project development and incorporate adaptation measures in the design of projects at risk. A CDB climate risk management framework would need to comprise: (1) context-sensitive climate risk screening at the concept development stage to identify projects that may be at medium or high risk; (2) climate change risk and vulnerability assessment during the preparation of projects at risk; (3) technical and economic evaluation of adaptation options; (4) identification of adaptation options in project design; and (5) monitoring and reporting of the level of risk and climate-proofing measures.

5.4 Genetic Resources

Progressive farmers and others engaged in commercial agriculture can access commercial varieties of horticulture produce that are in high demand by buyers. However, there is limited access to a broad range of germplasm for commercial species in the Caribbean region. This limits the establishment of plantings of the most commercially appropriate varieties or the capacity to change varieties in response to new market opportunities, new product developments, or climate change. Similarly, smallholder producers are unable to access newer varieties or other horticultural varieties demanded by consumers; these farmers do not have ready access to market information, thus they are unable to respond to changes in market demand.

Caribbean countries depend on non-indigenous crops and imported germplasm and seed for food and agricultural development. Government agencies are geared towards finding and promoting new, high-yielding crop varieties in an effort to enhance production, reduce food and input imports, and improve food sufficiency and security. Stronger and new linkages can be established with national and international suppliers in the Latin America and Caribbean region and beyond. This would facilitate the exchange of genetic material with good adaptive potential to a particular Caribbean country's conditions and related knowledge and expertise in genetic resources management and conservation. Interdependency will need to be enhanced and building national capacity for well-targeted and continued germplasm exchange will be a necessary adaptation tool for Caribbean countries.

Most fruit and vegetable varieties grown by small-scale farmers were introduced into the region more than 30 years ago. Although some testing for disease resistance of commercial vegetable varieties is being conducted in the region (e.g. Caribbean Agricultural Research and Development Institute), the testing is far from sufficient against a broad range of diverse pathogens present in the region. Genetic diversity and plant breeding are the key elements in enhancing the value of crops for improving nutrition and better health while adapting new cultivars to prevailing agroecological zones of the Caribbean region. For horticultural crops, breeding can improve the nutritional value of foods by increasing vitamins and minerals, antioxidants, fibre and healthy oils. Fruits and vegetables are sufficiently diverse to allow breeding for higher, more reliable yields, for greater availability and affordability.

Native plant species and traditional farming systems play an important role in food security and commercial agriculture. These crops may also have considerable potential for the development of niche products. For example, canned ackee fruit imports from Jamaica to the United States of America and the United Kingdom of Great Britain and Northern Ireland for expatriate residents were USD 21.1 million in 2017 and are expected to reach USD 29.25 million by 2020 (JAMPRO, 2018). However, the expansion of commercial agriculture could result in the displacement and disappearance of native genetic resources.

5.5 Natural Resources

The sustainability of horticultural crops relates to both the use of resources, such as water and nutrients, in a manner which considers future needs, and the responsible use of compounds, such as pesticides, which will not compromise the quality of the environment (or the safety of the produce).

5.5.1 Water

The most topical issue that is facing horticultural production in almost all areas of the world is the availability of water. Pressure on water resources for urban, industrial, recreational, conservation and other uses all appear to have higher priority within societies than the availability of water for horticultural crop (food) production. Current demands on water from both river and subterranean

sources are outstripping availability resulting in attention being given to water harvesting options with on-farm dams, the use of wastewater and to the use of more efficient application methods (including the use of enclosed systems such as simple greenhouses).

Severe water stress results in quality deterioration of fruits and vegetables (e.g. irregular ripening, sunburn, tough and leathery textures). Moderate water stress reduces fruit size and increases soluble solids content and acidity. Excess water, however, results in cracking of fruit and vegetables, excessive turbidity leading to increased susceptibility to physical damage and reduced solids content. Whenever water comes in contact with produce, its quality dictates the potential for contamination. Water quality needs to be continually monitored in order to reduce the potential of microbial contamination from water used with fresh fruits and vegetables.

Irrigation and irrigation equipment are critical for sustainable, successful and year-round crop production. Water availability for consumption and irrigation is an issue in the dry months in most Caribbean countries. Rainwater harvesting, micro-dams and tank storage have proven effective throughout the world, and when implemented, farmers have benefited from higher yields, crop diversification strategies, and income alternatives during the dry months. Capturing water during the rainy season and then pumping this water to fields with simple gas, diesel, and solar pumps is an efficient mechanism to increase productivity, particularly when coupled with improved irrigation systems, such as drip irrigation for horticulture production. When irrigation projects are implemented, the entire distribution system (from source to final use) must be analysed in order to anticipate any gaps in both infrastructure and knowledge. The cost of irrigation technologies is a major barrier for smallholders. Also, as with any shared common resources, effective and fair systems, regulations and policies must be enforced to ensure equitable distribution.

In addition to the availability of water for irrigation, the quality of available water is important. A major concern for human health and market opportunities is the potential for contaminants in the water – either heavy metals or microbial pathogens – to come in contact with fresh produce during irrigation or the application of pesticides, or when washing produce after harvest. The issue of water quality or potential contamination of water highlights the lack of information and awareness of food safety concerns among producers.

5.5.2 Soil

Healthy soils produce healthy crop plants that have optimum vigour and are less susceptible to pests. While many crops have key pests that attack even the healthiest of plants, proper soil, water and nutrient management can help prevent some pest problems brought on by crop stress or nutrient imbalance. Furthermore, crop management systems that impair soil quality often result in greater inputs of water, nutrients, pesticides, and/or energy for tillage to maintain yields. In sustainable systems, the soil is viewed as a fragile and living medium that must be protected and nurtured to ensure its long-term productivity and stability. Methods to protect and enhance the productivity of the soil include:

- using cover crops, compost and/or manures;
- reducing tillage;
- avoiding traffic on wet soils; and
- maintaining soil cover with plants and/or mulches.

Conditions in most Caribbean soils do not support the build-up of organic matter. Regular additions of organic matter or the use of cover crops can increase soil aggregate stability, soil tilth, and the diversity of soil microbial life. Preventive strategies and other alternatives should be employed

before using chemical inputs from any source. However, there may be situations where the use of synthetic chemicals would be more sustainable than a strictly non-chemical approach, such as zero tillage agriculture; a few applications of a broad-spectrum contact herbicide may use less energy and compact the soil less than numerous passes with a cultivator or mower.

5.5.3 Watersheds

The rise of more intensive commercial horticulture, with pollutants transported in runoff or through leaching into surface streams, contributes to declining water quality. Horticultural effluents are high in nitrogen and phosphorus, pesticide residues, and soil enhancements, which degrade water quality, and threaten the environment and human health.

Mountainous terrain is a common feature in all Caribbean countries, and sustainable cropping on hilly slopes presents many problems and challenges. Integrated watershed management planning is a key mechanism to comprehensively identify activities affecting the health of the watershed, and make recommendations to properly address them, so that adverse impacts from pollution are reduced. Watershed management also plays an important role in effective land and water resources management, as the planning process results in a partnership among all affected parties, who have a stake in the health of the watershed. It is an efficient way to prioritise the implementation of watershed management plans in times when resources may be limited. Comprehensive planning for the common resources within the entire watershed, with participation and commitment from all stakeholders, is critical to protecting the health of the watershed's resources.

5.6 Socio-economic constraints

There are many socio-economic challenges hindering further horticulture sector development in the Caribbean, particularly for smallholders: limited education and skills, a lack of support programmes as well as insufficient access to markets, insurance and affordable credit. To some degree, the underinvestment in skills and training reflects low levels of demand by producers, which could be unlocked by generational change. In addition, it also reflects coordination failures in a crowded landscape characterised by limited cooperation between beneficiaries (farmers), providers, accrediting bodies and funders.

Fruit and vegetable consumption varies considerably among and within countries, in large part reflecting the prevailing economic, cultural and agricultural environments. Low intake of fruits and vegetables is frequently observed with low socio-economic status, and is often due to the high cost of, or limited access to, fruits and vegetables relative to other foods as well as the wide availability of unhealthy options, such as energy-dense foods. Certain population groups are at increased risk of consuming inadequate quantities of fruits and vegetables for good health, such as persons with low levels of education, incomes, and occupations, or those living in socio-economically disadvantaged neighbourhoods.

Additional determinants of fruit and vegetable consumption among children are parental food consumption patterns and the availability of fruits and vegetables at home. Effective health communications have the capacity to increase awareness and knowledge and induce long-term positive changes in individual and social behaviours regarding fruit and vegetable consumption.

Women are involved in horticulture, but men often take the lead in managing small farms, and women provide much of the unpaid labour. Women generally lack equitable access to many of the necessary resources, such as land tenure, and often their participation is constrained by sociocultural issues. Women may also have little input or authority in decision-making at community level or in farmer

groups, and may have difficulty accessing technical and vocational training. However, women are more prevalent in downstream activities, such as trading and local retailing of fruits and vegetables.

5.7 Commercial Constraints

The main commercial constraints for Caribbean fruit and vegetable exporters include:

- **Trade barriers**: Natural trade barriers include high transportation costs to distant markets; artificial barriers include legal measures, such as protectionist policies. The liberalisation of trade through international agreements has been instrumental in relaxing many legal trade barriers by reducing tariffs and by harmonising the technical barriers to trade.
- **Scientific phytosanitary requirements**: Importing countries set the standards that potential trade partners must meet in order to protect human health or prevent the spread of pests and diseases. Infestation by fruit flies (Tepbritidae: Diptera), common in the Caribbean, is a major constraint to the production and export of tropical fruits.
- **Technological innovations**: Countries can increase their competitiveness and world market shares by providing higher quality products and promoting lower prices through technological innovations.[4]

Trade liberalization, implemented under the WTO, as well as through regional agreements, has expanded market access and provided strengthened mechanisms for combating non-tariff trade barriers, such as scientifically unfounded phytosanitary restrictions. Future prospects of fruits and vegetables exported from Caribbean countries will largely depend on the growth of import demand, mostly in developed countries. As consumer familiarity with more widely available fruits and vegetables increases, the ratio of imports to domestic products will also increase.

Similarly, Caribbean horticultural industries need to import most of their improved production inputs. For Caribbean farmers, the high cost of horticultural inputs (fertilizer, irrigation equipment, chemical and biological inputs, sorting, packaging, cooling equipment, transportation, and storage) negatively affects investment returns and competitiveness. The large variation in input prices in the region encourages unlawful practices, such as the adulteration of agro-chemicals and improved seeds/ seedlings, negatively affecting local producers.

5.7.1 Access to Markets

For smallholders, accessing markets can be an immediate barrier to the production and sale of crops. Lack of knowledge of current prices, market expectations, quality standards, and the availability of reliable transportation all act as disincentives to production and expansion. The cost of fuel and truck use is often a barrier to accessing higher value markets for producers of perishable products. Small-scale producers do not always grow what markets demand, especially with perennial species, preferring to grow what they know and reduce their livelihood risks by trying something new. This makes it difficult for them to sell their produce, particularly into higher value markets. Most smallholder growers sell to brokers because they have no other options or market channels. Under the current supply chain configuration, local traders are the gateway to markets for farmers. Unless alternative mechanisms to delivery of services related to finance, aggregation, grading and transport are developed, these actors will be inevitable partners to future development

Market prices are difficult to convey to many growers in a timely manner, and decisions made after the fact could be detrimental to them economically. The lack of timely market information and

4 For more information, see: www.fao.org/3/y4358e/y4358e04.htm

smallholder risk aversion means most continue to grow the same horticultural crop varieties every year. This leads to seasonal gluts on local markets, as wholesalers and processors struggle to clear surpluses and prices plummet often below a grower's cost of production. Conversely, many growers face what they perceive to be "unfair competition" because imported fruits and vegetables can be sold at lower prices. They blame exporting countries for providing subsidies for freight and/or local authorities for not exercising adequate controls or utilising tariffs, taxes and levies to protect local suppliers and industries.

Continental Caribbean countries, like other Caribbean countries, are high-cost vegetable producers, mainly due to economies of scale and dependence on imported production inputs, compared to neighbouring countries. Mexico, for example, supplies fresh produce throughout Central American countries. Traders in Belize would rather travel every other day to Mexico, pass through two Custom control points, and pay approximately 40 percent tariffs levied by Belize authorities, and still be able to sell Mexican vegetables in urban markets in Belize cheaper than local produce. The added advantage for these traders is that the quality and supply can be guaranteed in Mexican markets at the border.

In many horticultural value chains in the region, there is a lack of transparency in the seller-buyer relationship, and breaches of contract (both formal and informal) are common by both buyer and seller. There is a prevalence of weak organizational structures (both horizontally and vertically) and dysfunctional value chains with undefined rules and roles. A lack of quality standards, few contracts, little transparency, and limited knowledge of market information adversely impact smallholder farmers. However, these informal systems provide much needed cash to small-scale farmers and cater to the unpredictable nature of horticulture production. Many smallholder farmers develop long-term relationships with traders and intermediaries that go beyond simple buying and selling. These alliances provide credit at important times of the year (and not always just for planting crops), and buyers are often the only source of market information for many smallholder growers, providing them with an opportunity to grow for market needs. Both formal and informal systems offer producers certain advantages and help fill a niche for consumers.

Marketing of traditional export crops is generally undertaken by commodity boards. However, domestic marketing arrangements are less well organised, with produce normally channelled through an informal network of traders who purchase directly from farmers for resale. The Government of Jamaica has developed several policy initiatives to try and redress structural deficiencies in the marketing system for horticultural produce. These initiatives include: expanding the role of the Rural Agricultural Development Authority to incorporate the collection and dissemination of marketing information to farmers; and directly supporting associations engaged in the identification of markets and production planning.

5.7.2 Food Quality

In Caribbean countries food production, processing, and marketing systems are fragmented and dependent upon a large number of small producers. While this may have socio-economic benefits, the risk increases of exposing food to unhygienic environments, contamination and adulteration as large quantities of food pass through a multitude of food handlers and intermediaries. Problems occur as a result of poor post-harvest handling, processing and storage of food, as well as inadequate facilities and infrastructure, such as the absence or shortage of safe water supplies, electricity, storage facilities (including cold stores), and transport facilities and networks. Furthermore, most Caribbean food producers and handlers lack appropriate knowledge and expertise in the application of modern agricultural practices, food hygiene, and good food handling practices.

For example, when pests affect their crops, farmers absorb severe losses, face market rejections, and consequently suffer restricted market access. To avoid losing their crops, farmers in the region

often rely on increased agrochemical use with subsequent increased risk of chemical residues that surpass maximum residue levels. This lack of access to information on food safety and the high cost of chemical inputs impact negatively on key horticultural crops grown throughout the Caribbean region. The widespread use of agrochemicals for crop protection increases possible health risks for local consumers, farmers, and the environment. These issues accentuate the lack of biological control agents, the necessary skills for integrated pest management, and sustainable production practices. These problems emphasise the importance of the safe use of agrochemicals and safe handling procedures to prevent contamination. They also draw focus to the identified lack of education and knowledge base related to chemical use and regulations.

Caribbean countries need to promote integrated production systems and the management of crops under protected structures to improve productivity and the management of quality aspects during growth phases. These production systems require a holistic approach to fresh horticultural produce production, handling, storage and marketing. By adopting improved post-harvest handling practices, and better crop management, Caribbean countries can optimise post-harvest quality and ensure safety for both producers and consumers, such as defining maximum residual levels for commercial agrochemicals.

Several Caribbean countries have developed standards for good agricultural practices (GAP) for the production and handling of key horticultural crops. Dominica, for example, has developed GAP standards for its vegetable industry. Local GAP standards provide uniform guidelines for growers and other stakeholders in supply chains, who then implement these practices to produce higher quality food for local and export markets. The key constraints on food safety in Caribbean countries are as follows:

- **Low awareness:** there is a lack of organised consumer demand or advocacy for food safety, and minimal efforts are made to promote the adoption of safer practices by households, primary producers, or food establishments. Underlying capacities to provide programmed information, communication and training activities in food safety are especially weak.
- **Absence of strategy**: No assessment processes have identified specific health or food system risks for which targeted approaches might be adopted. Rather, the de facto 'strategy' is crisis management, simply reacting to disease outbreaks, reports of contaminated foods, or pressures from trading partners. Proactive or preventive measures are largely absent, although there are some exceptions in the private sector.
- **Adequate legislative basis**: Generally, supportive acts and regulations provide an adequate basis for proper food safety oversight and facilitation. Yet, in most regards, the underlying capacities to monitor and enforce the existing food laws are weak.
- **Weak coordinative structures:** Several different ministries, city councils, local government authorities, and private sector associations have important and designated roles to provide oversight and information related to food safety. Many coordinative committees have been formed at localized levels, yet most perform poorly due to lack of funds, staff or poor communications. A few Caribbean countries have a National CODEX Committee and a national SPS Committee, yet they rarely address food safety issues and only in the context of recommending approval or denial of food import permits.
- **Limited and unfocused food safety inspection capacity:** The responsibility for inspecting food companies and establishments is divided between multiple ministries, municipal authorities, and local councils. Most personnel lack appropriate training, tools, manuals, or guidelines for this inspection work. Lacking clear strategy or priorities for surveillance, the focus is on periodic visits for license renewals and responding to consumer complaints.

- **Uneven application of food safety standards in the private sector:** Except for a limited number of food processors, restaurants and hotels, the food safety standards applied in most food establishments across the Caribbean are unsatisfactory. The physical structures, equipment, facilities, personal hygiene, food handling practices, testing and calibration services, and other elements of 'good manufacturing practices' are problematic in most food establishments. The main exceptions are firms that are part of, or subsidiaries of, international companies (such as in the tourism and beverage industries), or firms that have had a long-standing export orientation.

The Background Report for CDB's Agriculture Sector Policy and Strategy describes the generally low level of awareness and application of food safety and 'good' hygiene or manufacturing practices within Caribbean agriculture and the agro-industry. This could pose risks for the production, sale, and consumption of horticultural products in the future, inhibiting the realisation of future growth opportunities at the upper end of the domestic consumer market, in the tourism industry, and in regional and international export markets.

5.7.3 Accreditation and Certification

The objective of reduced risk can be achieved most effectively by the principle of prevention throughout the production, processing and marketing chain. To achieve maximum consumer protection, it is essential that safety and quality be built into food products from production through to consumption. This calls for a comprehensive and integrated supply chain approach in which the producer, processor, transporter, vendor, and consumer play a role in ensuring food safety and quality. It is not possible to provide adequate protection to the consumer by merely sampling and analysing the final product. The introduction of preventive measures at all stages of the food production and distribution chain, makes better economic sense, as unsuitable products can be identified earlier along the chain.

The costs of compliance with quality, sanitary and environmental standards have significantly increased over the past decade. This is relevant with regard to the European and North American markets because of the stringent standards demanded by food retailers in most developed countries. Such standards lead to more formal and complex methods for monitoring quality, such as risk assessment and risk management systems, and growing implementation, compliance and certification costs, which are mainly incurred by producers. A common feature of these food safety systems is a fundamental shift from relying on inspection of products on arrival at destination to making importers and suppliers responsible for verifying and proving that they or their suppliers have implemented preventive food safety control systems. For example, impact studies conducted in Africa to analyse the costs and benefits of GlobalGAP (BASIC, 2015) in the fresh fruit sector have estimated that the initial investment costs represent between 4 percent of annual sales for large plantations, and 11 percent for small farmers. The recurrent costs represent 1 percent of the plantation's annual sales, whereas they can amount to almost 20 percent of the annual sales of small farmers (see also Annex 1).[5]

The most effective strategy for introducing internationally recognised food certification standards is to entrust food producers and operators with primary responsibility for food safety and quality. Government regulators are then responsible for auditing the performance of the food system through monitoring and surveillance activities, and for enforcing legal and regulatory requirements. Many, but not all, potential food hazards can be controlled along the food chain through the application of good

5 The standard is particularly challenging for small farmers in developing countries. First, it depends on paper-based systems for monitoring both processes and product flows. Second, there are economies of scale in the adoption of such systems, particularly with regard to the cost of certification, initial investment in equipment and training requirements. Thus, GlobalGAP tends to increase the obstacles to small-scale producer participation in export markets. For small-scale farmers, the challenges of compliance mean that their access to export markets becomes increasingly dependent upon working with larger-scale farmers or processors/exporters.

practices: good agricultural practices (GAP), good manufacturing practices (GMP), and good hygienic practices (GHP). The role of GAP codes is important in assisting Caribbean countries to promote the sustainable production of fruits, vegetables and other important horticultural crops, which are safe for consumption and meet sanitary, environmental and social requirements, both in domestic and international markets. In this context, options need to be explored for benchmarking national GAP codes in Caribbean countries to internationally accepted standards, such as GlobalGAP. Similarly, an important preventative approach that may be applied at all stages in the production, processing and handling of food products involves the Hazard Analysis Critical Control Point system (HACCP) provide a systematic structure to the identification and control of foodborne hazards. Governments should recognize the application of a HACCP approach by the food industry as a fundamental tool for improving the safety of food.

5.7.4 Access to Credit

The high cost of financing constitutes a barrier to the development of horticulture. Current formal financial systems in the Caribbean prohibit smallholders from accessing affordable credit, and few banks provide loans or credit specifically for agricultural purposes. Banks are generally conservative and have rigorous loan approval requirements; they often require fixed collateral, such as land titles, and do not readily consider (future) cash flow or profitability of a venture, such as horticultural cropping, as suitable collateral. Local farmers often have traditional, customary, informal, hereditary land-use rights, without formal title or legal possession of the land. With limited collateral, smallholders need to access informal credit sources, which often puts them at a disadvantage.

Various financial institutions and national banks, such as the Caribbean Development Bank and the Agricultural Industrial Development Bank in Dominica, have tried to tackle this problem by offering discounted interest rate loans to growers, cooperatives and farmer groups with varying success. The informal sector fills this gap; often buyers, intermediaries, family and friends take advantage of small-scale farmers' need for cash up front and offer them high interest loans at the beginning of the cropping season, then take a share of the final produce or sales at the end of the season to cover the loan plus interest. For buyers, this informal contract is meant to oblige a grower to sell their produce to the lender; however, this strategy is risky, as growers will often sell to other buyers or markets offering higher prices, as growers have no legal requirement to sell their harvested produce to the trader who had provided credit.

Overall, Caribbean countries have well-established, modern financial systems. Nevertheless, access to affordable credit is a key constraint to the development of the agriculture sector in all countries. The main reasons are as follows:

(a) *High risk* – a perception by commercial banks that small-scale agricultural enterprises (including farmers), are a high-risk sub-sector, and as a result, these entities have little incentive to actively promote their services in the sector.

(b) *High interest rates* – current interest rates for agricultural loans from the commercial banking sector vary between 18 and 20 percent per year. In general, the interest rates charged by commercial banks are relatively high by regional standards. It is difficult for banks to target commercially oriented, creditworthy farmers. Subsistence farmers often lack the collateral requirement of financial institutions and, in general, due to low levels of productivity and technology application, their enterprises are generally marginal, and they frequently have difficulty meeting their debt service obligations.

Microfinance has helped relax many of the credit constraints for smallholder growers, especially for women micro-entrepreneurs and other marginalised groups, who lack conventional collateral

assets. But the mismatch between the core principal of microfinance (mutual responsibility for loan repayment by groups of geographically proximate individuals) and the reality of agriculture in which all individuals within a small area may simultaneously suffer losses (such as from a drought), means that mutual payment responsibility fails, and lenders suffer considerable portfolio risk.

Formal financial institutions need support and incentives from governments and donors in order to enter the rural microcredit sector. Different approaches and strategies are required in order to be effective within the agricultural sector, particularly at the micro-enterprise or smallholder level. The following are some of the factors that can assist financial institutions in the successful introduction of lending to this segment of the rural population:

- Understand the client and the differences between traditional, urban and rural clientele, and smallholder farmers.
- Offer flexible products and terms adaptable to the diverse profiles of smallholder borrowers.
- Use cash flow analysis of the household production unit. Matching payment terms to cash flow provides a more accurate analysis of payment capacity and risk of lending.
- Promote diversified risk management tactics, such as client monitoring, portfolio diversification, conservative cash flow analysis, credit bureaus, and credit scoring.
- Use specialised credit officers and hire officers with a background in agriculture.
- Consider risk-based loan pricing for crops and products. In some cases, this may lead to lower rates for certain combinations of clients, crops, geographies, or financial products. In other cases, this might lead to higher rates as the probability of loss increases.
- Introduce or expand product costing. Improved costing could better inform product design, lending methodologies, and sales and risk management strategies, and lead to additional innovation.
- Explore opportunities to introduce or expand value chain finance that could be used both to serve the "missing middle farmers" – commercial smallholders in existing value chains – and to reach larger groups of smaller farmers more efficiently.
- Explore lower-cost delivery channels. Agent and Automatic Teller Machine networks, mobile phone banking, and debit cards can be used to reduce the costs of lending to rural clients, while making it easier for clients to access financial services.
- Introduce or expand the availability of longer-term financing for asset acquisition. Consider maximum loan terms and lending methodologies, and the use of value chain finance and other mechanisms to reduce the risk of long-term finance.

5.8 Modern Technology

Smallholder farmers need access to affordable production technologies; horticulture can be technology intensive, and without the availability of proper information and tools, farmers will continue with their labour-intensive current practices. The high costs of inputs (such as fertilizers, agrochemicals, irrigation equipment, and biopesticides), lack of services (reliable transport, tractors for land preparation, mechanized pruning, technical assistance), and pressure from pests and diseases contribute to high costs and reduced competitiveness.

Protected agriculture has proven to be effective for raising producer returns on small land plots. It is a suitable strategy to reduce pests and disease problems, increase productivity, improve production consistency, and improve water-use efficiency. However, despite some efforts to generate knowledge on the management of crops under plastic tunnels by public and private institutions

in the Caribbean, additional research and development efforts are required to promote the mass adoption of this technology. A major barrier to technology adoption is the lack of incentives, credit and education for small farmers.

A comprehensive, modern horticultural development programme has multiple objectives: increased production efficiency, improved product quality, more efficient chemical and seed use, energy conservation, and surface and groundwater protection. Information can be the modern farmer's most valuable resource. The development of crop management monitoring systems are required for ensuring agronomic and ethical standards in horticultural production and supply to markets of the United States and Europe. Such traceability systems require digital mapping and database development, which in turn requires compilation of digital plot maps of the growers' farms, agronomic and produce packaging practices database for food safety monitoring and evaluation according to the standards required of the end market.

Precise information is important in every phase of production, from initial planning to post-harvest. Information requirements include spatial and temporal data on the crop, soil, pests, topography, and weather during the field production phase. During the post-harvest phase, temperature, humidity, moisture, and a host of other parameters are important. Some of this information can be gleaned from previous crop records. Other data must be acquired in real time for immediate application by the system.

Technology is the second critical component of the system. Production equipment and systems must be compatible with the operational requirements to deliver high-quality, fresh produce, such as equipment designed for the accurate control and delivery of crop chemicals. In addition, the global positioning system (GPS), geographic information systems (GIS) and computers are key building blocks in this foundation. GPS, with differential correction, has proven to be an effective tool for geo-reference features or data in the field; it provides the ability to organise data by geo-referenced position. Computers provide the analysis and control capabilities to develop the comprehensive system needed in site-specific and post-harvest process management.

Management is the third key to success. Management gives the producer the means to analyse information and make timely and sound production decisions. Using the information and technology available to the modern farmer, management practices can be implemented to achieve more efficient farming systems. Without effective management practices, the information and technology add very little to the effectiveness of the production system.

5.9 Farming as a Business

A constant theme among smallholder farmers in Caribbean countries is their risk aversion towards new technologies and opportunities. Smallholder farmers maintain their production mindset based on their traditional cropping systems and they either do not understand or choose to ignore market information and data affecting their farming output. These producers do not treat their farms as businesses that need to be flexible and adaptable to the changing operational environment around them. This failure to make farming decisions from a business perspective manifests in a range of issues and problems, from a lack of investment in improved inputs and machinery, with production systems dependent on manual labour, to a lack of production records and accounting, and a failure to honour contracts.

Enforcement of contracts is central to contract success. A major problem is that agribusinesses are hampered by limited legal recourses when things "go wrong". Contracted smallholders may divert inputs provided by the agribusiness firm to other on-farm end uses, sell the inputs, or divert

contracted production to other purchasers without facing the types of penalties imposed on developed country contract farmers who default. Thus, an agribusiness firm setting up a contract needs to ensure contract default is minimised. In Jamaica, traders contracted by tourist resorts and hotels to supply potatoes have reached the point of prosecuting some of their contracted growers who are side-selling produce to other outlets offering higher prices thereby forcing traders onto open-markets to fulfil their orders to resorts and hotels. These traders need to make an example to stop or limit the extent of their contracted growers side-selling and not honouring their contracts.

5.10 Processing

A small number of large multinational processing industries exist in the Caribbean; however, the sector is dominated by micro- and small-sized enterprises, and a lesser number of mid-sized enterprises. Often, local processors use small quantities of local produce because imported, pre-processed materials, such as tomato paste from the United States of America, are cheaper. This might indicate that local production costs are too high for processing industries, or that fresh market demands exceed current local production. In addition, processors may be reluctant to source produce from smallholders due to the effort required to ensure consistent product volume to meet processing demands.

As prices collapse during local harvest times, and fresh markets become saturated with crops such as onion, tomato, and mango, promoting horticultural crop processing could represent a venue for reducing saturation of fresh markets, provided production costs are competitive for the processing industries. By making more processing varieties available to farmers, the processing industry may grow. In addition to processing facilities and skills, business development skills would need to be developed among local entrepreneurs. Similarly, among growers of horticultural crops, knowledge of production practices, processing, and post-harvest management of local species must be combined with business development skills.

Fresh produce traders in the Caribbean recognise the opportunities presented by the seasonal supply of vegetables and fruit and the corresponding opportunities presented by prevailing market prices during different seasons. Produce can be held temporarily to overcome gluts thus limiting price falls or to address shortage periods when prices are high. These traders store higher-value crops that can naturally adapt to long storage periods, such as potatoes and onions for three to four months in order to fulfil contracts and profit from higher prices.

5.11 Skills Development

The quality and safety of horticultural produce reaching the consumer depends upon pre-harvest factors as well as proper post-harvest management practices throughout the supply chain, from the field to the consumer. Each stakeholder along the post-harvest chain – those involved in the harvesting, handling and marketing of fresh produce – has a role to play in assuring the safety and quality of fresh produce. Basic approaches to maintaining the safety and quality of horticultural produce are the same, regardless of the targeted market of the produce. Stakeholders at each stage of the supply chain need various skills and capacities to deliver high-quality produce along the chain, which are often lacking in Caribbean horticultural value chains.

The lack of operational capacity among growers results in low-quality produce, low productivity, inadequate production practices, and reduced access to formal markets. Growers lack training in well-accepted best practices for horticultural crop production and handling. Governments in the Caribbean do not adequately fund their agricultural extension services, and technical assistance is increasingly delivered by the private sector, national and international NGOs. Sometimes farmer

organizations, through levies collected from sales, arrange for technical support to their grower members. However, without any proper scrutiny or oversight, many NGOs deliver questionable quality and scant quantity of technical assistance. Occasional technical assistance is available through government programmes when supported by international aid. When it exists, a single professional has to serve many farmers, and the assistance disappears when the project ends.

6. Focus Countries

6.1 Grenada

Grenada is a leading producer of several different spices. Important exports include cinnamon, cloves, ginger, mace, allspice, orange/citrus peels, coffee, and nutmeg. Second only to Indonesia, Grenada produces 20 percent of the world's supply of nutmeg (World Bank, 2013). Industry stakeholders established the Grenada Cooperative Nutmeg Association (GCNA) in order to support growers and industry development, maintain quality control, and introduce new technologies to advance cost effectiveness and efficiency. The GCNA and the Government of Grenada aim to strengthen research and development in all aspects of the industry, especially in product diversification, as the potential products to be derived from the nutmeg plant and fruit are under-exploited in Grenada.

The country's main horticultural crops are nutmeg and mace, other spices, tropical fruits, and cocoa. Various horticultural crops have been devastated by hurricanes during the past 20 years, which necessitated building back the industries. Over 80 percent of farmers in the horticultural sub-sectors are considered small-scale, subsistence farmers, cultivating less than 0.2 hectares of land, with only occasional market sales. Nutmeg and cocoa are export products, and cocoa is tied to local tourism. Yet, the area of agricultural land has fallen markedly since the 1960s, due to conversion to manufacturing, tourism, and residential uses, as well as abandonment of lands by absentee landlords. For many small-scale landowners, farming is no longer their principal economic activity.

The following are the main constraints on Grenada's horticultural sector:

- Although family farms predominate, many are not economically viable outside the spice sector due to lack of credit, fragmented and informal land tenancy, mountainous topography that limits the use of machinery, the small size of the local market, high costs of energy and other inputs, and widespread praedial larceny.
- Inefficient production practices, including the limited adoption of modern technologies and systems, inadequate use of quality planting material, as well as poor soil, water, pest and disease management.
- Limited investment in irrigation systems; less than 500 ha of the estimated 4 000 ha of arable land has reliable irrigation systems. Adoption of water harvesting technologies remains low, while peak demand for agricultural produce coincides with the tourism season.
- Absence of quality compliance systems. All facilities/farms involved in food production need to establish controls consistent with internationally recognised Good Agriculture Practices.
- Inadequate infrastructure for access to agricultural lands.

- Insufficient access to financial and business support services.
- Lack of competitiveness. Young people have little incentive to get involved in farming, and the population of active farmers in Grenada is aging, while a large amount of land with agricultural potential is currently underused or neglected.
- Limited skills in quality control, business management, and marketing. Capacity building is required in these areas, and in the use of climate information as a basis for informed decision-making.

The Ministry of Agriculture has focused on enhancing the fruits, vegetables and spice sub-sectors by facilitating and ensuring the availability of improved planting materials to farmers, the adoption of Integrated Management of pests and diseases, and incentives for farmers to adopt good agriculture practices. The horticultural sector remains constrained by several pests and diseases, including the West Indian fruit fly pest, nutmeg wilt, Moko and Black Sigatoka diseases. The government is supporting other programmes concerning the redevelopment of the banana industry, the establishment of large fruit orchards, and increased vegetable production, through technical assistance to improve and encourage the use of greenhouse technology.

6.2 Guyana

Guyana's vast tracts of productive land present opportunities for growth in a range of horticultural produce. Guyana's traditional agricultural sectors, such as rice and sugar, continue to account for significant percentages of Guyana's exports, while the value and share of fresh fruit and vegetable exports has also grown, serving a number of different markets. This is the result of efforts by the government and the private sector to diversify Guyana's agricultural sector, such as government ceasing operations in sugar production, and selling sugar estates and processing facilities.

Non-traditional agriculture products, including many horticultural sub-sectors, are demonstrating high growth potential. For example, processed exports of prepared horticultural foods – such as jams and jellies, coconut milk, and spices – have increased due to investments in production, facilities, quality assurance, and processing. Guyana's comparative advantages in horticulture are due to the following:

- **Diverse agricultural environments** – highly fertile soils in the coastal areas are currently used extensively for rice and sugarcane production, and large parcels of flat, irrigated land can be used for fresh fruits and vegetables; intermediate savannah is suitable for the medium- to large-scale production of citrus, cashew nuts, peanuts, and orchard crops. Soils are well drained and responsive to fertilisation.
- **Organic cropland** – Guyana has large tracts of land that have never been used for modern agriculture and remain free of agricultural chemicals.
- **Irrigation** – Nearly 30 percent of Guyana's cropland is currently irrigated.
- **Agricultural population** – Whereas the populations of most Caribbean countries have become urbanised, over 50 percent of Guyana's population remains rural and closely linked to agriculture.
- **Markets** – Guyana's proximity to the CARICOM, Central and North American markets enables exporters to supply consumers with fresh produce as well as meet the demands of a growing local food processing industry.

Guyana has identified several horticultural crops with potential for growth both locally and in export markets: citrus fruits, such as oranges, grapefruit, tangerines, and limes; and tropical fruits, such as mangoes, sapodillas, papayas, pineapples, and passion fruit. In addition to exports, opportunities

exist for fruit farmers to supply the tourism industry as well as the expanding agro-processing industry in Guyana and the Caribbean. Export opportunities exist for vegetables – such as cucumber, pumpkin, watermelon, and melon – within the Caribbean, Central and North American markets.

The growing demand for organic products in North America and Europe also presents market opportunities for Guyana. In most cases, organic products receive a premium price compared to their conventional counterparts. Organic cocoa, pineapple and heart of palm are already being grown for export from Guyana. There is also growing demand in the Caribbean, North America and Europe for other horticultural produce, such as hot peppers, eschallot, celery and other herbs and spices, which are grown throughout Guyana.

6.3 Haiti

The viability of most farms in Haiti is being steadily eroded due to pressures of an expanding population and a diminishing resource base. The consequences are falling farm sizes, increasing rural poverty and urban migration. To satisfy domestic food requirements, increasing areas of land are being absorbed at the expense of cash crops, such as coffee and cocoa. Mixed cropping by smallholders using traditional methods is widespread; there are more than 600 000 farmers cultivating less than 3 hectares of land. Although smallholders enjoyed relative prosperity until the early twentieth century, cash income from coffee and other food crops has always been limited due to low levels of adoption of improved technologies. As a result, farmers have been unable to produce large marketable surpluses. Although some improved tools are available, they are imported, and there are very few people in rural areas with the expertise to repair them.

Haiti is a major producer and exporter of mangoes, with domestic production in 2016 estimated at 670 000 tonnes, and exports at USD 8.8 million (International Trade Centre, 2018). Mangoes are naturally abundant throughout Haiti, and are not cultivated per se. Mango trees are resistant to prolonged, hot dry spells and dry soils, which accounts for its persistence; they are raised primarily by small-scale farmers, using simple cultivation techniques and no fertilizers or other agrochemicals. Mango transactions yield high product margins; but risks are high because the fruit is perishable and fragile. Price variations in the market of the United States introduce further risks, depending in part on competing supplies from Florida or other exporting countries, including Brazil and Mexico.

Traditionally, coffee was the most important cash crop for Haiti; however, exports have been in decline for the past two decades. Coffee is frequently inter-cropped with maize, sorghum, beans or bananas. At 500 to 550 kg/ha, yields are only one-half of those in Jamaica and one-quarter of those in Brazil. Trees tend to be overcrowded, too shaded and unweeded. Harvesting techniques are crude, which lowers the coffee quality. Yet, the industry is starting to revitalise, with Haitian coffee building unique brand recognition in the United States of America. Incentives to increase investment in coffee are low because food crops (maize, cassava, beans) generate a faster and higher return. Despite these disadvantages, coffee serves as an important security item for farmers: It requires less labour than food crops and guarantees a minimum income.

Cocoa is the largest exported agricultural commodity, with exports valued at USD 10.2 million in 2016 (International Trade Centre, 2018). Yields are about 500 kg/ha, and the crop is grown primarily on small plantations ranging in size from 0.5 to 1.5 hectares. Grown in humid locations, often at altitudes of up to 300 metres, cocoa occupies only 1 percent of Haiti's cultivated area. Much like coffee, cocoa competes for land that often has higher value alternative uses, though the introduction of improved technologies could lead to a gradual shift from coffee to cocoa in lowland areas.

Essential oils are the most important agro-industrial export from Haiti, amounting to USD 25 million in export earnings in 2016. Vetiver accounted for most of the export earnings, followed by lime and amyris. Vetiver is an ideal crop for Haiti's poor soils. It is grown in locations where rainfall is moderate to abundant – 1 200 mm to more than 2 000 mm per year – as well as in the dryer regions. Cultivation is dispersed among small farms, most of which are no larger than 1 hectare. The United States of America, France and Guadeloupe purchase all of Haiti's essential oil exports. Despite the renowned, superior quality of its essential oils, Haiti continues to lose market share due to aggressive marketing by China and Indonesia.

Haiti is dependent on imports for most of its vegetable supplies, because most farmers only grow sufficient volumes for their own household needs, and minimal quantities are found in local markets. The large trade imbalance creates opportunities for smallholder farmers to grow vegetables and become more productive on their small plots. There are also opportunities to develop industrial crops, such as tomatoes for processing and export. As these crops are labour intensive to grow, they serve to generate employment.

6.4 Jamaica

The horticultural sector is an important contributor to socio-economic development and an integral part of rural livelihoods in Jamaica. It provides important sources of employment for rural residents, and has significant backward and forward linkages with the rest of the economy. The sector was dominated by the production of traditional export crops – bananas, sugar, and coffee – but these have been in decline due to the impact of trade liberalisation, in particular the loss of preferential market access to the European Union, and falling market prices. Although Jamaica has an established agro-processing industry, these companies import much of their raw produce. Local farmers are unable to supply the high-quality produce on a consistent basis demanded by these agro-processors and other local enterprises, such as restaurants, hotels and supermarkets.

Investment in irrigation systems has been limited in Jamaica, although plans are underway to build and expand systems in prospective areas. The small-scale agricultural sector exhibits significant potential for growth, particularly in the domestic market, displacing high-cost imports of fruits and vegetables. This sector needs to be strengthened through technology transfer and infrastructure improvements to become more competitive. Small farmers, in particular, tend to be at a comparative disadvantage in accessing these higher value horticultural markets due to the following: insufficient market information; inefficient production practices and outdated technologies; a lack of production of value added products; limited economies of scale for storage and packing; and high logistics costs.

Various development agencies have worked with the government to implement projects aimed at improving on-farm productivity, cost efficiency and quality in order to assist local farmer access to higher value markets. Among the strategies is the development of specified zones and/or agro-parks in partnership with private sector operatives and farmers with financing from the government, the European Union, and the Inter-American Development Bank (IDB). Key investments in agro-parks include irrigation and drainage systems, road network improvements, and the provision of farmer advisory services in all aspects of the value chain, including the implementation of a GlobalGAP certification programme for all agro-parks to ensure compliance with international food safety standards.

Much of the land formerly devoted to plantation crops plus rehabilitated mined lands are being devolved to smaller plots with the objective of bringing under-utilised rural lands and labour into more efficient agricultural production systems, and reducing the vulnerability of rural communities. The Jamaican Government, industry and growers targeted two vegetables which were in high demand and had high annual import bills: potatoes and onions. Jamaica was able to establish a thriving potato-growing industry – based on high-quality imported seeds – which now supplies about

85 percent of local consumption needs. Similar endeavours with onions, however, have proven unsuccessful to date, due to insects continually devastating crops each year across the island.

Support for the adoption of protected agricultural production and improvements to existing greenhouses has resulted in increased efficiencies and higher quality vegetable production that supplies hotels, resorts and restaurants serving the tourism sector. Traders serving these outlets are contracting small-scale farmers and providing them with seeds/seedlings to grow vegetables in demand (such as tomatoes, sweet peppers, beans, chillies, cauliflower, cabbage and capsicum) under greenhouses in order to deliver to the quality and quantity standards demanded in these markets. Groups of smallholders grow vegetables under their greenhouses to demand specifications, and build necessary infrastructure, such as packhouses and storage, to supply traders on a contracted, regular basis. These initiatives have increased incomes for smallholder growers, who supply superior quality, fresh produce compared to farmers relying on open-field production.

7. Development Assistance

Horticulture is generally included as a component in rural development projects in the region. The **World Bank** has mainly assisted the agricultural sectors of Jamaica and Haiti in the Caribbean, and Dominica to a lesser extent, following the devastation of hurricane Maria in September 2017. The following are examples of World Bank-sponsored development projects in the Caribbean:

- Dominica – *Emergency Agricultural Livelihoods and Climate Resilience Project*.
- Haiti – *Relaunching Agriculture: Strengthening Agriculture Public Services II Project* (focused on strengthening public services in agriculture, including extension services). The World Bank also implemented several emergency agricultural rehabilitation projects in Haiti following the earthquake destruction in 2010.
- Jamaica – *Rural Economic Development Initiative*, and *Access to Finance for Micro, Small, and Medium Enterprises Project* (projects aimed at strengthening credit and market linkages between producers and agri-businesses, with a prominent role for horticulture); and *Foundations for Competitiveness and Growth Project* (aimed at improving the business enabling environment.

The International Fund for Agricultural Development **(IFAD)** currently operates in Grenada, Guyana and Haiti[6]targeting smallholder farmers. The common themes of all their projects are: (1) promoting climate-smart agriculture through proven, sustainable farming technologies and systems that build resilience to the effects of adverse climatic conditions and foster high productivity; (2) promoting productive initiatives, improving small-scale producers' access to both markets and financial services; and (3) investing in human capital development, building the capacity of rural associations to communicate their needs and manage their productive initiatives more effectively.

The United States Agency for International Development (**USAID**) is also a major donor to the Caribbean region. The agency supports an integrated system for the implementation and financing of sustainable adaptation approaches to changing weather patterns in the Eastern and Southern

6 IFAD implemented four projects in Belize for a total investment of USD 16.7 million, with the final project ending in 2015.

Caribbean regions. Haiti is the main Caribbean recipient of USAID's "Feed the Future" global initiative, which aims to improve access to locally produced, nutritious foods among vulnerable households through a national system of food vouchers. USAID also supports farmers to increase agricultural production, modernise natural resource management, improve food security, reduce post-harvest losses and facilitate public–private partnerships. The United States Department of Agriculture (**USDA**) is also active in the Caribbean, supporting land and water conservation programmes, and providing financial and technical advisory support for the benefit of farmers and the environment. All these projects have interventions focused on horticultural development.

The main horticultural projects funded by the Inter-American Development Bank (**IDB**) are the Agricultural Competitiveness Projects in Jamaica (USD 15 million), and the Sustainable Agricultural Development Programme in Guyana (USD 15 million). The general objective of each project is to contribute to the competitiveness of the agricultural sector by: (1) strengthening the capacity of small- and medium-scale farmers to access national and international markets; (2) increasing the performance of the country's food quality and safety management systems; and (3) developing agricultural and agro-processing value chains. In Jamaica, the project provides funding to the Agro-Investment Corporation to develop four Agro Parks. The plan is to convert former sugar-growing areas into parcels leased to smallholder farmers who can grow higher value horticultural crops, supported by the necessary infrastructure, including some irrigated areas, technical assistance and linkages to markets.

The CARICOM Regional Organisation for Standards and Quality (**CROSQ**) was established in 2002 to facilitate regional standardisation and the verification of quality. It is a network of 15 National Standards Bodies in CARICOM and is responsible for the development and/or harmonisation of regional quality infrastructure to facilitate intra-regional and international trade, to ensure consumer safety, and to protect the environment. The following are examples of CROSQ support to member states for their national quality infrastructure development:

- 2013–2015: *Strengthening the Capabilities of Testing Laboratories in the Caribbean to Reduce Technical Barriers to Trade,* implemented with funding from the Caribbean Aid for Trade Regional Integration Trust Fund (Department for International Development, DFID). Fifteen laboratories in the CARIFORUM region were supported to develop quality management systems; technical assistance was provided for the ISO17025 accreditation of specific tests conducted by three laboratories (Guyana Rice Board, Pesticide Residue Laboratory University of the West Indies Jamaica, and the Chemistry Laboratory of the Grenada Bureau of Standards).
- 2012–2017: CROSQ implemented the EUR 7.8 million programme under the European Development Fund to Support the Caribbean Forum of ACP States, in the implementation of commitments under the EPA TBT component. Additionally, five testing, inspection and certification bodies were assessed and awarded accreditation certifications – the inspection division of the Trinidad and Tobago Bureau of Standards, and testing laboratories in Belize, Guyana, Jamaica, and Suriname.

Moreover, CROSQ developed its accreditation methodology into a comprehensive, documented and systematic Stepwise Improvement Programme to Accreditation for Inspection Bodies (ISO 17020), Analytical Testing and Medical Labs (ISO 17025 and ISO 15189) and Certification Bodies (ISO 17065). With CDB's assistance, CROSQ intends to extend these services to other testing, inspection and certification bodies in the region.

Other programmes include: the five-year Regional Standardisation Development Priority Plan (2017–2022); collaboration with the WTO for training of National Enquiry Points; revision of legislation for standards in five CARICOM Member States; increased adoption of CARICOM regional standards as national standards by National Standards Bodies; strengthening metrology infrastructure within

the region; increasing the number of accredited Conformity Assessment Bodies by 50 percent; and providing training for the increased knowledge and application of ISO/IEC 17020 and 17065.

7.1 Lessons Learned

The Department for International Development reported the following challenges in their programmes and EPA implementation more broadly:

- Slow pace of implementation and disbursement in some projects
- Obtaining adequate monitoring data to track results
- Recruiting adequate human resources with the right skills
- Mobilising adequate resources to maximise and sustain benefits in some projects
- Realising the opportunities for promoting gender equality across the portfolio.

Despite the capacity issues, it was important for the private sector and other actors to fully engage and try to take advantage of opportunities presented by EPA projects, and to help identify the priorities and practical problems. This would help guide and prioritise required actions and advocacy by national governments as well as regional and EPA institutions. Also, the EPA was a complex agreement, with associated technical, legislative, and administrative work for implementation, along with the practical private sector side of utilisation. The challenge in this context was obtaining a clear vision of the objective, key gaps and priorities. An adequate monitoring and reporting system for both implementation and compliance issues was lacking.

This experience demonstrated the need to improve mechanisms to share knowledge products, best practices and lessons learned from the project portfolio. Also, better coordination would have helped with the challenge of resource mobilisation experienced by some Caribbean stakeholders, as it would be easier to match available resources with identified gaps from existing programmes.

The IDB reported that while the concept of clustering smallholder farmers with supporting infrastructure and technical assistance was promising (Agro Parks in Jamaica are an example), there were insufficient incentives included to attract supporting agro-enterprises that would drive the market linkages, reduce supply chains, and add value to local produce. No economic analysis was completed prior to the launch of the programme. The prevailing mindset within the Ministry of Industry, Commerce, Agriculture and Fisheries in Jamaica was that the government needed to invest and establish the Agro Park model, which would consequently encourage private sector investment to further develop the model. Also, the leasing model utilised by the Agro Parks was a disincentive for companies to invest and most investors expected more generous government incentives before they would commit funding.

7.1.1 CDB

Careful consideration of lessons learned can increase the likelihood of success for future projects. The following are general lessons learned from CDB projects.[7]

Project design and management

- Programme design needs to be adapted to the capacity and experience of the local staff. The monitoring and evaluation (M&E) system must be well established with appropriate baseline

7 These projects include: Community-Based Agriculture and Rural Development – Haiti (2016–2021), Climate Smart Agriculture and Rural Enterprise Programme – Grenada (2018–2022), Agricultural Support Project – Jamaica (2009–2013), Market Access and Rural Enterprise Development Project – Grenada (2011–2016).

information to allow revisions to outputs and outcomes, and assessment of the project's socio-economic impact.

- Poverty reduction projects should build the capacity of the rural poor to engage in productive activities with the potential to increase their incomes. This can be achieved through beneficiary capacity building and the provision of social infrastructure.
- Participatory approaches must include central and local government agencies and project beneficiaries at all stages of the sub-project cycle to ensure sustainability of interventions.
- Proactive support and supervision are needed to address challenges during implementation; project management systems should be flexible to allow adjustments of implementation strategies and approaches based on changing realities.

Agricultural and rural development

- Increasingly, participation in fresh produce trade requires compliance with GAP, specifically with GlobalGap, which is the most internationally recognised standard. Given the cost for individual small-farmer compliance can be prohibitive, a cost-sharing system is critical.
- Ownership and private sector participation can improve the sustainability of interventions.
- A reliable supply of water is critical, but not sufficient for improved agricultural output, particularly in an era of climate change and increasing consumer attention to food safety.
- The delivery of farmer advisory services should take place as early as possible, rather than as a residual activity which is undertaken after physical facilities are completed.
- Public programmes should be participatory and facilitate community-driven empowerment, including vulnerable groups as a cross-cutting socio-economic developmental imperative.
- Agricultural/rural development programmes must address a number of constraints, resulting in often complex programmes, requiring large and relatively costly implementation arrangements.
- Provision will also be made to improve the capacity of farmers to adopt improved production technologies and to increase the range of crops produced (to improve diet diversity and health outcomes). Where feasible, improve access to business support services and credit to assist beneficiaries to grow and sustain viable businesses.
- Arbitrarily setting a monetary threshold for sub-projects limits the ability of the intervention to address challenges and provides less than optimum solutions. Utilise general guidelines and assess each sub-project investment – cost of infrastructure/services per measured area/beneficiary – in setting a ceiling for sub-project interventions.
- Financing irrigation operations and maintenance through the collection of water user fees helps ensure systems are financially sustainable and encourages farmers to use less water.

Agricultural credit

- The Executing Agency and participating financial institutions are able to maintain their viability by charging appropriate interest rates; they have a strong capacity in credit risk appraisal, technical and financial analysis.
- Ministries of agriculture and other agencies can provide technical support in the appraisal of business plans, farmer training, and market information and extension services.
- While farmers are sensitive to loan terms and conditions, other factors such as the efficiency of application processing and reporting requirements are of equal importance.

- Participating financial institutions must ensure that sub-borrowers comply with environmental laws and undertake sub-projects that are environmentally sound.
- Targeting commercially oriented farmers is generally more successful than targeting subsistence farmers who often lack the collateral requirements of financial institutions. Also, subsistence farmers have low levels of productivity and technology application, their enterprises are generally marginal, and they often have difficulty in meeting their debt service obligations.

8. Challenges

The challenges to sustainable horticultural development outcomes in Caribbean countries are not automatically associated with lack of investment; rather they require public and private collaboration to overcome several existing barriers to expansion. Smallholders often face upgrading challenges, which include the following: difficulty to self-organise at the production level to achieve economies of scale; poor access to key services, such as finance, technical services, and market information; weak institutional services with respect to quality control and SPS regulation; and the absence of capable local lead firms.

8.1 Post-Harvest Handling

Reducing post-harvest losses would make diversification into horticultural crop production less risky and more attractive for small-scale farmers. However, this requires the coordination of multiple factors, each of which entails complicated and often costly options. For example handling, packing, storage and transport can require costly equipment and extensive research into aspects such as controlled atmosphere for storage and quality assessment. Tropical and subtropical fruit, and most vegetables, and herbs are perishable and have limited storage and shelf lives; they are susceptible to physical damage, heat injury and they generally produce, and are susceptible to, ethylene gas, which induces ripening. This means that most export crops must be transported to destinations by expensive airfreight. However, developments in storage technologies mean that an increasing number of tropical and subtropical fruit crops can be sent by slower, but cheaper sea freight. A major challenge to any new development involving horticultural crops is to ensure that post-harvest quality is maintained through the supply chain from farmer to the consumer.

Once important attributes have been established for the high-value crops produced (such as optimum harvest maturity indices, optimum storage conditions and temperatures, adequate packaging and the nature of post-harvest diseases), the logistics of moving products to the market in the most expeditious manner has to be determined. Education and training of farmers, and others involved in the supply chain, is important. Post-harvest accumulation, sorting, packing and storage facilities are essential requisites for preparing products for markets; major investments are required and funding for these will generally be from donor agencies, government sources, or as public-private ventures.

The production of high-quality fruits and vegetables and the maintenance and enhancement of this quality in post-harvest and distribution operations is associated with the careful incorporation of technologies applied throughout the production, harvesting and post-harvesting stages. For small-scale producers, or when ready supplies of water and electricity are not available, simple alternative

solutions should be considered. The principle is not to use sophisticated technologies, but to handle produce efficiently throughout the supply chain. Caribbean countries need to develop (and strengthen where relevant) the implementation of national Good Handling Practices (GHP) systems and promote national training and education programmes on appropriate technologies to reduce post-harvest losses throughout horticultural value chains. Post-harvest mishandling accounts for more than 30 to 40 percent of productivity losses in many horticultural crops. Lack of knowledge and appropriate technologies are the main constraints to using appropriate handling practices in the field and after harvest. Some approaches to address this issue could include the following:

- Conduct training courses on best practices for producing and marketing safe, high-quality produce, including attention to the principal routes of microbial contamination (agricultural water; biological soil amendments of animal origin; worker health and hygiene; equipment, tools, buildings and sanitation) and fresh produce damage through poor handling.
- Highlight economic incentives to eliminate barriers for the adoption of post-harvest technologies and methods.
- Reduce tariffs, where appropriate, on the import of post-harvest equipment and supplies or develop local manufacturing facilities.
- Promote the development and utilisation of appropriate infrastructure (e.g. simple, shaded packing sheds, small-scale coolers near growing locations, standardized rigid plastic containers for produce, and insulated or refrigerated transportation units).

8.2 Markets

Without markets for their products, Caribbean smallholder growers switching their farming systems to more horticultural production will fail. Although the production of high-value horticultural crops can be a high-risk business in any country, opportunities exist to improve rural household incomes and resilience to shifting weather patterns among Caribbean growers. However, there are challenges for smallholder farmers to access markets, especially those in large urban centres or in developed countries. As market systems and consumer demands change in relation to product diversity, safety and convenience, so do the challenges confronting growers trying to gain access to these more profitable markets.

There are various strategies farmers and other stakeholders in horticultural value chains can adopt to help meet these challenges, such as farmers forming groups, cooperatives or associations for marketing purposes, contract farming, and out-grower schemes centred around larger, more commercial farmers. Most marketing initiatives are based on collaboration and the need for trust to apply across all members of the supply chain, which often requires many years to be successful. The importance of public-private sector cooperation and the need for governments to promote an attractive enabling policy environment can facilitate these trust-building processes.

>> Box 5. Case Study: Cocoa revival and value addition – Trinidad and Tobago

Trinidad and Tobago has exported cocoa for over two hundred years and exports peaked at about 34 000 tonnes in 1921. However, production fell during the twentieth century, partly due to the introduction of a fungus, *Moniliophthora perniciosa* in 1927, which is the causal agent of Witches' Broom disease. This coincided with a steep fall in the international price of cocoa.

The selection of elite cocoa germplasm and collection of material with no symptoms of Witches' Broom from locations endemic to the disease resulted in the breeding of renowned hybrids, which maintain the traditional "Trinidad flavour", are high yielding, and provide good tolerance to disease. These varieties have been widely distributed to farmers, so Trinidad and Tobago is now in a position where the agronomic constraints to cocoa production have largely been overcome. Currently, there are about 5 000 registered cocoa farmers in Trinidad and Tobago, of which less than 6 percent produce more than 1 tonne of cocoa annually. Although the yield potential of current varieties is over 2 tonnes per ha, the average yield reported in Trinidad is only 150 kg per ha. Most farmers own small plots (less than 5 ha), and they cannot make a living growing only cocoa.

Technically, large quantities of good quality, fine or flavour cocoa could be grown in Trinidad and Tobago using developed varieties in combination with intensive cultivation systems. In addition, there is currently a growing demand for fine or flavoured cocoa worldwide, due to improved living standards in traditional markets and the opening of new markets. Recent developments are the production of origin-specific dark chocolates, and certified organic dark chocolate, which attract premium prices in niche markets. Trinidad and Tobago is well placed to take advantage of these recent developments, since demand for their cocoa exceeds production, and specialist manufacturers are willing to pay substantial premiums for consistent supplies of good quality cocoa. Many local and several multinational chocolatiers have established processing units in Trinidad and Tobago to take advantage of these emerging global trends in chocolate. In 2017, chocolate exports from Trinidad and Tobago amounted to USD 8.1 million, and cocoa beans to almost USD 2 million.

Source: Jewell (2017).

8.3 Developing Food Quality Standards

High demands for food safety and quality (from both consumers and regulatory agencies), particularly in high-value markets (such as export and local tourism) impose stringent standards for growers and other value chain participants to deliver a competitive product. This has led to the establishment of industry-wide standards set by the supermarkets working together; these include the Safe Quality Food and British Retail Consortium food safety certification programmes, and the GlobalGAP protocol, which include the recognised principles of hazard analysis critical control points (HACCP). Such developments have created major barriers for smallholder farmers wishing to export to high-value markets in Europe and North America, as often they cannot meet the production and quality expectations of consumers in these markets. Another barrier is increasing consumer awareness of environmental and social welfare issues in developing countries; exploitation of local labour and over-use of agrochemicals has resulted in a series of codes in some countries to promote ethical production systems. The associated compliance costs of these regulatory steps may in turn impact negatively on smallholder farmers to the extent that they are marginalised and excluded from high-value supply chains.

Laboratories are an essential component of a food control system, which requires considerable capital investment, and they are expensive to maintain and operate. Therefore, careful planning is necessary to achieve optimum results. The number and location of the laboratories should be

determined in relation to the objectives of the system and the volume of work. The laboratories should have adequate facilities for physical, microbiological and chemical analyses. In addition to simple routine analysis, the laboratories can be equipped with more sophisticated instruments, apparatus and library facilities, as required. It is not only the type of equipment that determines the accuracy and reliability of analytical results, but also the qualification and skill of the analyst and the reliability of the method used.

An important element of a national food control system is its integration in a national food safety system so that links between food contamination and food-borne diseases can be established and analysed. Access to reliable and current intelligence on the incidence of food-borne illness is critical. It is essential that effective linkages are established between food control agencies and the public health system, including epidemiologists and microbiologists. In this way, information on food-borne diseases may be linked with food monitoring data, and lead to appropriate risk-based food control policies. This information includes annual incidence trends and the identification of susceptible population groups and hazardous foods; it also includes the identification and tracing of causes of food-borne diseases, and the development of early warning systems for outbreaks and food contamination.

But Caribbean countries possess limited capacities for food safety and agricultural health management in relation to pest/disease/food contaminant surveillance, inspection, risk analysis, and conformity assessment, which are probably having more substantial adverse effects on domestic agricultural productivity and on domestic consumer health than on the competitiveness and market access for external trade. Limited capacities and resources, together with a relatively low prioritisation seemingly given to matters of food safety and agricultural health in Caribbean countries, have resulted in a situation where crisis management is the dominant 'approach' to addressing emergent risks and problems. Thus, measures are taken to cope with or in response to outbreaks of diseases, pest infestations, and/or episodes of food or water-related contamination.

With few exceptions, it is difficult to identify specific policies and/or pro-active strategies that are being adopted by Caribbean Governments to manage SPS-related risks. The situation is better within the private sector, yet this pattern varies considerably between industries, and the overall picture is not impressive compared with prevailing patterns in many countries competing with the Caribbean for external markets.

8.4 Training and Education

Farming knowledge based on the production of staple crops cannot be transferred easily to the production of high-value horticultural crops. Therefore, development programmes require continuous education and training using a variety of tools, including workshops, seminars, Farmer Field Schools, handouts, booklets and one-to-one interactions. Education and training involves basic information transfer on the biology of fruits and vegetables, management systems, pest and disease management, irrigation, and greenhouse management, along with the challenge of successful intercropping of high-value vegetables, fruits, herbs, spices and aromatic plants.

Such training has to be undertaken with well-trained information transfer specialists. Caribbean countries could access the wealth of information and capacity available in neighbouring Latin American countries growing similar horticultural crops, but with more developed supply chains and markets. These countries have experienced and overcome the same training and capacity building constraints currently experienced in the Caribbean region. In addition, education and training in post-harvest handling practices and technologies is essential so that post-harvest quality of fresh products can be maintained through the supply chain, from the smallholder to the consumer. In addition, new

information technologies are available, enabling farmers to communicate in real time with each other and with participants in the supply chain, as well as access current market information.

An increasingly important role for food control systems is the delivery of information, education and advice to stakeholders across the supply chain, such as the provision of balanced factual information to consumers; the provision of information packages and educational programmes for key officials and workers in the food industry; development of train-the-trainer programmes; and the provision of reference literature to extension workers in the agriculture and health sectors. Food control agencies should address the specific training needs of their food inspectors and laboratory analysts as a high priority. These activities provide an important means of building food control expertise and skills in all interested parties, and thereby serve an essential preventive function.

8.5 Research and Development

As production of high-value crops intensifes and planted areas expand, the likelihood of pests and diseases damaging crops increases throughout the Caribbean region. In addition, ecologically friendly management systems will need to be tailored to ensure adequate nutrient and water requirements are achieved for optimum production without despoiling the environment. Research and development (R&D) will be needed to support integrated and sustainable production and post-harvest systems as production increases. The selection and evaluation of improved varieties of high-value crops suited to specific microclimates also requires long-term R&D. Similarly, local under-utilised species should be evaluated and manipulated to generate new sources of income, either for fresh or processed products.

There are many examples of the advances that have been made through conventional plant breeding that are benefitting modern consumers. These include cultivars of strawberries that allow longer production periods, a wider range of lettuce types, new pineapples with improved flavours, and new kiwifruit with different flavours and colours. As indicated above, consumers (and, therefore, supermarkets) are seeking new eating experiences, different quality attributes, and improved convenience; they are prepared to pay a premium for such produce if their expectations are met. In some instances, these premiums are considerable, benefiting the overall industry by improving the popularity of the crop overall. However, these premiums can often exceed those that most consumers are prepared to pay for the choice of consuming produce, such as organic fruit and vegetables.

Global research on horticultural crops has been underfunded and inadequate over the past 20 years compared to the research dollars allocated to staple grain crops. The key R&D priorities for Caribbean countries are as follows:

- ▶ increase productivity per unit area;
- ▶ ensure post-harvest maintenance of product quality;
- ▶ develop environmentally friendly production systems;
- ▶ improve planting materials through breeding and selection; and
- ▶ enhance peri-urban horticulture.

8.6 Technology and Knowledge Transfer

Technology transfer from both university and government sources in many developed countries to horticultural sectors in developing countries has markedly declined over the past two decades and has been replaced with a greater provision of services from the private sector. But the rudimentary private sector in the horticultural industry in most Caribbean countries cannot deliver such services.

Paradoxically, the demand for information from public providers has nonetheless increased as providers of information in the private sector seek to stay abreast of the latest developments and producers seek to secure the best advice possible. In Caribbean countries, the provision of knowledge from both private and public sectors may be poorly developed; however, the demand for useful and relevant information is growing as enterprises become more sophisticated and often more focused on exporting their produce.

In parallel with such changes, there has been an unprecedented expansion of methods by which to transfer information – mobile phones, the internet, laptop computers, private and public networking, etc. Equally, there is a growing expansion of the types of information that can be accessed through the use of remote sensing, environmental monitoring, image analysis, weather forecasting, among others. The challenges relate not to the availability of information, which can sometimes be well in excess of that needed, but to the provision of relevant knowledge and the more effective means of transmitting the specific information requirements. Stakeholders in many horticulture value chains have rapidly adopted many such technologies, including the use of near infrared scanning in modern fruit grading equipment, which can now sort up to 1.5 million fruit per hour. The challenge facing horticulture producers in the future will be to filter the information that is available into useful knowledge that will allow them to be more effective and efficient in their various enterprises.

9. Recommendations

By raising agricultural productivity, Caribbean countries can keep pace with the increasing domestic demand for food, meet requirements for enhancing competitiveness, and ultimately raise rural incomes. Most Caribbean countries are at an early stage of agricultural technology and the potential to increase productivity is substantial. However, sustained agricultural growth in most cases calls for substantial investment in irrigation and rural infrastructure, human development and institutions.

New developments in biotechnology and bio-energy production may pose further threats to Caribbean countries if these new technologies result in an increase in productivity in more advanced economies, thereby increasing production, pushing down prices in products competing with those of the Caribbean and providing more incentives for Caribbean countries to import these cheaper food products.

Local initiatives in Caribbean horticulture need to focus on diversification of smallholder cropping systems toward increased production, post-harvest handling, value-added processing, and marketing. There are many market niches waiting to be exploited, especially for creative enterprises if they can obtain technical assistance in the fields of market research, standard certification, packaging and product adaptation to the requirements of selected target markets and tourists visiting the region. These horticultural industries are highly differentiated across countries and across sub-sectors. Countries such as Barbados, Jamaica, and Trinidad and Tobago have better infrastructure, human resources, and track records in diversifying their economies, and meeting some of the demand for suppling fresh horticultural produce to high-end markets, such as restaurants and resorts serving local tourist industries. These countries are also the main players in the intra-regional horticultural trade and thus, they could act as role models for other Caribbean horticultural industries to follow similar development trends.

Recommended initiatives are as follows:

a) **Support clustering of smallholders based on a product of common interest or common infrastructure**. Clustering of smallholders has proven successful in achieving economies of scale to enable growers to purchase cheaper production inputs and increase their bargaining power when selling produce. They can link together a large number of small farmers with organizations or companies that have expertise in areas such as marketing, packaging and transportation. Such linking and partnering could be useful as a way of pooling expertise and taking advantage of economies of scale to meet logistical, testing and certification requirements. Clusters could help build brand recognition and trusted relationships with larger traders supplying high-end markets, thus preventing smallholders from being squeezed out of supply chains as industry structures become more concentrated. These clusters also have a better credit standing and can therefore obtain easier access to bank financing for investment or commercial transactions.

   Clustering individual farmers or farmer groups around a common interest horticultural product or infrastructure, such as packhouses or storage, assists the promotion and uptake of advanced technologies, including protected horticultural production. For example, producers growing vegetables in greenhouse clusters are able to better control quality and crop production schedules, which consequently attract larger traders who are often connected to higher value markets, such as supermarkets. Such partnerships usually result in higher returns to growers.

   Clusters with accompanying post-harvest infrastructure, such as cool rooms and packhouses, serving multiple growers, increases efficiencies and reduces post-harvest losses through better post-harvest management of fresh produce. Promoting the uptake and clustering of protected agriculture – cultivation of high-value vegetables and other horticultural crops in greenhouses, or plastic tunnels – allows farmers to grow cash crops on small plots in marginal, water-deficient areas where traditional cropping is not viable. Protected agriculture offers many advantages: increases in yield, produce quality and revenue; water savings; reduction in pesticide use; year-round production, allowing farmers to take advantage of market seasonality and higher prices; and low-cost greenhouses can be fabricated locally. Integrated crop management methods have been developed to maximize the benefits of greenhouse cultivation.

   Greenhouses, plastic tunnels and mulching are low-cost season-extension technologies used for producing a diversity of horticulture crops, including vegetables, fruits, and herbs. Crops are grown directly in the soil beneath the greenhouse, and the only external connection is the drip irrigation system. In addition to accelerating crop growth and maturity, greenhouses protect the crop from an erratic environment where extremes in temperature, wind, rainfall, pests and light intensity can severely reduce marketable fresh produce. When properly managed, protected agriculture systems facilitate yield increases from improved plant health and plant life. Compared to open-field production systems of similar size, protected agriculture systems have more favourable labour requirements.

   Protected horticultural production has been adapted and used in smallholder farming systems in various Caribbean countries. However, farmers, technicians and researchers have not always been sufficiently aware of the more specialised techniques for growing crops under protected structures, and they have often simply adopted the technology from more developed farming systems, such as from the United States of America, which are not always directly applicable to Caribbean conditions. The agronomic practices required for protected agriculture systems are specialised and a range of crop performance problems can be exacerbated by incorrect management practices. The promotion of protected horticultural production practices need to be supported by adaptive research; farmers require technical advice on the management of such inputs as the growth

media, crops/variety selection; nutrient and water management; environmental conditions; and cost. Expertise is required from countries which have experience in the application and clustering of protected agriculture technologies for transfer into smallholder farming systems.

b) **Improve the performance and sustainability of plant quarantine services** and improve working relationships with other entities. The role of plant quarantine is to prevent the entry, establishment and spread of regulated pests into a country and to support the access of that country's agricultural and other products of quarantine significance to foreign markets through the certification of their phytosanitary status in conformity with the requirements of the importing country. The following recommended interventions aim to build more proactive quarantine services in Caribbean countries to protect plant and human health:

- *Pest and disease surveys and associated training* – a series of pest surveys are carried out as part of a programme of in-service training. When the accurate and up-to-date pest lists are established and proper border controls are instigated, it should be possible to establish certain areas in each Caribbean country, or indeed the whole country, to be free of certain pests and diseases to the satisfaction of trading partners. Farmer awareness programmes are also integral activities. Carrying out the necessary taxonomic work requires the services of an international agency contracted to support the in-country training programmes.

- *Document control and preparation (or update) of manuals* – A Standard Operational Procedures manual is designed as a hands-on tool for use by Plant Quarantine officers to carry out their everyday duties related to protecting the plant germplasm of Caribbean countries from the direct and indirect effects of introduced pests and diseases that might enter the country. Manuals would include guidelines for (1) the movement of agricultural produce in and out of countries for use by border inspectors, including customs officials; (2) quarantine pests on pest lists for use by all agencies and where necessary customs officials; and (3) the writing and review of the import control addenda.

- *Procurement of equipment and services to improve on-going operations* – laboratory and quarantine equipment to upgrade existing services and priority vector control measures, particularly at border entry points.

A national integrated pest management programme to address major pests, diseases and weeds should be an integral part of any contemporary quarantine and inspection service. Within this programme, efforts could be directed towards research and innovation to develop and promote the adoption of non-chemical control methods, such as intercropping, antagonistic fungi, and pheromone traps. Training in diagnostics and management of pests and diseases should also be included in any programme. Such an effort will reduce the current trend of excessive pesticide use, which results in chemical residues, food safety problems, and export rejections.

c) **Support the development of national food safety strategies** that consider international perceptions of food risks, international standards, and any international commitments in the food protection area. All stakeholders need to reach consensus on objectives, priorities, policies, roles of different ministries/agencies, industry responsibilities, and time frame for implementation in order to prevent confusion, duplication of effort, inefficiencies in performance, and wastage of resources. The strategy should focus on the need for food security, and consumer protection from unsafe, adulterated or misbranded food whilst also considering the economic interests of the country in regard to export/import trade, the development of the food industry, and the interests of farmers and food producers. The need for human resource development and the strengthening of infrastructure, such as laboratories, should also be considered. The strategy will be influenced by

each country's stage of development, the size of its economy, and the level of sophistication of its food industry. The following actions are essential to building a national food safety strategy:

- Create a national strategy for food control with defined objectives, a plan of action for its implementation, and milestones.
- Develop appropriate food legislation or revise the existing legislation to achieve the objectives defined by the national strategy.
- Extend or revise food regulations, standards and codes of practice, harmonizing these with international requirements.
- Strengthen food surveillance and control systems through a programme.
- Promote systems to improve food safety and quality along the food chain, introducing HACCP-based food control programmes.
- Develop and organize training programmes for food handlers and processors, food inspectors, and analysts.
- Enhance inputs into research, food-borne disease surveillance, and data collection, creating increased scientific capacity within the system.
- Promote consumer education and other community outreach initiatives.

d) Support initiatives to address pertinent risks and opportunities associated with food safety. Rather than recommending large capacity-building initiatives that would overhaul existing institutional structures and invest resources in physical infrastructure, facilities, etc., the recommendation is for a limited set of catalytic and demonstrative initiatives that will raise the food safety awareness and application of better production and post-harvest practices to improve quality among selected food system participants:

Design and support the implementation of quality assurance schemes

The development of the domestic supply chains and markets for fresh fruits and vegetables has, until recently, been largely neglected by most Caribbean countries and the donor community. There is growing recognition of the current size and potential of domestic markets and the opportunities it might provide for a larger number of small- and medium-scale farmers. Buyers give preference to reliable growers who can consistently supply good quality produce. Yet, buyers generally lack the resources to advise farmers on matters of good agricultural practices. Limited requirements and systems have been developed for production record-keeping, product traceability, and so on. Thus, the prevailing standards lag behind those required for supplying supermarkets or the tourism industry elsewhere in the region.

An assured produce scheme would be a stepping stone toward international standards (such as GlobalGAP), and a means to reduce the fresh produce procurement risks faced by Caribbean retailers, tourist/hospitality operators, and food processors. The scheme is also a basis for promoting improved practices among local producers and enabling those producers who do make operational upgrades to become longer term, preferred suppliers to remunerative segments of the domestic (and regional) market. Technical cooperation programmes aimed at applying GAP in an integrated and multidisciplinary approach for horticulture production (horizontal and vertical market integration, environmental protection, social concerns, quality and safety, plant and animal health, etc.) become important because of the erosion of official agricultural extension services.

The quality assurance scheme would focus on: (1) the safe and timely application and storage of pesticides; (2) basic principles and practices of food safety; and (3) proper record-keeping and

systems of traceability. It would thus centre on core aspects of international protocols, such as GlobalGAP, and be designed and implemented with direction and oversight by all stakeholders – the main buying organizations, farmer associations/groups/cooperatives, agrochemical companies, and government. The quality assurance scheme would also involve the development of suitable manuals, and training materials, the subsequent training of selected farmers and audits to ensure the actual adoption of better management practices.

Strengthen implementation of Good Handling Practices (GHP)

Develop national GHP systems in selected horticultural industries and promote national training and education programmes on appropriate technologies to reduce post-harvest losses throughout horticultural value chains. Post-harvest mishandling accounts for more than 30 to 40 percent of productivity losses in many horticultural crops. Lack of knowledge and appropriate technologies are the main constraints to using appropriate handling practices in the field and after harvest.

- *Promote the implementation of Good Manufacturing Practices (GMP) and HACCP in selected food industries:* undertake a demonstration programme which could be replicated in other sub-sectors; conduct gap analysis of selected food industries and establishments from selected priority sectors; select food industries and implement GMP and HACCP (ISO 22000); provide company training, and training of trainers for food industry GMP, HACCP (ISO 22000) planning; and monitor the implementation of GMP and HACCP (ISO 22000) in these selected industries;
- *Strengthen information, education, communication and training capacity:* create informed and organised consumer and producer groups, and a competent food control authority through education, training, communication and information. Provide technical support for the following:
  - educational systems in the Caribbean to better incorporate messages or more advanced curriculum related to basic food hygiene and food safety, starting from the primary school level through to institutes of higher education;
  - national food safety weeks/days and prepare special programmes and a campaign on food safety through media outlets and promotion materials;
  - consumer associations and food safety associations; and
  - training workshops for members of the media on issues related to food safety and responsible news reporting in this field.
- *Establish and Strengthen Food Inspection Operations:* these systems in the Caribbean are mostly understaffed in terms of technically competent personnel, and have limited resources (facilities, inspection tools, manuals, etc.) to undertake inspection, follow up and monitoring activities.
  - Provide training, and training of trainers in courses for food inspectors.
  - Establish inspection operations with the necessary trained and competent staff, inspection manuals, tools, facilities, transportation systems.

Following these initiatives, government regulatory authorities will be able to assess and upgrade, where necessary, their regulatory frameworks for food safety, the associated institutional arrangements and capacities for food safety monitoring and inspection, and the patterns of awareness of application of appropriate health and hygiene measures in Caribbean food industries and service establishments. For most Caribbean producers and traders, international certification is unnecessary, although there have been reports that some insurance companies working with international hotel and resort companies operational in the Caribbean are insisting

that client hotels and resorts can only source foodstuffs from internationally certified suppliers in order to guarantee the quality of food served to foreign tourists visiting Caribbean resorts. This requirement will impose an onerous expense on producers that will be reflected in higher costs in local fruit and vegetable supply chains and thereby further reduces local competitiveness. Therefore, stakeholders in horticultural supply chains should adopt GAP standards and prepare for the possibility of needing to upgrade to GlobalGAP or other international food safety certification standards, such as Safe Quality Food.

Related to the recommendations on food safety and plant quarantine is the capacity in each Caribbean country to conduct appropriate laboratory testing serving their local agricultural and food sectors. This is important for trading nations and countries with tourism industries in order to assure buyers and regulators in importing countries and establishments serving the local tourism industry that the supplied products are safe and compliant with established standards. Diagnostic testing capacity in both public and private laboratories is also important for monitoring and assessing risks associated with pests, diseases, and food-related contaminants in the domestic markets of Caribbean countries. Therefore, as part of these recommendations, assessments by international experts should be undertaken to gauge the testing needs in food and agricultural industries, the current approaches to meet those needs, and necessary improvements in local diagnostic testing systems. This includes possible linkages with foreign laboratory services for more complex and expensive diagnostic tests.

e) **Develop capacities in both the public and private sector in new technologies.** The horticultural industry in the Caribbean region needs to become smarter and adopt remote sensing technologies able to assist more precise and effective supplies of high-quality produce into all markets. New technologies are bringing down the cost of communications, which should benefit remote, more sparsely populated areas with poor roads. Biotechnology (with appropriate safeguards) offers opportunities for more rapid technological advances if there is sufficient investment in their application to the crops and problems in Caribbean countries.

   Development of skills in new technologies, such as GIS in public and private institutions, and capacities within industry in documenting, managing and monitoring production and distribution systems is now important to developing modern industries. Remote sensing has numerous applications for the horticultural sector: crop production and yield forecasting, identification of planting and harvesting dates, identification of pests and disease infestations, soil moisture estimation, irrigation monitoring and management, soil mapping, nutrient deficiency detection, collection of past and current weather data, crop intensification, water resources mapping, compliance monitoring (ensuring farmers follow correct procedures when planting and harvesting crops), and soil management practices.

f) **Support the deployment of a weather forecast system that reaches all small producers,** especially those farmers in more remote areas, such as highland areas where chilling and sometimes freezing temperatures occur during the dry months. The delivery of timely weather forecasts and severe weather warnings (e.g. chilling, elevated temperatures) could be done through text messages via mobile phones, thus providing sufficient time for farmers to act accordingly to mitigate the negative impact of such weather events. Clear guidelines are needed to determine production areas with high risk of suffering losses due to seasonal weather variability. This information could be useful to extend the growing season in some areas and avoid damage to expensive infrastructure, such as greenhouses and equipment, drip irrigation and sprayers in other areas. In some regions, farmers can avoid planting crops should the weather forecasts present excessive risk of damage.

g) **Pilot weather-indexed crop insurance schemes.** Crop insurance is difficult to develop and establish, particularly within the small country nations that dominate the Caribbean, and private insurance companies are reluctant to venture into the agricultural sector. They perceive horticulture and agriculture in general to be high risk and becoming more risky as increasing weather variability impacts farmers, with smallholders the most vulnerable group. Nevertheless, farmers need to be supported to invest in higher value cropping activities and crop insurance can provide 'peace-of-mind' against unpredictable weather events.

Therefore, to provide a safety net for farmers, it is recommended that the design of a sustainable crop insurance system or risk management tool should be suitable for (but not exclusive to) small-scale farmer groups – cooperatives or even a given region with a high concentration of small-scale farmers. This must be a private sector-driven initiative with sufficient government support and regulation to facilitate the implementation of the scheme. The costs of implementing micro-insurance may fall due to increasing use of geospatial data, more sophisticated weather forecasting models and data recording, improved communication networks and other ICT improvements, that could prove weather-indexed crop insurance feasible to pilot in some areas. When weather-related events occur, they tend to affect several countries simultaneously, thus concurrently affecting many Caribbean farmers. Crop insurance could be a public-private partnership, including the insurance companies, governments and farmers; such systems have been recognised as the most sustainable and effective crop insurance programmes for developing countries.

h) **Develop long-term national development strategies for key horticultural products** in each country. For each horticultural value chain, industry experts need to be hired to prepare national development strategies (20-30 years) for the entire value chain that will inform investment directions with regard to changing weather patterns and market opportunities. This is particularly important for perennial fruit trees that would be planted now, but any investment needs to consider the likely weather conditions during the 15 to 20-year productive life of the trees and the varieties required in targeted markets. Similarly, the development strategy targets specific markets for the horticultural product (local, regional, international), the seasonal opportunity, and volumes, based on economic and financial analyses.

These long-term development strategies provide national governments, industry associations and other stakeholders with a road map of the investments required to build more viable, and more profitable local horticultural industries. For example, Dominica wants to turn their cocoa, coffee and citrus sectors into key agricultural industries, which will generate higher incomes for their smallholder farmers. To do so, Dominica's cocoa industry needs to hire industry experts from a more advanced national cocoa industry (such as Trinidad and Tobago's), to help develop their sector investment strategy – the support required for growers, the varieties to grow, the requirements of key export markets, the required business enabling environment to attract foreign investment, among others. With such a strategy, the stakeholders in the cocoa sector in Dominica would be confident that their investments were building towards a more viable industry, and they could gauge their progress each year against the targets described in their long-term cocoa development strategy.

- Included in the national development strategy should be a national research and innovation plan for a targeted horticultural crop derived from broad and inclusive consultation with different actors in the industry. It could be created by promoting linkages between research/higher education institutions with farmer groups/federations, service and input providers and other value chain actors to provide needed focus on solving critical issues affecting horticulture and agricultural-related activities (water quality, environment, biodiversity, technologies, finances, etc.). Research partnerships could also be developed between Caribbean institutions

and the United States of America, and Central American institutions to work on research activities in support of national needs. Such an activity will help build the capacity of local institutions to undertake research and outreach while addressing key needs of the country. These collaborative research activities could be designed to help address much of the current weakness in national horticultural industries of Caribbean countries, such as developing online resources of information about plant health, quality platforms, germplasm and safety.

i) **Establish incentives to attract more private investment into local horticultural sectors.** Policies to encourage local and foreign investment, such as provision of land to promote increased productivity through shifts to higher value commodities (such as fruits and vegetables); facilitating improved access to more dynamic markets (both domestic and external); an appropriate institutional environment; market information; and assistance in meeting health and sanitation standards are some of the possible policy enticements. Caribbean countries need to compete with other regions that have more favourable natural attributes, such as sizeable local populations with growing wealth, in order to attract investment; therefore, they need to offer more tempting packages to encourage and facilitate foreign investment in their horticultural sectors.

Foreign direct investment could be a potentially important contributor to filling the investment gap in the sector. Land rents demanded are typically low or even zero, for example, while the various tax concessions offered to foreign investors mean tax revenue foregone. However, foreign investments are seen as potentially providing developmental benefits through, for example, technology transfer, employment creation, infrastructural development, and upstream and downstream linkages. However, these beneficial flows are not automatic. Care must be taken in the formulation of investment contracts, selection of foreign partners and suitable business models; appropriate legislative and policy frameworks need to be in place to ensure that development benefits are obtained, and the risks minimised. But the information base and capacities within most Caribbean governments to design and implement effective policies and legislation is weak. There is therefore a need to monitor the extent, nature and impacts of foreign investments and to catalogue best practices in law and policy to better inform both host countries and investors. Detailed impact analysis is needed to assess what policies and legislation, whether national or international, are needed and what specific measures are most appropriate to create more favourable business enabling environments throughout the Caribbean region.

j) **Support research programmes that develop, test and implement climate change adaptation and mitigation strategies,** such as the development of horticultural varieties able to tolerate temperature extremes and the promotion of agroforestry. Research is needed to resolve issues, such as the development of drought tolerant crops, the management of crops under water deficits, dealing with increased salinity, and the use of low-quality water. Prevention strategies to avoid high or low temperature impacts on crop productivity might involve active or passive approaches that should be validated under local conditions. Active methods to prevent low temperature damage might include covering the crop before chilling or freezing temperatures occur in the field. Mulching crops to cool roots, use of shade cloth and improved irrigation strategies could be tested to reduce high temperature stress. Researching, developing and demonstrating new and improved horticultural production techniques is an important role governments should adopt and improve on their existing field stations.

k) **Develop and support a research agenda focusing on sustainable production systems** relevant to key horticultural crops in specific Caribbean countries. Production systems could be evaluated for social, economic and environmental sustainability, and should include modern technologies whenever possible. Collaborations with external agencies willing to support such initiatives should be investigated. New initiatives such as agroforestry, mixed cropping systems,

improved irrigation practices could be researched, evaluated, and demonstrated as part of a strategy to increase resilience, diversify agriculture, minimize risks against climate change, and enhance biodiversity conservation.

l) **Develop mechanisms to coordinate and enhance the marketing of horticultural products** from smallholder growers. Smallholders sell their produce through different venues, including direct sales in local markets, to intermediaries, or contract sales through formal markets (wholesale or supermarkets). The programme may involve the following:

1. Work with supermarket chains domestically to connect smallholders to formal markets with contracts and transparent systems.
2. Encourage communication and relationship building with traders and buyers through the establishment of business/collection centres. Foster agribusiness linkages among such groups by training farmers in business skills.
3. Promote local government initiatives to enhance conditions in local markets (e.g. farmer markets), so they become attractive to a broader range of customers and so that small-scale farmers can sell their produce locally.
4. Promote producer associations that can market cooperatively with more power, and assist them to develop successful and sustainable business models for their members.
5. Provide market information about demand and prices through a broad range of communication channels – radio, television and cell phones – where daily prices of fruits and vegetables are reported for major markets.
6. Deliver training about quality and safety requirements, and post-harvest handling to farmers, transporters and buyers.
7. Support initiatives for planned plantings, and consistency in delivering the volumes and qualities of produce by smallholders as demanded by consumers in close coordination with local, national and regional buyers.
8. Develop incentives that influence private actors in supply chains to ensure fair access for small growers.
9. Influence private policies for prompt payment and support sustainable business development (i.e. fair trade approaches for local markets).
10. Implement programmes for promoting agribusiness linkages between growers and buyers that favour formal agreements for buyers to purchase horticultural products, and for producers to access horticultural supplies.

m) **Create incentives and an attractive enabling environment to develop rural business services**, especially those that are suitable for smallholders. Incentives such as tax breaks, technical assistance, or business planning could help develop valuable horticultural services. Examples include:

- Protected cultivation technologies (row covers, tunnels and greenhouses). Adoption of these technologies are viable options to reduce losses from adverse weather events, major pests and diseases, and are technologies adaptable to small-scale growers.
- Technical advisory services, including remote sensing analysis.
- Small-scale commercial laboratories to test fruits and vegetables for chemical residues and human pathogens. Cooperatives engaged in export markets could be in a better position to negotiate deals with commercial laboratories.
- Modern irrigation, packaging, small-scale cold rooms, and processing technologies.

n) **Support efforts to introduce affordable finance**. While larger-scale farmers, corporate, and agribusinesses in the Caribbean would seek access to affordable credit, smallholder farmers would represent most of the unfulfilled demands for credit. The focus of providing credit activities to this market has shifted from nurturing subsidised, government-run institutions with cheap credit, to developing institutional capacity and improving institutional performance for a broader range of rural financial institutions.

Donor and government support could facilitate the development of institutional capacity through assistance to activities, such as the initial training of employees or early innovators in rural finance. They could develop modes of operations and lending instruments suitable for the target rural communities. These interventions are geared towards building knowledge and understanding within local financial institutions about local agriculture and the particular commodities grown by the targeted rural communities. The aim is to break down traditional misperceptions and to build capacity to assess productivity and potential profitability of farming operations so that appropriate loan packages can be developed for specific clientele.

Development assistance for local finance institutions could also include the following:

- design and implementation of market research (demand and supply analyses) to help them understand different smallholder segments and their needs;
- product design and piloting to reduce the costs and risks of new market entry and innovation;
- systems improvements to adapt management information/core banking systems, and use technology solutions, such as automation of data capture and analysis to accommodate tailored credit assessment, portfolio monitoring requirements, and loan repayment schedules;
- design of staff incentive plans to promote agricultural lending;
- introduction of product-costing practices to inform product and programme design and to help to make the business case for new market entrants;
- design and piloting of new delivery channels to reduce the costs and risk of lending; and
- support for non-financial services, such as financial education and/or technical assistance programmes for smallholders, to complement credit services.

o) **Promote interventions for women to participate more actively in horticultural value chains.** The growth of modern horticulture supply chains has been associated with direct beneficial effects for rural women and reduced gender inequalities in rural areas. Horticulture offers opportunities for women to attain financial independence, such as various on-farm casual labouring jobs, seasonal packhouse work, processing horticultural produce, and operating trading enterprises. Ownership of land and small businesses provide women with the financial independence needed to make decisions and take control over their own resources and future.

p) Examples of interventions that aim to empower women in the horticulture sector include: (1) agribusiness training, focusing on the steps needed to enter new markets; (2) training women to process and sell horticultural products to increase the end value of their production; (3) Farmer Field Schools directed towards women; and (4) encouraging women's increased participation in cooperatives and female-only organizations. Female extension workers are more able to connect to female farmers, especially in rural areas, and encourage increased women's participation in cooperatives and female-only organizations by involving both sexes in meaningful training that empower women to be assertive in community and household decision-making.

10. Indicators

Dual horticultural production systems operate in most Caribbean countries. A growing commercial and modern farm sub-sector operates alongside a small, subsistence farms sub-sector. The bulk of horticultural production is still produced by the small subsistence farms sub-sector, and within this sector, there are a wide variety of horticultural practices: mixed-cropping, continuous planting and harvesting on small and irregular shaped plots, greenhouses, plastic tunnels and open-field production, among others.

Record-keeping tends to be limited, as is the use of standard measurement units. Most horticultural growers are also consumers. Additionally, there is wide regional diversity in the importance of certain horticultural crops grown in the different Caribbean countries and within each country. As a result, there are specific methodological challenges to accurately measuring basic variables, such as crop area, yield and production, and collecting relevant data for understanding the decision making of smallholder growers.

Generally, horticultural interventions by governments or donors in Caribbean countries are a key component of livelihoods and rural development projects. The following are examples of indicators which help capture the effectiveness of a programme:

Sector-wide indicators for horticulture and rural development

Early outcome

- Public spending on agriculture as a percentage of GDP from the agriculture sector
- Change in public spending on agricultural input subsidies as a percentage of total public spending on agriculture
- Percentage of underweight children under five years of age in rural areas
- Percentage of population who consider themselves better off now than 12 months ago

Medium-term outcome

- Food Production Index
- Annual growth (percentage) in horticultural value added

Long-term outcome

- Rural poor as a proportion of the total poor population
- Percentage change in the share of the rural population living on less than USD 1 per day or below the national poverty line
- Percentage of the population with access to safe or improved drinking water
- Consumer Price Index for food items
- Horticultural exports as a percentage of total value added in the agriculture sector
- Proportion of undernourished population
- Producer Price Index for food items
- Ratio of horticultural (or specific horticultural species) land area to total agricultural land area of the country
- Percentage change in unit cost of transportation of horticultural products

- Percentage change of rural labour force employed in horticulture
- Percentage change of rural labour force employed in non-farm activities
- Percentage change of the labour force underemployed or unemployed
- Annual growth rate of household income from horticultural activity (percentage)
- Annual growth rate (percentage) of household income from non-horticultural activity

Specific indicators for horticultural crops (inputs and services related to crop production)

Early outcome

- Access, use and satisfaction with services involving sustainable crop production practices, technologies and inputs

Medium-term outcome

- Percentage change in yields of major horticultural crops of the target area/country

Long-term outcome

- Yield gap between on-farm and the research station for major horticultural crops
- Change in water use per unit of horticultural production

Rural micro and enterprise finance

Early outcome

- Indicators of access, use, and satisfaction with respect to rural finance
- Percentage of the rural population using financial services of formal financial institutions
- Percentage change in access to finance in rural areas

Long-term outcome

- Percentage of total savings that are mobilised from rural areas
- Percentage of rural population using non-bank financial services
- Recovery rate of rural credit

Agricultural research and extension

Early outcome

- Indicators of access, use, and satisfaction with research and extension advice
- Public investment in agricultural research as a percentage of GDP from the agriculture sector

Long-term outcome

- Percentage change in yields resulting from improved practices, for major horticultural crops
- Change in farmer income as a result of new technologies (by gender)

Irrigation and water harvesting

Early outcome

- Indicators of access, use, and satisfaction with respect to irrigation and water harvesting services
- Irrigated land for horticulture as percentage of crop land

- Percentage of users who report a significant increase in horticultural crop yields as a result of irrigation and/or water harvesting services
- Service fees collected as a percentage of the total cost of sustainable horticultural farmer group activities

Long-term outcome

- Percentage change in horticultural value added created by irrigated horticulture
- Percentage of irrigation schemes that is financially self-sufficient
- Percentage increase in horticultural cropping intensity

Agribusiness (agricultural marketing, trade and agro-industry)

Early outcome

- Indicators of access, use and satisfaction with respect to agribusiness and market services,
- Percentage change in number and value of activities managed by agro-enterprises
- Percentage of agro-enterprises adopting improved/certified hygiene/food management systems

Medium-term outcome

- Percentage change in sales/turnovers of agro-enterprises

Long-term outcome

- Percentage change in number of horticultural input suppliers and other business service provider outlets in target areas
- Percentage increase in private sector investments in horticulture
- Percentage increase in market share of cooperatives/agribusiness/farmer group enterprises

Community-based rural development

Early outcome

- Access, use, satisfaction with respect to services provided by community-based rural development organizations/grower groups
- Percentage of farmers who are members of community/producer organizations
- Proportion of community/producer organizations capable of meeting the production and marketing needs of their members
- Proportion of producer organizations with functional internal system of checks and balances

Long-term outcome

- Percentage increase in number of local enterprises in rural areas
- Ratio of average income of the richest quintile to the poorest quintile in rural areas

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Appendix

Food Quality Standards

The following are some of the most important (public and private) food quality standards affecting horticultural exports to the European Union and the United States of America:

- **GlobalGAP** is a pre-farm gate standard that covers the agricultural production process of the certified product, from pre-planting to harvest. The GlobalGAP certification scheme is considered a supply-chain partnership of retailers, produce suppliers/growers and associate members from the agricultural input and service sectors. It principally concerns pesticides, chemical use and application, and the environmental impact of farming systems. GlobalGAP was created not only in response to the increasing stringency of mandatory regulations, such as European Commission regulations on maximum residue levels for pesticides, but also in response to pressure from NGOs and consumer groups over issues such as environmental impacts.
- **BRC** (British Retail Consortium) developed Food Technical Standards to be used to evaluate manufacturers of retailers' own-brand food products. It is a post-farm gate standard.
- **Nature's Choice of Tesco** (United Kingdom of Great Britain and Northern Ireland), established by the supermarket chain, Tesco, identifies key principles and practices for Tesco's producers and suppliers of fresh fruits and vegetables to ensure that the production and produce handling systems are sustainable and environmentally responsible. For non-domestic markets, Tesco uses GlobalGAP.
- **The Assured Produce scheme** (United Kingdom of Great Britain and Northern Ireland), founded by the country's National Farmers' Union in conjunction with multiple retailers, seeks to assure consumers that fresh produce is grown in an environmentally sensitive manner, in particular using reduced amounts of pesticides. The scheme currently covers 45 crops with specific protocols.
- **Safe Quality Food 2000** (SQF 2000), administered by the Food Marketing Institute (United States of America), is recognised by the Global Food Safety Initiative, a retailer-driven initiative founded by the Food Business Forum. It provides a Code that specifies food safety and quality system requirements to be used for all sectors of the food industry. The objective is to supply food that is safe and meets quality and legislative requirements. The standard applies the following concepts and principles: hazard analysis and critical control points (HACCP); good manufacturing practice (GMP); good hygiene practice (GHP); and good agricultural practices (GAP). It is used mainly by retailers in the United States of America and Australia. SQF 1000 is the standard for pre-farm gate and SQF 3000 for retail outlet levels.

Problems reported by South East Asian countries implementing GAP[8]

- Many developing countries lack a coherent and well-coordinated policy approach on developing national GAP programmes. Some uncoordinated, top-down, government-driven (or bottom-up, private-sector-driven or donor-driven) GAP initiatives exist, a number of which are unsustainable or already faltering.

8 UNCTAD, *Food Safety and Environmental Requirements in Export Markets – Friend or Foe for Producers of Fruit and Vegetables in Asian Developing Countries?* (New York and Geneva, 2007).

- Discussions on GAP at national level generally lack a conceptual underpinning and fail to involve all key stakeholders. Once appropriate concepts have been developed, effective forms of public–private dialogue and appropriate partnerships need to be established.
- There is a lack of incentives for compliance with the GlobalGAP standard, such as price premiums and the possibility to use a promotional logo.
- Meeting GAP requirements tends to be more costly for farmers operating at a small scale than for those operating at a larger scale, due to higher initial investment costs and higher monitoring and certification costs. Long-term government and/or donor support are likely to be required to permanently offset these higher costs if smallholders are to become, or remain, part of global supply chains.
- Traditional wholesalers and food sellers try to compete against supermarkets in selling fruit and vegetables and have thus become more demanding towards their suppliers. This improves the overall quality of fresh produce, but it also exposes small-scale farmers to the risk of losing their traditional markets if they are unable to meet the new requirements.
- Laboratory costs for pesticide residue analysis – usually required by GAP codes – are expensive and pose a challenge to small-scale producers.
- New and more stringent requirements are exacerbated by the lack of administrative, technical and other capacities needed for compliance.
- National extension support and capacity-building support from international donors are inadequate; more GAP training is needed for farmers, collectors of fruits and vegetables, packing houses and exporters.
- R&D efforts are insufficient.
- Food safety and agricultural health measures within the context of wider capacity constraints and underlying supply chain trends and drivers need to be considered, along with the effects of rising standards on the competitive position of individual countries and various market participants.

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Annex 6
Livestock in the Caribbean region

Acronyms and abbreviations

ACP	Africa, Caribbean and Pacific Group of States
AI	Artificial Insemination
BLPA	Belize Livestock Producers' Association
CAHW	Community Animal Health Worker
CARICOM	Caribbean Community
CDB	Caribbean Development Bank
CLA	Conjugated Linoleic Acids
DNA	Deoxyribonucleic Acid
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GLDA	Guyana Livestock Development Authority
HACCP	Hazard Analysis Critical Control Point
IFAD	International Fund for Agricultural Development
LITS	Livestock Identification and Traceability System
M&E	Monitoring and Evaluation
SVE	Small and Vulnerable Economies
UHT	Ultra-Heat Treated Milk
USA	United States of America
USD	United States Dollar
WTO	World Trade Organization

Executive Summary

Due to growing populations, increasing urbanisation with raised demand for easily cooked nutritious food, and rising incomes, urban consumers are changing their traditional diets based on cereals and plants. The demand for livestock products is the fastest growing agricultural market, and livestock play an integral part in rural life in Caribbean countries. An estimated 65 percent of the global rural population participates in livestock-related activities (Biasca, 2012). Livestock are of economic importance, generating between 14 and 30 percent of agricultural GDP, and contributing to nutritional security. Animals also serve as investment sinks and sources of cash income in times of need; they are providers of transport for goods and services and are central to many sociocultural events and ceremonies.

Many diets of Caribbean countries are based on cereals or root crops. Meat can complement most diets and can compensate for nutritional deficiencies in plant staple diets. Foods of animal origin are rich in energy, protein, calcium, iron, zinc, vitamin B-12, riboflavin, vitamin A and conjugated linoleic acids. The concerns about public health in modern economies, where coronary heart disease, obesity, and other "diseases of affluence" are common, have led to recommendations to the public to modify their diet, particularly to reduce the intake of fats, especially saturated fatty acids, and consequently, red meat.

Environment

In the future, production will increasingly be affected by competition for natural resources, particularly land and water, competition between food and feed, and by the need to operate in a carbon-constrained economy. Rainfed crop-livestock systems prevalent in the Caribbean region can improve productivity through better integration of agriculture and livestock. Fodder productivity may be raised by integrated plant nutrition, better varieties and improved water control, employing supplementary irrigation or water harvesting.

Developments in breeding, nutrition and animal health will continue to contribute to increasing potential production and further efficiency and genetic gains. A shift towards the production of monogastric animals, which use concentrated feeds more efficiently than ruminants, has occurred in the last two decades. In the Caribbean, intensive livestock growers are almost totally dependent on imported feed, particularly the concentrates that largely determine the quality of commercial feeds. Sustainable agricultural practices are part of the solution to current environmental changes. Intensive production systems produce less greenhouse gases (GHG) per kilogram of product than low production systems and may reduce pressure on fragile ecosystems.

Markets

Increased livestock product demand can offer opportunities for smallholders in the Caribbean, as livestock production is among the few commodities that smallholders produce widely and can return decent incomes. High transportation costs in the Caribbean, and stricter animal welfare and environmental regulations in the industrial world support efforts to increase local livestock production. However, many smallholders have been forced to exit livestock farming, mainly because they cannot compete against the larger operations that benefit from both technical and allocative economies of scale embodied in the genetic improvement of animals and feeds or improved organisation. There is also a need to streamline and reinforce legitimate anti-dumping measures as many smallholder broiler growers in the Caribbean cannot compete against imported chicken meat rejected by supermarkets of the United States, which hinders private investment. Larger Caribbean countries protect their poultry industries through tariffs based on food security policies.

Farmer collective action for the marketing and processing of farm products and/or for the purchase and production of farm inputs are primary reasons for forming collaborations among farmers. They aim to increase members' production and incomes by helping them to access finance, agricultural inputs, information, and output markets. Producer groups and cooperatives also enable farmers to improve product and service quality and reduce risks; they can empower their members economically and socially by involving them in decision-making processes that enable them to become more resilient to economic and environmental shocks.

Consumer Preferences

While shifts in livestock product demand are discernible as incomes rise, consumers with higher incomes are consuming higher quality products rather than larger quantities. To satisfy the demands of increasingly well-informed, heterogeneous consumers, differentiated products with attributes such as environmentally friendly, hormone-free, produced on a family farm, free range, and a variety of other niche products, fill supermarket shelves. There has been a shift toward more convenience in food preparation and more consumers are choosing to eat away from home or purchase foods already partially prepared. Fast food industries throughout the Caribbean have expanded to cater to these changing food preferences and provide the convenience demanded by local consumers.

Livestock industries in the Caribbean

A national commitment to stimulate the development of different livestock sub-sectors has been lacking in most Caribbean countries resulting in inadequate producer organisations, limited access of (small-scale) farmers to markets and credit, high-risk technologies, under-developed infrastructure, low and fluctuating producer returns, and weak marketing organisations.

The Caribbean **dairy industry** is plagued by rising input costs and high levels of inefficiencies. Local production of dairy products generally falls short of domestic demand for fresh milk and processed products, with the shortfall met through imports of milk powder for processing. The prevailing view is that there are still good prospects for local, fresh milk production if efficient, vertically integrated operations can be established, targeting key market components. Wider self-sufficiency in dairy product manufacturing based on locally produced fresh milk supplies is, however, seen as largely impractical in most Caribbean dairy-producing economies.

The **small ruminant** industry is ideally suited for intensification and development. Sheep and goats are well-suited to the wide range of agroecological conditions in the Caribbean region. They are able to convert low-quality forages into high-quality products, are small in size, use minimal land space, and require low capital investment per head, making them ideal livestock for resource-poor Caribbean farmers. Expansion of the production of milk and cheese from small ruminants is due to growing recognition of the numerous health and nutritional benefits of these goods, including goat cheeses as well as sheep and goat milk soaps, which occupy a lucrative niche in the specialty cosmetics market.

There are many constraints to the development of smallholder **poultry** production in the Caribbean–disease control, protection against various predators, better feeding, genetic improvements, marketing, training and management, access to production inputs, infrastructure and capital, farmer organisation, and conducive institutions and governmental policies. Many growers cannot compete against cheap meat imports, which are often dumped into the Caribbean. While this provides a source of cheap protein to urban consumers, it detracts from private investment. To protect local food production, many countries levy tariffs on imported poultry meat. According to the World Trade Organization (2017), poultry imports (whole birds and certain cuts) are subject to some of Jamaica's highest duties of up to 80 percent.

The major restraints to efficient smallholder **pork** production in Caribbean countries are that many smallholder growers lack the basic pig husbandry skills to sustain a viable enterprise. Most Caribbean countries have stabilised their pork production at constant levels, with shortfalls offset by imports. Although pork imports are a small percentage of the total volume of meat imported each year in most Caribbean countries, the cost of pork imports are significant due to the higher cost of meat per unit of weight, particularly when compared to the other intensively produced animals.

Beef cattle herds in most Caribbean countries have decreased following market liberalisation across the agricultural sector and annual beef import levels are consistent. Local beef producers have difficulty responding quickly to local market price signals in order to exploit opportunities. The fast food trade, which is highly conscious of costs, has also become dependent on cheaper imported beef cuts compared to local produce.

Despite the rapid growth in demand for poultry, smallholders in Caribbean countries can be expected to rely on ruminants as their primary livestock assets because they use locally available, low-quality feeds more efficiently, and they provide a wider range of products, particularly draught and manure, which are crucial to the overall farming system. In meat production, smallholders can compete effectively with larger commercial enterprises only to the extent that they have access to low-cost farm resources, especially feed and labour, which cannot economically be sold off-site.

Development Assistance

The challenge for development assistance programmes is to maintain a focus on smallholder producers, while managing an increasingly complex group of actors and facilitating behaviour change within institutions and on farms – different subsectors (poultry, goats, cattle, etc.), commodities (meat, milk, eggs, fibre, etc.), systems (e.g. agropastoralism, mixed crop-livestock farming and pastoralism), and institutional arrangements (pasture access, use and management, veterinary service provision, etc.). Lessons learned are as follows: livestock ownership forms part of rural livelihood strategies, which usually are a series of trade-offs given the many problems faced by smallholders; livestock play multiple roles in providing livelihoods; outcomes and impacts are relatively long term; and women are significant contributors and should benefit from activities.

Constraints

Rates of genetic change have increased in most species in developed countries. This is because of more efficient statistical methods for estimating genetic merit, the wider use of technologies (including artificial insemination and embryo transfer), and more focused selection on objective traits, such as milk yield. These are mostly impracticable in most parts of the Caribbean.

There are considerable opportunities to increase productivity in Caribbean countries. Most animals in the Caribbean are nutrition constrained as the scarcity and poor quality of forages used as energy sources in the dry seasons constrains productivity. The main limiting nutrient in animal feeds is protein, and additives need to be imported and are expensive. Veterinary services and quarantine control systems in most Caribbean countries are inadequate, and in some countries, almost non-existent. There is also little research cooperation across the region or with institutions in developed countries for identifying and controlling animal diseases. Well-equipped veterinary laboratories, which are suitably staffed and able to provide rapid confirmatory diagnosis or cutting edge research, are needed in order to improve animal health and quarantine services.

The mixed crop-livestock systems dominant in Caribbean livestock production systems will continue to be critical to future food security due to increasing competition for land, driven by continued concerns about climate change, energy security, urban expansion and alternative income sources for smallholder farming households. Competition for water is expected to grow as a result of changing

patterns of livestock production and the demand for fodder. Methane mitigation strategies in ruminant-livestock systems need to address the key trade-offs among emissions, livestock production and livestock numbers. In a carbon-constrained future, livestock growers will need to adapt a variety of climate change mitigation and adaptation practices in order to continue their livestock production livelihoods. For different locations, the impacts of a wider array of diet combinations using local feed resources need to be tested – such as crop by-products, legumes and agroforestry practices, improved grasses and forages. Holistic research into strategies and technologies is required for the management and treatment of manures and other animal processing by-products, which can ensure the sustainable use of nutrients and mitigation of environmental impacts, including odour and emissions of nitrates and GHG, and the spread of diseases.

Many factors contribute to potential food safety hazards: improper agricultural practices; poor hygiene at all stages of the food chain; lack of preventive controls in food processing and preparation operations; misuse of chemicals; contaminated raw materials, ingredients and water; and inadequate or improper storage. The safety of meat calls for control throughout the food chain, from the farm of origin, and inspection before and after slaughter, to the handling and storage of meat and processed products until the time the meat is consumed. The responsibility for the production of safe and wholesome meat is shared by the livestock industry and the government controlling authority in each Caribbean country. Food safety and quality control are becoming more prevalent and onerous for Caribbean livestock growers, and local safety standards based on export standards need to be developed for each key livestock industry in each Caribbean country.

In the Caribbean region, where agriculture and food production are the mainstays of rural livelihoods and food security, tariffs are seen as critical to stability and further development. Promoters of livelihood interventions with access to credit activities for smallholder farmers should be aware that the focus has shifted from nurturing subsidised, government-run institutions with cheap credit to developing institutional capacity and improving performance for a broader range of rural financial institutions.

Recommendations

The multiple functions of livestock underline the need for a systems approach in the elaboration of sustainable livestock development. The systems approach recognises that a modification in one function affects other functions, emphasising the analysis of the whole farm in its socio-economic context, and participation of the farmers in the research and development process. The challenge is to arrive at sustainable increases in production while avoiding environmental degradation. External inputs are indispensable, but need to be used more efficiently. Therefore, any recommendations for the development of improved livestock production need to be long term and include aspects of feeding, health and hygiene, housing and breeding for smallholder producers:

- Establish national livestock identification, traceability, animal health certification systems.
- Develop national long-term investment strategies for each selected livestock sub-sector.
- Strengthen quarantine capacity for early detection of potential pests and diseases.
- Develop a more attractive business enabling environment.
- Support local livestock research capacity.
- Promote the growing of small ruminants.
- Improve local feed and fodder conservation practices.
- Improve herd and flock quality by supplying high genetic merit breeding stock.
- Upgrade the capacity of local veterinary services, particularly in more remote areas.
- Establish adaptation and mitigation strategies to changing weather patterns.

1. Introduction

People's food preferences are changing with growing populations, rising incomes, and increasing urbanisation. The demand for livestock products is the fastest growing agricultural market, especially for the products in which smallholders can be competitive. This increased demand will need to be met by expansion and intensification in poultry and pig production systems, and increases in sustainable ruminant production, within the available natural resource base. This offers opportunities for small-scale livestock keepers to earn extra returns from increased productivity and better marketing of their produce. However, the appropriate utilisation or expansion of existing sources of meat calls for the coherent development of a complex system of production, processing and marketing, including aspects of finance and expertise for construction and operation of meat plants, storage, meat preservation, transport and marketing.

Livestock play an integral part in rural life including in Caribbean countries. An estimated 65 percent of the global rural population participates in livestock-related activities (Biasca, 2012). Livestock are of economic importance, contributing between 14 and 30 percent of agricultural GDP: they contribute to nutritional security through the provision of meat, milk and eggs; and they provide important farm inputs, such as draught power and manure to sustain crop production for food and feed. Animals also serve as investment sinks and sources of cash income in times of need; they are providers of transport for goods and services, and are central to many sociocultural events and ceremonies. However, productivity is lower than other regions, such as in neighbouring Latin American countries, although local production is estimated to satisfy most of the local demand for meat and dairy produce, except on Small Island States (SIS) of the Caribbean. The deficit is made up by imports, which could be reduced, and additional income earned, by improving local production and marketing systems.

2. Human Nutrition

Many diets in Caribbean countries are based on cereals or root crops and are relatively bulky, especially where fats are in short supply, and this can limit the total energy intake. This is especially true of infants after weaning and young children. Meat can complement most diets, especially those dependent on a limited selection of plant foods, and can compensate for nutritional deficiencies in plant staple diets. As shown in Table 1, foods of animal origin are rich in energy, protein, calcium, iron, zinc, vitamin B-12, riboflavin, vitamin A and conjugated linoleic acids (CLA). These nutrients are an essential part of a healthy diet and, in some cases, foods of animal origin are the only sources of these nutrients. Diets in most of the developing world, including some locations in the Caribbean, are deficient in several of these nutrients, especially the micronutrients (calcium, iron, zinc, vitamin B-12, riboflavin, vitamin A and CLA), mostly because diets have limited amounts of foods of animal origin. As a result, there is malnutrition in these areas reflected by stunted growth, impaired cognitive function, susceptibility to disease and high mortality rates, especially in women and children.

The effects of malnutrition are not only limited to individuals, they can negatively affect communities and nations through lowered productivity, thus perpetuating the poverty cycle. While micronutrients

can be produced industrially and made available as supplements, the effectiveness of this route is limited compared to consumption of foods of animal origin that provide multiple micronutrients simultaneously and are tasty. It is important to increase the production of foods of animal origin at the household level and link this production to the nutrition and health of mothers and children. Conversely, excessive consumption of foods of animal origin have been linked to cardiovascular diseases, type 2 diabetes, cancer and obesity.

Table 1. Approximate nutritional value of some animal source foods per 100 grams

Food	Energy (KJ)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Zinc (mg)	Vit. A (RE*)[a]	Vit. B-12 (µg)
Milk (cow)	301	3.3	4.0	76	0.04	0.31	28	0.29
Milk (goat)	289	2.9	3.0	90	0.04	0.24	46	0.05
Beef	1 101	18.5	20.0	7	3.2	6.0	0	2.4
Chicken	674	31.0	6.0	13	1.3	1.8	42	0.2
Goat	1 126	13.4	3.4	17	3.7	0	0	1.2
Offal	599	11.2	10.6	0	2.1	0	0	0
Eggs	628	12.1	10.0	50	1.54	1.1	192	1.0
Daily Req.#[b]	6 688	17.3		800	1.86	1.44	400	1.2

Source: Ndlovu (2010).

[a]*Note: * Retinol Equivalent.*
[b]*Note: # Recommended daily intake for 7-year-old, weighing 20 kg.*

The concerns about public health in modern economies where coronary heart disease, obesity, and other "diseases of affluence" are common have led to recommendations to the public to modify their diet, particularly to reduce their intake of fat, especially saturated fatty acids, and consequently, red meat. In some sections of their populations, this has led to a relative increase in the consumption of poultry and fish at the expense of red meat.

3. Livestock Systems in Transition

Historical changes in the demand for livestock products have been largely driven by human population growth, income growth and urbanisation. The production response in different livestock systems has been associated with science and technology as well as increases in animal numbers. In the future, production will increasingly be affected by competition for natural resources, particularly land and water, competition between food and feed, and by the need to operate in a carbon-constrained economy. Developments in breeding, nutrition and animal health will continue to contribute to increasing potential production and further efficiency and genetic gains. Livestock production is likely to be increasingly affected by carbon constraints and environmental and animal welfare legislation. Demand for livestock products in the future could also be moderated by socio-economic factors, such as human health concerns and changing sociocultural values. There is considerable uncertainty as to how these factors will play out in different regions of the world in the coming decades.

A shift towards production of monogastric animals, such as chickens and pigs, which use concentrated feeds more efficiently than cattle or sheep, has occurred in the last two decades. Chickens and pigs also have short life cycles that accelerate genetic improvements. For instance, the average time needed to produce a broiler in the United States of America was cut from 72 days in 1960 to 48 days in 1995, to 35 days now, and the slaughter weight rose from 1.8 to 2.2 kg. Meanwhile, conversion ratios of feed per kilogram of product were reduced by 15 percent for broilers and by over 30 percent for layers (Smil, 2012).

Determining the most appropriate ways to increase production is critical in intensive systems. Feed accounts for about 50 to 60 percent of total production costs in ruminant feeding systems, and 65 to 80 percent in industrial or intensive systems. Specialised commercial livestock farming systems (poultry, pigs, milk or meat) can only be sustainable if there is adequate marketing, a good price policy, infrastructure, continuous supply of quality feed and concentrates, adequate veterinary services (vaccines, medicines, cost recovery) availability of skilled labour, management and control of pollution. Smallholder farmers are more wary of such large production costs, especially feed costs, than larger growers.

Industrial production systems depend on external inputs, and in the Caribbean, intensive livestock growers are almost totally dependent on imported feed, particularly the concentrates that largely determine the quality of commercial feeds. The intensification and concentration of the livestock industry over the last decades is threatening to crowd out smallholders, and they need support from policies, institutions, and for adopting new technologies. The following factors have become crucial to mitigating the negative and enhancing the positive effects of livestock intensification, and to enhancing sustainability: environmental impact, markets, food safety and institutional arrangements.

3.1 Environmental Impact

Degradation of ecosystem functions, such as nutrient and water cycling, constrains production and may limit the ability of agricultural systems to adapt to climatic and other changes in the Caribbean region. Sustainable agricultural practices are part of the solution to current environmental changes. Examples include improved carbon storage in soil and biomass, reduced emissions of methane gas and nitrous oxide from livestock systems, and decreased use of inorganic fertilisers. Intensive production systems produce less greenhouse gases per kilogram of product than low-production systems, and they may reduce pressure on fragile ecosystems. However, the separation of industrialised livestock production from the land used to produce feed also results in a concentration of waste products, which can put pressure on the nutrient absorptive capacity of the surrounding environment. In contrast, grazing and mixed farming systems tend to be more closed systems, in which waste products of one production activity (manure, crop residues) are used as resources or inputs to the other production activity.

However, advocates against such a 'manage the damage' approach to future livestock development argue that with its industrialised vision of environmental sustainability, more intensive livestock development is problematic for diverse reasons, including for its: (1) impacts on animal welfare; (2) concentrated corporate power structures; (3) use of large amounts of human-edible feed; (4) failure to take account of poor people and their production systems; and (5) a general unease with the 'unnaturalness' of these production systems. Additionally, recent outbreaks of pandemics, such as swine fever, avian influenza and foot-and-mouth disease have focused consumer attention on the negative side effects of intensive livestock production. The widespread abuse of antibiotics in promoting livestock production has led to antibiotic resistance that has caused human health concerns.

The long-term environmental impact of livestock production in the Caribbean region is difficult to predict. With a predominance of mixed cropping-livestock production systems, animals may be reared on a farm that grows various crops and produces different animal types; or a farmer may specialise in one species only and source feed from neighbouring farms. But even if the farm itself is mixed, the animals probably consume feed inputs sourced from distant regions. Rarely will the farm operate an entirely closed nutrient loop: feeds or fertilisers will have been produced elsewhere, potentially causing nutrient deficits in one area and surpluses in another. Knowing these details is essential in order to draw informed conclusions on the environmental impacts of the various livestock production systems in the Caribbean.

3.2 Markets

Trade and food security are linked in Caribbean countries through the importance of exports and imports to their economies. Export-oriented economic activity is a major source of foreign exchange and employment-based income-earning opportunities (linked to both the supply and accessibility dimensions of food security). Conversely, imports are equally critical to nutritional and stability dimensions of food security, as most Caribbean countries are net food importers. Further, much of the production for national, regional and international trade is dependent on imported inputs, thereby underlining the dynamic synergies between imports, exports and food security.

Liberalised markets have meant that livestock producers and other industry actors have been increasingly able to respond to consumer demands. Most food is being consumed locally and, with higher energy prices, local consumption will be preferred wherever possible. Consequently, increased livestock product demand can offer opportunities for smallholders in the Caribbean because livestock production is among the few commodities that smallholder farmers produce widely that can return decent incomes. High transportation costs in the Caribbean, stricter animal welfare, and environmental regulations in the industrial world support efforts to increase local production. However, many smallholders have been forced to exit livestock farming, mainly because they cannot compete against larger operations that benefit from both technical and allocative economies of scale embodied in the genetic improvement of animals and feeds or improved organisation. This is especially true for poultry and pig industries, where profitable adoption requires large farm sizes and their production and marketing are increasingly linked to major retail chains.

Table 2. Main livestock product imports

(USD million)	Meat						Dairy Products	Eggs
	Bovine	Sheep Goats	Poultry	Pork	Offal	Total		
Grenada	1.03	0.06	9.66	0.71	0.96	12.42	8.57	
Guyana	0.20	0.08	0.15	0.16	0.20	0.79	34.44	9.16
Haiti	0.48	0.07	40.77	3.78	4.50	49.60	55.10	1.53
Jamaica	16.92	9.71	20.58	3.14	11.77	62.12	41.99	0.08

Source: COMSTAT (2017).

There is also a need to streamline and reinforce legitimate anti-dumping measures. For example, many smallholder broiler growers in the Caribbean cannot compete against imported chicken meat rejected by supermarket companies of the United States, which is the cheapest meat available in many Caribbean markets and popular with local consumers. This supply of cheap meat hinders private investment in local broiler production, and smallholders increasingly concentrate on egg

production instead. Proven policy interventions that benefit smallholders include expanding access to microfinance, keeping inflation rates low, identifying reliable banks, financing value chains, developing local markets, supporting farmer associations and cooperatives, and supporting fair trade and product diversification. Larger Caribbean countries protect their poultry industries, which they perceive as essential to national food security, employment and rural welfare. For example, Jamaica imposes an 80 percent tariff on imported chicken meat, but it still remains one of the country's largest imported food items (WTO, 2017).

3.3 Food Quality and Safety

Food quality and safety[1] is emerging as the most prominent source of conflict in markets. Caribbean countries need to upgrade their food quality control capacities if they want to increase their access to higher value local and regional markets, such as restaurants and hotels serving the tourism industry. Fears of increased intensification of livestock production systems leading to the emergence of new diseases create adverse repercussions for local industries. For instance, the re-emergence of classical swine fever and foot-and-mouth disease has led to the massive destruction of animals; these disease outbreaks are directly related to animal densities, which increased the effects of infection. Emphasis should be on good sanitary practices, standards and compliance with health and food safety obligations.

Rapid urbanisation and rising incomes increase concerns for food safety that are likely to pose new constraints on smallholder participation and their ability to compete in modern markets. There are food safety issues at all stages of the livestock value chains. Developing a credible and transparent food safety system is especially critical in animal products where quality and safety attributes are not usually visual. The government's role in managing food safety is important; however, agencies involved in this task in the Caribbean region are not well coordinated and cooperation is weak. Food Safety Laws are not effectively implemented due to weak coordination among responsible agencies, as well as a lack of capacity for risk assessment in institutions tasked to perform these functions.

The foremost responsibility of Caribbean government agencies responsible for food control systems is to enforce food law(s) protecting the consumer against unsafe, impure and fraudulently presented food. This is achieved by prohibiting the sale of food not of the nature, substance or quality demanded by the purchaser. Confidence in the safety and integrity of the food supply is an important requirement for consumers. Food-borne disease outbreaks[2] in meat and meat products involving agents, such as *Escherichia coli, Salmonella* and chemical contaminants, highlight problems with food safety and increase public anxiety that modern farming systems, food processing and marketing do not provide adequate safeguards for public health. Factors contributing to potential hazards in foods include improper agricultural practices; poor hygiene at all stages of the food chain; lack of preventive controls in food processing and preparation operations; misuse of chemicals; contaminated raw materials, ingredients and water; inadequate or improper storage. Specific concerns about food hazards have usually focused on:

1 Food safety refers to all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer. Quality includes all other attributes that influence a product's value to the consumer. This includes negative attributes, such as spoilage, contamination with filth, discoloration, and off-odours; and positive attributes, such as the origin, colour, flavour, texture and processing method of the food.

2 The Caribbean Public Health Agency detected through regional surveillance among English-speaking Caribbean countries a 26 percent increase in the number of cases of reported human food-borne disease during 2005–2014 (Guerra, de Almeida and Willingham, 2016).

- microbiological hazards;
- pesticide residues;
- misuse of food additives;
- chemical contaminants, including biological toxins;
- adulteration;
- genetically modified organisms;
- allergens;
- veterinary drug residues; and
- growth promoting hormones used in the production of animal products.

Control measures for zoonotic diseases requires rapid identification and communication of disease outbreaks, financial compensation, and training and strengthening of coordination between veterinary and public health infrastructure. Identifying and responding effectively to emerging infectious diseases also requires enhancing epidemiologic and laboratory capacity and providing training opportunities to relevant staff. Focusing on interventions at a single point along the food chain may not provide the most efficient and effective control.

Caribbean countries should aim to develop a food control system that enforces mandatory requirements, along with training and education, community outreach programmes and promotion of voluntary compliance. The introduction of preventive approaches, such as the Hazard Analysis Critical Control Point system (HACCP), have resulted in industry taking greater responsibility and control of food safety risks, but the presence of HACCP across the Caribbean region is patchy. Such an integrated food safety approach facilitates improved consumer protection, effectively stimulates agriculture and the food processing industry, and promotes domestic and international food trade.

3.4 Institutional Arrangements

To ensure that technology supports livestock development and sustainability goals, the Caribbean livestock industry needs policy guidance and stronger institutional arrangements to balance private and communal rights with regard to knowledge and resources. Individual small farmers can improve their well-being when they are members of strong farmer associations and cooperatives that successfully operate in livestock value chains. These institutional needs are important for a future of relatively small but productive and sustainable farms in the Caribbean livestock industry.

Farmer collective action for the marketing and processing of farm products and/or for the purchase and production of farm inputs are primary reasons for forming collaborations. They aim to increase members' production and incomes by helping to better link them with finance, agricultural inputs, information, and output markets. Specialisation may be in production, service provision, or marketing, or offer all or some combination of support within the various stages. Farmer groups and cooperatives create social linkages that enable individuals to achieve goals that they may not otherwise be able to achieve by themselves. For example, producer collaboration around a common product of interest can help farmers benefit from economies of scale to lower their costs of acquiring inputs or hiring services, such as storage and transport. Producer groups and cooperatives also enable farmers to improve product and service quality and reduce risks. They may also empower their members economically and socially by involving them in decision-making processes that create additional rural employment opportunities, or enable them to become more resilient to economic and environmental shocks.

The ability of producer groups or cooperatives to improve the welfare of smallholder farmers in the Caribbean is mixed and contextual. Some groups and cooperatives have not performed well as the result of poor governance structures, multiple and competing goals, but also problems that arise from insufficient trust between members. In some cases, top-down approaches where groups have been established by external agents, rather than farmers themselves, have produced unfavourable results. Elements for successful producer groups and cooperatives include the following: appropriate legal frameworks and governance aligned with national policies; support for business development, business skills and governance capacity; access to markets and trading links, especially for competing in international markets; and the need for improved understanding of the dual nature of producer groups and cooperatives as business and civil society members.

Some Caribbean countries have favourable policy settings to support an institutional environment that allows farmers to (a) market their produce for higher prices, (b) obtain inputs at lower cost, and (c) access information necessary for more rapid and effective decision-making, which is critical to livestock development. Infrastructure is especially important where timely access to inputs is essential and where livestock produce must be marketed quickly. Milk production is such an example and depends on an efficient marketing and distribution system, including milk collection, transport, and processing. The diffusion of new technologies to farmers, such as artificial insemination and forage technologies, has often been achieved through the same systems. In the Caribbean region, government agencies have tried to deliver such services, although private firms and cooperatives, where available, have proven to be more efficient service providers.

3.5 Consumer Preferences

While shifts in livestock product demand are discernible as incomes rise, these consumers with higher levels of income are also consuming higher quality products rather than larger quantities. To satisfy the demands of increasingly well-informed, heterogeneous consumers, differentiated products with attributes such as environmentally friendly, hormone-free, produced on a family farm, free range, and a variety of other labels, fill supermarket shelves. A segment of consumers have been purchasing these products and demonstrating their willingness to pay higher prices for food production process attributes. There has been a shift toward more convenience in food preparation due to more women in the workforce compared to about 20 years ago. Thus, with more households having two working adults, less time is spent preparing meals. More consumers are choosing to eat away from home or purchase foods already partially prepared. Fast food industries throughout the Caribbean region have expanded to cater to these changing food preferences and provide the convenience demanded by local consumers.

The potential for smallholders in the Caribbean to engage in such value chains depends largely on the specific context of the market, product and place in question. Smallholders are efficient producers in informal, low-input/low-output settings by virtue of being able to leverage household labour and low-cost inputs in production. An increasing number of consumers demand informal sector products that are produced with low levels of inputs, such as energy and chemicals, and support local communities through increased incomes and job creation. The ability of smallholders to engage in such higher-value market opportunities will be dependent on the organisational model they adopt to exploit such opportunities.

4. Livestock Industries in the Caribbean

One of the main challenges facing livestock sector development across the Caribbean region has been the weak policies (that have not always been based on relevance and context of the country and its systems), and inadequate implementation of these policies. Most Caribbean governments have an urban bias and preference for short-term benefits, such as consumer access to 'cheap food' that usually needs to be imported. A commitment to stimulate development of the rural livestock sector has been lacking, resulting in inadequate producer organisations, limited access of (small-scale) farmers to markets and credit, high-risk technologies, under-developed infrastructure, low and fluctuating producer returns, and weak marketing organisations.

A number of issues that pose significant constraints for smallholder growers and the development of well-functioning livestock value chains in the Caribbean can be identified – breed, animal health, feed prices, market and output prices, food safety, waste, and environmental pollution. Domestic feed manufacturers and feed markets are dependent on imported feed ingredients, such as maize, soybean meal, and pre-mixes, which create volatility in feed markets and expose farmers to market risks. Thus, livestock feed prices are much higher in the Caribbean compared to other countries in the region. Expensive feed has led to expensive domestic commercial livestock production that compromises Caribbean countries' competitiveness in international markets and opens the door to cheaper meat and animal product imports. Research and development on feed technologies that will enable cost-effective feed rations mainly based on readily available local feedstuffs would enhance feed-cost efficiency across all types and scale of livestock production.

4.1 Dairy

The main dairy producers in the Caribbean region are Barbados, Guyana, Haiti, Jamaica, and Trinidad and Tobago. Caribbean countries traditionally hosted dairy industries that were pivotal to the supply of fresh milk to domestic markets, and the region's dairy industry is still dominated by a large number of small-scale producers using a mix of hand and machines for milking. Feeding systems also vary, and usually include a mixture of pasture or concentrate, and cut-and-carry systems. The Caribbean dairy industry is dominated by fresh milk production, with a range of dairy by-products, including milk drinks and yoghurt. Local production of dairy products generally falls short of domestic demand for fresh milk and processed products, with the shortfall met through imports of milk powder for processing, although imports of liquid product are increasingly common, including ultra-heat treated (UHT) and other milk drinks. Caribbean dairy processors complain that many consumers now prefer to purchase imported powdered milk rather than local fresh and UHT milk, due to perceived food quality and price considerations.[3]

Milk imports have been growing steadily in all Caribbean countries, aided in large measure by government policies to enhance access to 'cheap foods'. Notwithstanding high production costs and operational efficiency considerations, trade liberalisation is widely blamed by Caribbean milk producers for the contraction of domestic dairy industries in Caribbean countries. In Trinidad and Tobago, for example, milk production fell from 65 percent of total consumption to about 20 percent

3 Based on discussions with Richard Pandhoie, Chief Executive Officer of Seprod, Jamaica, on 23 August 2018.

between 2009 and 2016. This contraction is indicative of a general trend across the major Caribbean dairy-producing countries.

Table 3. Caribbean milk production trends

	Milk Production (tonnes)					
	1990	1995	2000	2005	2010	2016
Antigua and Barbuda	5 538	6 000	6 547	7 040	2 898	2 581
Barbados	14 199	7 869	7 930	6 256	6 701	4 549
Belize	1 240	1 318	1 397	3 786	3 325	5 471
Dominica	6 450	6 100	6 661	6 674	7 500	6 951
Grenada	490	520	520	520	550	559
Guyana	18 820	13 000	24 676	22 332	22 828	56 000
Haiti	40 000	38 000	41 250	44 750	48 132	49 425
Jamaica	51 500	28 090	26 248	14 574	12 489	12 191
Montserrat	2 175	3 858	3 866	3 873	3 487	3 998
Saint Lucia	1 050	1 150	800	1 004	1 037	1 031
Saint Vincent and the Grenadines	1 340	1 360	1 370	1 100	1 263	1 046
Trinidad and Tobago	11 147	9 175	10 477	7 849	4 316	2 324
Total	**154 617**	**119 150**	**132 355**	**120 508**	**115 246**	**146 798**

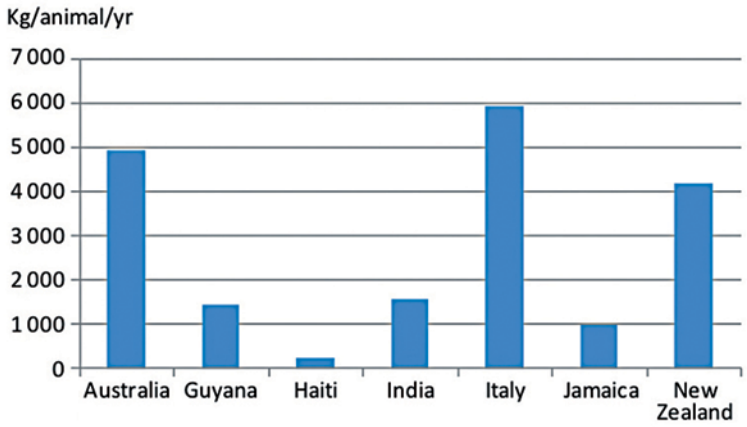
Source: FAOSTAT.

Following trade liberalisation in 1992, all Caribbean countries experienced major declines in their local milk production. For example, between 2000 and 2002, Jamaican production of liquid milk fell by 35 percent, from 27.5 million litres in 1999 to 20.5 million litres in 2002, and a further 22 percent by 2016 to 12.1 million litres. Caribbean countries receive preferential trade status, and many countries apply flexible tariffs on their milk imports (e.g. Jamaica: up to 75 percent [Shik *et al.*, 2017]; Barbados: 0-141 percent [Shik *et al.*, 2019]), as they perceive local fresh milk production as an essential industry to their national food security requirements. However, these trade policies have failed to stop the decline in local dairying. In Barbados, for example, milk production halved between 1991 and 2012, by which time only one dairy processor remained in business. Guyana, however, has reversed this trend; since 2004 when local production accounted for less than 5 percent of the domestic market, demand for products made from fresh milk has been increasing, driving an expansion in the dairy industry and an increase in the number of value-added dairy products from a number of small-scale pasteurisation plants (FAOSTAT, 2016; Agritrade, 2012).

Despite the efforts of dairy farmers, local processors and governments, the dairy industry in Caribbean countries, particularly local fresh milk production, is characterised by dwindling profits, shrinking markets, no incentives and a lack of clear rules for the management of milk powder imports, which account for roughly one-third of total dairy imports, with a long-term trend towards increased milk powder imports. However, imports have been highly variable over the past decade, with sharp dips in imports linked to high global prices. These trends consequently impact the demand for local fresh milk supplies by the larger milk processing companies in each Caribbean dairy-producing country.

The regional dairy sector continues to be plagued by rising input costs and high levels of inefficiencies, even though the prevailing view is that there are still good prospects for local fresh milk production if efficient, vertically integrated operations can be established, targeting key market components. Wider self-sufficiency in dairy product manufacturing based on locally produced fresh milk supplies is, however, seen as largely impractical in most Caribbean dairy-producing economies.

Figure 1. Productivity of select national dairy industries.



Source: FAOSTAT (2016).

A more limited dairy economy that stabilises and maintains domestic fresh milk production requires the right mix of domestic and trade policy measures, supported by technological innovation, clear marketing and sector development strategies. At the interface of technology and public-sector interventions, this will need to address such agro-economic issues as land utilisation, improving pasture management, and strengthening the genetic basis of the dairy herd to improve yields. Praedial larceny serves as an impediment to dairy production upgrades and further investment in the industry. Many farmers are deterred from investing in improved cattle breeds, and consequently, from upgrading machinery, housing, fodder production and conservation, knowing the expense of security or that their investment could disappear. More widely, the problems and issues impacting the industry suggest a need for a review and evaluation of the various industry-led and public policy measures in place to ensure the establishment of the right policy mix at national and regional levels.

4.2 Sheep and Goats

The Background Report to CDB's Agriculture Sector Policy and Strategy recognises small ruminants (sheep and goats) as the most prospective enterprise for smallholder producers in the Caribbean. The small ruminant industry is ideally suited for intensification and development. Sheep and goats are well suited to the wide range of both geophysical and socio-economic conditions commonly encountered in the Caribbean region. They are able to convert low-quality forages and feed into high-quality products; are small in size; use minimal land space and require low capital investment per head, making them ideal livestock for resource-poor Caribbean farmers. The majority of sheep and goats are grown by smallholders within a mixed, integrated crop-livestock farming system. In many instances, small ruminants graze on land that is unsuitable for crop production, and use feed resources that cannot directly be used by humans.

A large percentage of farmers use the 'cut and carry system' where animals are housed, and grass and forages are cut and fed to them indoors or in confined areas. This is supplemented with readily

available by-products, such as crop residues, citrus pulp, molasses and spent brewer's grain. Some farmers also purchase additional commercial grain-based rations that are strategically fed to the animals for maximum effect before breeding, during pregnancy and in the early lactation period. However, the small ruminant industry throughout the Caribbean region is adversely affected by the following:

- a lack of investment in the sector;
- most livestock owners follow low input/low output animal husbandry practices with accompanying low productivity levels;
- an absence of modern breeding methods and programmes leading to a lack of genetic improvement even for local breeds that possess good traits and above average qualities;
- inadequate technical support from government extension and livestock divisions;
- a lack of demand for quality products from local markets;
- unhygienic slaughter facilities with many growers selling meat from their own premises;
- difficulties in accessing adequate land for forages and pastures;
- high costs of supplementary feeds and concentrates that usually need to be imported;
- difficulties in the intra-regional transportation of animals; and
- losses of animals due to praedial larceny and predation by dogs.

In some countries, communities have established small ruminant organisations in order to mobilise resources, raise awareness and help build partnerships and cooperation to create a sustainable sector. These efforts could be bolstered by timely and appropriate policy interventions and investment, but local goat production cannot fulfil demand. In Jamaica, for example, local production accounts for about two-thirds of supply, and in Trinidad and Tobago, only 4 percent (FAOSTAT, 2015). Local goat is also more expensive than imported goat meat. Goats are not grown intensively and smallholders perceive goats as secondary to their main livelihood and useful for providing cash in emergencies or for traditional occasions.

Caribbean countries imported almost the same volume of goat and sheep meat (8 200 tonnes) as they produced (9 500 tonnes) in 2016, mainly due to imports by Barbados, Jamaica, and Trinidad and Tobago. Therefore, development of the small ruminant industry in major growing countries could:

- generate significant reductions in food import expenditures;
- provide potentially more employment in value-adding industries;
- help alleviate obesity-related health diseases, because goat meat contains less total fat, cholesterol and saturated fat per gram than other types of meat;
- develop premium meat products (e.g. Barbados black belly sheep) that could be sold to restaurants, tourist sector businesses and export markets; and
- expand sales of leather products from sheep and goat hides.

Table 4. Comparison of nutritional value of goat meat to other meats (85 g, roasted)

	Calories	Total fat (grams)	Saturated fat (grams)	Protein (grams)
Goat	122	2.58	0.79	23
Beef	245	16.00	6.80	23
Pork	310	24.00	8.70	21
Lamb	235	16.00	7.30	22
Chicken	120	3.50	1.10	21

Source: Kadim and Webb (2012).

Expansion of the production of milk and cheese from small ruminants is due to growing recognition of the numerous health and nutritional benefits of these goods. Anglo-Nubian goats, already present in many Caribbean countries, are good milk producers, eliminating the expense of procuring specialised dairy cow breeds. Goat milk production industries have the potential to generate further value-added products, including goat cheeses, which are in demand as health and gourmet food products. Sheep and goat milk soaps are gaining attention as nutrient-rich, anti-inflammatory soaps that are useful in treating skin conditions and these products could occupy a lucrative niche in the specialty cosmetics market.

4.3 Poultry

Despite the rapid development of commercial poultry systems worldwide, an estimated 80 percent of the global poultry population is found in traditional family-based production systems, which provide up to 90 percent of the total poultry products in many countries (Mack, Hoffmann and Otte, 2005). In developing countries nearly all families at the village level, even the poor and landless, are owners of poultry. Production is feasible at village level, where only low-cost technology is needed to improve production. Minimal investments are required to achieve such change, land ownership is not a constraint, and village production is environmentally friendly. The role of family poultry in food security and the promotion of gender equality in developing countries are well documented. Smallholder farmers generally consider poultry production secondary to other agricultural activities, but it makes an important contribution to supplying local populations with additional income and high-quality protein.

The poultry sector has evolved through three phases: (1) traditional systems, which include family poultry consisting of scavenging birds and backyard production; (2) small-scale semi-commercial systems; and (3) large-scale commercial systems. They differ markedly in investment, type of birds used, husbandry level and inputs, such as feeds.

- The traditional system is the most common type of poultry production in most Caribbean countries.
- The semi-commercial system is characterised by small- to medium-sized flocks (50 to 500 birds) of local, crossbred or "improved" genotype stock, and the purchase of at least part of their feed from commercial sources.
- Large-scale commercial systems have expanded in most Caribbean countries and are responsible for most of the growth in poultry production during the past two decades. Commercial systems are characterised by large, vertically integrated production units and use high-producing modern chicken strains. In these systems, feed is the most important variable cost component, accounting for 65

to 70 percent of production costs (Ravindran, 2013). The high genetic potential of current poultry strains can only be achieved with properly formulated feeds that are protein- and energy-dense.

Table 5. Growth trends in main poultry producing Caribbean countries

	Chicken meat (tonnes)			
	2000	2006	2011	2016
Bahamas	6 721	6 440	6 550	6 460
Barbados	10 420	13 571	14 406	14 897
Belize	8 622	13 553	13 871	18 924
Grenada	706	1 081	710	572
Guyana	11 800	20 700	25 573	32 163
Haiti	7 920	8 010	8 640	8 510
Jamaica	77 244	104 590	101 526	120 129
Trinidad and Tobago	38 792	47 129	64 333	59 703

Source: FAOSTAT.

There are many constraints to the development of smallholder poultry production in the Caribbean region that need to be addressed – disease control, protection against various predators, better feeding, genetic improvements, marketing, training and management, access to production inputs, infrastructure and capital, farmer organisation, and conducive institutions and governmental policies. Poultry production has undergone rapid changes during the past decades due to the introduction of modern intensive production methods, new breeds, improved preventive disease control and bio-security measures. Investment in cyclone-proof housing for poultry is becoming more important as small growers invest their limited financial resources in improved genetics and feed, but are susceptible to natural disasters, which are predicted to become more prevalent among Caribbean countries as climate patterns change.

Table 6. Dependence of the main Caribbean poultry meat importing countries on the USA

(USD million)	2013		2014		2015		2016		2017	
	USA	Total	USA	Total	USA	Total	USA	Total	USA	Total
Bahamas	31.22	36.90	29.23	45.53	28.76	42.34	28.01	36.84		
Barbados	1.53	1.96	2.93	3.43	2.51	2.58	1.89	2.88	2.92	3.34
Haiti	71.01	73.78	71.70	75.94	59.58	65.32	74.66	84.46	33.57	40.77
Jamaica	28.76	31.48	28.69	32.18	26.82	27.84	18.33	20.35	18.52	20.58
Trinidad and Tobago	19.21	20.38	22.58	24.78	21.07	23.46	24.44	26.74	23.32	25.66

Source: COMSTAT.

Poultry growers in many Caribbean countries complain they cannot compete against cheap poultry meat imports, particularly from the United States of America, which is often accused of dumping poultry meat into Caribbean (and other) countries. While this provides a source of cheap protein to urban consumers, it detracts from private investment in the local industry. To prevent outside competition and protect their local food production, many Caribbean countries levy tariffs on imported poultry meat (e.g. Barbados at 184 percent [Shik *et al.*, 2019]).

4.4 Pigs

Pork production in Caribbean countries is typically undertaken in a closed system, with producers operating all breeding, weaning and finishing operations themselves. This is in contrast to producers in more commercial operations where producers often specialise in a single aspect of production, disaggregating the supply chain to an extent. While this system allows for greater specialisation in production, the holistic system employed in the Caribbean has the benefit that piglets enter the finishing barn at cost price, rather than market price, decreasing the cost of production for growers. Production in commercial units utilise specialised housing with advanced climate control features, allowing the producer to optimize growing conditions through the manipulation of temperature and light conditions. The cost of specialised housing is high and precludes most smallholders from such production systems.

The major restraints to efficient smallholder pork production in Caribbean countries are: (1) a lack of cost-effective feeds; (2) the lack of a stable and efficient fresh pork market; (3) a lack of guaranteed supply of quality breeding stock; (4) limited understanding of how to manage reproduction; (5) inadequate knowledge and understanding of pig nutrition, diet formulation and the importance of water in the pig's diet; (6) sub-optimal housing; and (7) poor knowledge of biosecurity, health, and disease control. Developing balanced and cost-effective diets based on readily available (local) feed ingredients would be a major achievement in the pig industries of Caribbean countries. Although informal fresh pork markets already exist, they do not provide a reliable supply of good quality product and lack the necessary infrastructure to support the sale of fresh pork. Many smallholder growers lack the basic pig husbandry skills to sustain a viable enterprise.

Caribbean pig growers operate distinct production systems:

a) Free-range scavenger systems – low care, low-input system where pigs may have access to shelter at night, but are allowed to roam and scavenge for food during the day. Pigs may be fed small amounts of feed, such as cassava or sweet potato, but it is irregular and pigs generally suffer both energy and protein deficiencies. Pigs tend to be a low priority for some households and water is seldom provided on a regular basis. Pigs in this system usually carry large burdens of internal parasites, which reduce their viability and capacity to grow. Free-range pigs also damage crops, may cause soil erosion and are often a source of zoonotic diseases (i.e. diseases that can transfer to humans) such as *Cysticercosis* and *Trichinosis*.

b) In semi-intensive production systems, pigs are confined inside a house with access to an outside pen. Pigs are fed and sleep in pens inside the house with drinking water provided in the outside pens, which keeps inside pens clean and dry. The most important aspect of both semi-intensive and intensive systems is that pigs must be supplied with all their daily feed and water requirements, which can be a viable option for smallholder growers provided they can access sufficient quantities of quality feed every day.

c) Intensive pig production farms may house several hundred to thousands of pigs inside confined spaces. Growers often struggle to maintain production due to difficulties in obtaining a balanced cost-effective diet for their pigs. These production systems require growers to have good husbandry skills regarding nutrition, housing and reproduction.

The comparative advantage of smallholder pig producers is their ability to generate efficiency gains from technology choices. This involves the use of crossbreeds that are locally adapted and can thrive under low-input systems through feeding strategies based on low-cost, locally available feed resources. With demand for fresh, unchilled pork by local consumers, smallholder pig producers can supply local markets as effectively as commercial farms in the absence of a market failure.

Table 7. Pork production trends in Caribbean countries

	Pork Production (tonnes)			
	2000	2006	2011	2016
Antigua and Barbuda	169	180	75	15
Bahamas	310	325	330	353
Barbados	1 922	2 637	2 657	2 664
Belize	841	1 161	1 181	1 687
Dominica	420	420	420	424
Grenada	190	200	250	221
Guyana	350	400	203	252
Haiti	28 000	33 000	33 000	32 667
Jamaica	6 621	7 638	7 110	7 349
Saint Kitts and Nevis	144	132	131	45
Saint Lucia	1 003	1 020	1 368	2 740
Saint Vincent and the Grenadines	570	550	384	386
Trinidad and Tobago	1 693	3 548	3 334	2 343

Source: FAOSTAT.

Most Caribbean countries have stabilised their pork production at constant levels, with shortfalls offset by imports. Although pork imports are a small percentage of the total volume of meat imported each year in most Caribbean countries, the cost of pork imports are significant due to the higher cost of meat per unit of weight, particularly when compared to the other intensively produced animal meat – chicken. Demand for pork follows seasonal trends, and Caribbean governments protect their local industries by restricting the allocation of import licences to try and flatten the seasonal fluctuations. But government agencies do not adequately monitor the local industry (number of pigs or production of pork products) and they will often grant licences for cheaper imported pork supplies onto local markets that coincide with local producers also trying to grow pigs to meet the high seasonal demand periods when prices are higher. Imported pork meat will often exacerbate gluts, causing falling prices and lower incomes for local growers.[4]

4.5 Beef

Despite the rapid growth in demand for poultry, smallholders in Caribbean countries can be expected to rely on ruminants as their primary livestock assets because they use locally available, low-quality feeds more efficiently, and they provide a wider range of products, particularly draught and manure, which are crucial to the overall farming system. In meat production, smallholders can compete effectively with larger commercial enterprises only to the extent that they have access to low-cost farm resources, especially feed and labour, which cannot economically be sold off-site. Such low-cost resources usually result from the integration of cropping and livestock activities. Many smallholders will find it profitable to maintain a small number of other species to utilise the available feed which ruminants do not consume efficiently, to provide diversity to the family diet and to provide assets which can be liquidated in smaller amounts.

4 Based on discussions with representatives from the Ministry of Agriculture and Fisheries, Roseau, Dominica on 22 January 2018.

Beef is a politically-sensitive product and the industry has frequently been subject to interventions. Caribbean governments face a trade-off between higher livestock prices to encourage output and lower prices to benefit consumers. The political strength of urban consumers has usually induced governments to restrict prices. This policy is feasible, provided a country has an export surplus or if the government is willing to subsidise the cost of imports. In both cases, the loss of foreign exchange is costly. Lower prices to consumers usually require lower prices to producers, which lead eventually to lower output. Thus, the effort to assist consumers via lower prices is usually successful only in the short term, and may actually harm consumers in the longer term as local output declines, and consumers need to depend on costly beef imports. Of course, producers lose in both the short and the longer term due to the lower price received.

Table 8. Value of main Caribbean countries' imports of beef and beef products

(USD million)	1995	2000	2005	2010	2016
Antigua and Barbuda	0.96	0.32	2.57	2.10	2.37
Barbados	5.74	5.33	7.24	9.68	13.01
Dominica	0.49	0.48	0.45	0.47	0.53
Grenada	0.66	0.42	0.97	0.82	1.13
Guyana	0	0.22	0.17	0.31	0.51
Haiti	0	0.14	0.76	1.69	1.60
Jamaica	14.67	8.02	20.20	20.42	21.61
Saint Kitts and Nevis	0	0.53	0.75	0.36	0.89
Saint Lucia	3.71	3.10	2.63	3.23	4.19
Saint Vincent and Grenadines	0.28	0.36	1.22	1.31	0.91
Trinidad and Tobago	6.78	11.48	12.85	20.73	33.00
Total	**33.29**	**30.40**	**49.81**	**61.12**	**79.75**

Source: COMSTAT.

Beef cattle herds in most Caribbean countries have decreased following market liberalisation across the agricultural sector, which started in the 1990s and become fully implemented during the 2000s. Beef imports have mostly increased across the region, particularly in continental Caribbean countries with land borders to facilitate live animal trade. Local beef producers have difficulty responding quickly to local market price signals in order to exploit opportunities, due to the lengthy growth periods to market weight for cattle. The fast food trade, which is highly conscious of costs, has also become dependent on cheaper imported beef cuts compared to local produce. Increasing consumer demand for beef from the expanding middle classes in developing countries, such as China, will continue to put upward pressure on international beef prices, and therefore, continue increasing costs for imported beef into Caribbean countries.

5. Focus Countries

5.1 Grenada

Grenada's livestock sub-sector mainly consists of poultry and pig production, small ruminants, and beef cattle. Growers cannot meet local demand for meat and animal products, and as a result, over 90 percent of the meat needs are imported. To try and reduce these levels of imports, the Ministry of Agriculture's focus is to assist livestock farmers to improve production and management practices, particularly ensuring a healthy animal population and the prevention of communicable diseases to humans. Due to the small size of the livestock sector and the few agribusinesses in the country, government agencies are usually at the forefront of driving innovation and changes to existing practices. Various international organizations have assisted with the development of livestock sub-sector initiatives, such as the International Fund for Agricultural Development's (IFAD) support to a local goat breeding programme, and the Food and Agriculture Organization's (FAO) rehabilitation of the Veterinary Diagnostic Laboratory. The ministry is also continuing an artificial insemination programme for cattle aimed at introducing a new breed (Jersey), which is specially bred for high meat and milk production.

Government agencies in Grenada are active players in the livestock industry and one of their targets is to reduce the country's chicken meat import bill by increasing local production. However, in 2016, local production accounted for only 12 percent of the country's consumption – equivalent to 570 tonnes – and a trade imbalance of about USD 8 million (James, 2015). Imported chicken meat is cheaper than the local product, which further deters investments in the industry, but does provide a source of cheap meat to local consumers. The goal for the government strategy is to increase local production by 60 percent, which warrants significant investment in the sector beyond the means of the government. Grenada is self-sufficient in egg production.

The traditional system for rearing small ruminants (sheep and goats) continues to be plagued by praedial larceny, which has become a deterrent to conventional farmers rearing animals with inadequate housing. Government is seeking to encourage new management systems (housing or fencing of animals) to try and overcome these problems. Additionally, these new management systems will also have implications for food security and safety. There is an exigency for land use policy, especially in the case of resort and prime peri-urban areas, traditionally used for livestock production. These areas are increasingly being lost to major hotel and real estate development projects. Stronger land use policies and their strict enforcement for agriculture development must be instituted together with more effective use of government lands for livestock production.

Recently, the Grenada Association of Poultry Producers lobbied the government to lend more support to building capacity in farmer organisations, thereby empowering these groups and as a result, facilitating greater interest and investments in the sub-sector. The association and other poultry stakeholders also promoted the view that government should invest in a Central Processing Unit that would be linked to existing distribution channels, as a means to promote increased production and growth in the poultry sub-sector. Other agricultural industry stakeholders have also recommended the government invest in new project initiatives, such as rainwater harvesting, expansion of the support provided to farmers to improve their on-farm livestock infrastructure (housing facilities and pasture fencing), the development of feedlots and production units on government estates and an increase in sow herds.

5.2 Guyana

Over the past three years, beef production has been flat mainly due to relatively stable prices. There are a number of constraints affecting the growth and expansion of the local beef industry: the absence of an abattoir of international standard and facilities for processing meats to export standards; poor on-farm nutrition of animals; low carcass weight; poor daily weight gain; and the long maturity time taken for animals to reach market weights. The industry produces approximately 2 300 tonnes of beef per year. The slaughter of productive females continues to be a problem, which prompted the Guyana Livestock Development Authority (GLDA) to start buying productive females from abattoirs in order to reduce the number of females slaughtered.

Guyana promoted the cattle industry as a pivotal component of its agricultural diversification programme (to lessen dependence on rice and sugar), but interventions failed to deliver the majority of the key development milestones. The cattle industry was targeted due to the opportunity identified by GLDA to expand beef exports to CARICOM countries. A lack of suitable land allocated for cattle pasture development to encourage cattle farmers to invest into the sector, and insufficient uptake of modern technologies among farmers to improve cattle production were blamed as the main impediments to the success of the strategy.

During the 1980s, Guyana imported Holstein-Zebu cattle from Cuba in an effort to become self-sufficient in milk production. This strategy has been successful; Guyana is almost self-sufficient in fresh milk and milk products, and the industry is dominated by many small- and mid-sized dairy production units. Following trade liberalisation in the 1990s, cheaper milk powder and other milk product imports increased market share. In 2018, the Government of Guyana announced its intention to revitalise the local dairy industry by building a modern milk pasteurising plant and expected to produce cheese, butter, milk and other dairy products. It was seeking funding from IDB to build the facility.

The poultry industry in Guyana records annual increases in production for both meat and eggs, but has not been able to keep up with the increased consumer demands for this staple on local markets. This resulted in increased imports of 32 000 tonnes of processed chicken meat, mainly from the United States of America. Pork production is low compared to local demand, with comparatively high prices for scarce breeding animals. Many local growers blame the few large-scale pig farms for effectively blocking other local producers from the high-value restaurant market. Thus, alternative markets are depressed due to over-supply, which has created difficulty for many growers to get reasonable prices for their pigs.

Small ruminant production also continued to be low due to high retail prices repressing most local demand. Both these meats were not eaten as staples in Guyana, and consumption was influenced by culture, religion and seasonal demand. High prices also served as a disincentive, especially with carcasses having low dressing out percentages. Production output for 2016 was about 100 tonnes, with supermarkets and restaurants paying high prices for quality meat mainly for serving the tourist industry. Sheep and goat meat is considered a niche market in Guyana. Nevertheless, GLDA has a small ruminant breeding programme aimed at trying to boost local production through increasing dressing out percentages and improved carcass quality characteristics. Goats and sheep are grown extensively in Guyana, principally by smallholder farmers. A lack of adequate land for grazing animals, larceny, conflict with crop farmers, and an absence of a relevant legislative agenda to promote development have negatively impacted this sub-sector. Currently, GLDA is trying to promote more intensive production of sheep and goats as a means to improve performance efficiency, lower production costs and increase domestic consumption.

Guyana continues to import significant quantities of chicken, pork, lamb and beef, which costs between USD 100 and 200 million each year. This represents an opportunity for the livestock farming

community, as many industry players believe the imported meats could be easily supplied by local growers. However, the quality of meat on offer from local farmers is inferior to imported meat, and these quality issues need to be addressed before local growers can become more competitive.

The pig and small ruminant industries continue to suffer from the unavailability of quality breeding stocks; high feed costs; unfocused and under-qualified pig and small ruminant development extension officers; a lethargic private sector, as it relates to the advancement of the industry; lack of an abattoir of international standard; an under-developed animal health programme to address health issues specific to the rearing of pigs and small ruminants; and an absence of supportive legislation to enhance the sustained development of these sub-sectors.

5.3 Haiti

Despite its potential, domestic livestock production in Haiti cannot cover the demand for dairy products, eggs, poultry and meat. Each year, Haiti imports more dairy products (about USD 55 million in 2016) and chicken meat (about USD 41 million [FAOSTAT]). Trade liberalisation adopted in the 1990s opened Haiti to cheaper food imports, but liberalisation has also deterred local investment and hinders the development of domestic production. Most smallholder farmers possess some farm animals, usually goats, pigs, chickens and cattle, with few small-scale growers specialising only in livestock. Many farm animals serve as a kind of savings account, and are sold or slaughtered in order to pay for marriage, medical emergencies, schooling, seeds for crops, or ceremonial occasions.

The challenge for livestock development in Haiti is feeding animals sufficient quantities and balanced diets, particularly for pigs and poultry. The availability of grain and fodder from local crop production is insufficient to meet the food needs of animals. Access to food concentrates imported from the neighbouring Dominican Republic or United States of America, is mainly limited by the quantities available on the domestic market and the limited purchasing power of most Haitian farmers. Various development assistance projects implemented through government agencies have aimed to make local livestock more competitive, with initiatives such as taxes collected from imported chicken subsidising the manufacture of animal feeds by domestic mills, but local feed products remain more expensive than imported feeds. Few growers know how to feed their livestock properly, and for the bulk of their feed requirements, they rely on local ingredients, such as crop stubble and harvest by-products.

Livestock diseases remain the main threat to animal and human health and continue to take a toll causing decline in animal numbers. Vaccines need to be imported and annual vaccination programmes are usually inadequate. For intensive animal production, due to disease and inadequate diet, pig and poultry numbers fluctuate from season to season. Diseases that have been controlled in more developed countries, such as Teschen disease in pigs, are widespread throughout Haiti and can cause losses of up to 40 percent among pig herds. The unavailability of a vaccine against this disease poses a threat in Haiti, although strict biosecurity controls on pig farming premises can effectively control the disease (Spickler, 2018). Pig farmers needed to slaughter the entire herd of 1.2 million pigs when African Swine Flu spread throughout the herd in the 1980s. The government's repopulation programme became highly controversial and further impoverished many growers. Importation of modern pig breeds from the United States of America to replace more hardy local breeds proved inappropriate for the Haitian environment and economy (Haggerty, 1989).

Goats are plentiful farm animals in Haiti as they are well adapted to the rugged terrain and sparse vegetation. The Ministry of Agriculture estimates that over half of all local farmers own goats, with more than 1 million goats in the country. After chickens, goats are the most common household animal in rural Haiti, with typically two to three goats per rural household (Schwartz, 2019). Similarly, smallholders own the majority of the country's estimated 1.3 million head of cattle, with about

half of the farmers owning at least one head of cattle (Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural, 2013). In the 1980s, Haiti exported beef to the United States of America, but nowadays all beef is for local consumption. Farmers raise sheep in some areas, but these animals are not particularly well adapted to the country's climate. Chickens are increasingly being grown in sheds in order to meet local demand with increased productivity of improved breeds and feed rations. After the swine-flu epidemic and the subsequent slaughter of pigs, chicken replaced pork as the most widely consumed meat in the Haitian diet (Haggerty, 1989).

In general, underfunding of government livestock agencies in Haiti and a lack of adequate resources has meant diseases, such as classical swine fever and Newcastle disease in chickens, cannot be fully controlled, even though these diseases have been present in Haiti for many decades. Government agencies and the Ministry of Agriculture's overall capability needs to be strengthened through improvements to research (especially adaptive research), extension and livestock development.

5.4 Jamaica

The livestock sector is a major contributor to agricultural GDP and rural employment generation in Jamaica. The main livestock husbandry systems are: (1) *pastoral free-range systems*, characterised by animal mobility (extensive cattle and small ruminant production systems); (2) *sedentary semi-intensive systems* (for ruminants, including dairy, as well as poultry); and (3) *improved systems* (mainly peri-urban, semi-intensive poultry and pig production, ruminant fattening and dairy). The poultry sub-sector is a well-structured and intensive industry and has become the largest livestock industry in Jamaica. Livestock production is the fastest growing sub-sector in agriculture as demand for livestock products has been rising rapidly during the past 10 years as a result of increasing incomes. However, local producers are unable to meet the increasing consumer demand for meat and animal food products and thus, imports fulfil the increasing shortfall.

Livestock plays a significant role in generating rural incomes in Jamaica and is dominated by small-scale farmers growing small ruminants, cows and poultry in extensive free-range or semi-intensive production as part of their mixed-cropping farming systems. For smallholders, livestock is a major source of food and a means to save and provide ready cash. Livestock producers face several constraints when trying to intensify their production to become more competitive and profitable due to: (a) limited knowledge and access to production innovations; (b) weak preventive disease control; (c) scarcity of fodder, particularly during the dry season and a dependence on imported feed concentrates; (d) a lack of farmer organisation prevents smallholders from sharing experiences, learning new husbandry practices, and commanding greater purchasing and bargaining power for production inputs such as animal feed; and (e) the inability to meet food safety standards.

The lack of quality feed and adequate fodder conservation means animals extensively reared usually suffer nutritional stress for certain periods of the year. Disease outbreaks also place the small-scale producer at serious risk, whether from lack of knowledge, lack of access to veterinary services (that are short of equipment, field transport and recurrent operating budgets), and improved production technologies. In addition, the lack of technical and financial resources affects the overall resilience of small-scale livestock producers to external shocks, compared to medium- and large-scale commercial producers. Actors in the livestock sector are not well organised; for instance, producer organisations have little structure or capacity for economic organisation. The genetic potential of animal breeds is not well developed, and artificial insemination services are not widely available.

Goat is the most popular meat among Jamaican consumers, but local producers can supply only two-thirds of demand. Goat and sheep production on a more intensive basis offers attractive opportunities for smallholders, including value-added products, such as goat milk, skin lotions and cheeses. The

dairy industry has been in decline for the past two decades and a single processor producing fresh and UHT milk supplied by local farmers competes against increasing quantities of milk powder imports. The poultry industry is well structured and geared towards intensive broiler production. A few mid-sized companies dominate the industry and control their supply chains to ensure food quality through contracts for both small-sized and industrial-scale growers. Jamaican authorities consider local poultry production to be of national importance with regard to food security, rural employment and socio-economic development, and thus, they are able to impose a flexible tariff of up to 80 percent on imported chicken meat. Pork is seasonally popular and Jamaican pig growers are able to supply most local demand. However, authorities regularly issue extra import licences to cover perceived supply shortfalls, which can often produce an over-supply on local markets and create problems for small-scale growers trying to be profitable.

Local consumer expectations for food safety continue to increase, which places extra burdens on small-scale growers to meet necessary standards. Smallholders usually sell animals to traders supplying small-scale slaughterhouses that usually operate in unhygienic conditions with an absence of proper meat inspections. Meat markets are often supplied by these unofficial and illegal slaughterhouses, with resultant poor-quality meat being sold to local consumers.

6. Development Assistance

In comparison to other agricultural sectors, livestock has received minimal assistance from multilateral and bilateral donor agencies in the Caribbean. For example, IFAD implemented regional projects spanning Latin America and the Caribbean on issues such as climate change, youth employment and transboundary disease control that had elements concerning livestock development. In general, IFAD surmised that investments in the livestock sector had been fragmented, uncoordinated projects funded by various donors that lacked market orientation and focus (health, fodder production, breeding, etc.). Livestock development programmes needed to:

a) have a lifespan of at least 20 years, with phased interventions;

b) be holistic regarding livestock inputs and on-farm production systems; and

c) upgrade the entire livestock commodity value chain.

Such programmes do not work if a "one size fits all" approach is adopted. The challenge for large-scale programmes was to maintain a focus on smallholder producers, while managing an increasingly complex group of actors and facilitating behaviour change within institutions and on farms. Furthermore, livestock interventions were particularly complex, as they entailed different sub-sectors (poultry, goats, cattle, etc.), commodities (meat, milk, eggs, fibre, etc.), systems (e.g. agropastoralism, mixed crop-livestock farming and pastoralism), and institutional arrangements (pasture access, use and management, veterinary service provision, etc.).[5]

5 Antonio Rota, *Smallholder livestock development: Scaling Up Note* (Rome: IFAD, 2015).

Continental Caribbean countries such as Belize have comparative advantages in some livestock production systems, and live animal and meat exports are significant contributions to national economic performance, including employment. Taiwan Province of China invested in government support structures for the livestock industry in Belize, such as an agro-processing unit and a ruminant breeding programme specifically targeted at small-scale growers. The European Union and the Government of Mexico contributed most of the funding for a USD 6 million, three-year project in Belize to establish a bovine brucellosis and tuberculosis-free beef herd. The Belize Animal Health Authority and the Belize Livestock Producers Authority expect to declare their herd disease free by the end of 2018, once they meet the World Organisation for Animal Health standards. A key element was a tagging programme to identify and track all 120 000 cattle in Belize with accompanying regulations legislated in 2017.[6]

Following natural disasters in several Caribbean countries, donors provided emergency funding to help restore rural livelihoods. The livestock sectors in Haiti and Dominica were recent recipients of emergency funding that aimed to restore livestock production systems as quickly as possible, and rehabilitate accompanying infrastructure to be more durable to future weather events. Practical examples and lessons learned from the Centre for Agricultural and Rural Cooperation's livestock development projects across African, Caribbean and Pacific (ACP) countries concluded that consideration of the following principles can help increase the likelihood that livestock development efforts will contribute to improved livelihoods and sustainable natural resource management:

- Livestock ownership forms part of rural people's livelihood strategies, which are usually a series of trade-offs given the many issues and problems faced by smallholder farmers (e.g. increasing food prices, conflict, land and labour constraints, and poor health).
- Livestock play multiple roles in providing livelihoods and the implications of all these contributions should be considered in assessing their benefits, such as enabling savings, providing security, accumulating assets, financing planned expenditures, providing livestock products (meat, milk, eggs, manure, draught power), improving household nutrition, and maintaining social capital.
- The outcomes and impacts of livestock-related interventions are generally long-term compared to those from crops, and often require significant initial investment.
- Livestock production is constrained by institutions, markets and policies, as well as technical issues and requires inter-disciplinary approaches.
- Successful livestock interventions are contingent on broad stakeholder involvement from initial planning to project conclusion, including the involvement of public and private sector actors, local communities, researchers and development practitioners from diverse parts of the economy.
- Women make significant contributions to livestock rearing and should benefit from these inputs.

6 Based on discussions with representatives from the Ministry of Agriculture and Fisheries, Belmopan City, Belize on 30 August 2018.

7. Constraints

The resources necessary for livestock production include water, feed, land, labour, capital and energy. Efficiency of output can be related to any of these resources and so what is perceived as efficiency will differ with the measure and local availability of these resources. There are many factors limiting livestock production in the Caribbean region:

- the direct and indirect effects of climate;
- the genetic merit of available livestock;
- the quality and seasonal availability of food supplies;
- the health of animals both on the farm and in the region;
- production systems;
- institutional framework;
- the level and type of management; and
- the availability of credit, particularly to subsistence-level farms.

The relative importance of each of the above constraints will vary from country to country, but overcoming these constraints will need the input of a number of specialists, such as animal physiologists, breeders, nutritionists, forage/range agronomists, veterinarians, sociologists and economists. This list is not exhaustive but provides an indication of the many different disciplines involved in livestock production and the necessary capacities and skills required for further development.

Livestock are reared under a wide range of production systems in Caribbean countries, which discounts a uniform approach to improving productivity. Confined livestock production systems are the source of much of the world's poultry and pig meat production, and such systems are well established in Caribbean countries (both intensive and semi-intensive systems) to meet increasing demand. Increases in livestock production will likely result from expansion in livestock numbers, particularly ruminants, more than in carcass weight improvements. Ruminant grazing intensity is projected to increase, resulting in considerable intensification of livestock production in the Caribbean. Subsequently, growing scarcities of water and land will require substantially increased resource use efficiencies in livestock production to avoid adverse impacts on food security and human well-being goals.

7.1 Biological Constraints

There are many and continuing developments in countries with advanced livestock sectors that increase productivity of animals, ranging from the artificial insemination of animals with synchronised oestrus and embryo transfer to recombinant DNA technology intended to improve growth and feed conversion. Most of these technologies are, however, impracticable in most parts of the Caribbean; instead, there would seem to be considerable potential in making better use of indigenous animals and more immediate gains from on-farm productivity, better handling before and during slaughter, and from closer control of processing.

7.1.1 Genetics

Rates of genetic change have increased in recent decades in most species in developed countries for several reasons, including more efficient statistical methods for estimating the genetic merit of animals, the wider use of technologies such as artificial insemination and embryo transfer, and more focused selection on objective traits such as milk yield. The greatest gains have been made in poultry and pigs, with smaller gains in dairy cattle, particularly in developed countries and in the more industrialized production systems of some developing countries. There are considerable opportunities to increase productivity in Caribbean countries, which was described in the Background Paper for the CDB Agriculture Sector Policy and Strategy. Within-breed selection has not been widely practised, in part because of the lack of appropriate infrastructure needed (such as performance recording and genetic evaluation schemes). Breed substitution or crossing can result in rapid improvements in productivity, but new breeds and crosses need to be appropriate for the Caribbean environment and to fit within production systems that may be characterised by limited resources and other constraints.

Indigenous breeds in the Caribbean, including minority species, need to be preserved for their genetic variation specific to their environment. Their contribution to present and future resource utilisation may be highly significant and important to sustainable development. But this resource is being eroded, which can be linked to the limited human and technological capacity and enabling policies to manage genetic resources across the Caribbean region. The paradox is that while there is an urgent need for the conservation of the indigenous breeds, higher demands for animal products will probably justify a more rapid breed improvement, through the introduction of exotic pure breeds or cross-breeding. The conservation of animal genetic resources must therefore be part of national breeding plans and should not be an isolated exercise. Breeding systems must be related to the existing or potential feed supplies and management practices of Caribbean livestock production systems. Advances in biotechnology (genomics) can be used to map genetic stock to identify unique traits for improving livestock robustness and productivity. Recent advances in endocrinology and *in vitro* fertilization techniques make it possible to increase the reproductive rates of animals through synchronization and artificial insemination.

7.1.2 Nutrition and Feeding

Most of the livestock, particularly ruminants in mixed farming systems in Caribbean countries, suffer from permanent or seasonal nutritional stress. Poor nutrition is one of the major production constraints in smallholder systems. Much research has been carried out to improve the quality and availability of feed resources, including work on sown forages, forage conservation, the use of multi-purpose trees, fibrous crop residues and strategic supplementation. There are also prospects for using novel feeds from various sources to provide alternative sources of protein and energy, such as plantation crops and various industrial by-products (e.g. grain waste from the brewing industry). The potential of such feeds is largely unknown. Given the prevalence of mixed crop-livestock systems in the Caribbean, closer integration of crops and livestock in such systems could give rise to increased productivity and increased soil fertility.

Fluctuations in feed quality and quantity compromise nutritional quality. The main limiting nutrient in animal feeds is protein and recent developments in optimising the use of legumes, shrubs and trees for feedstock and propagating them in all agro-ecological zones ranging from arid to wet areas would help alleviate this constraint. The scarcity and poor quality of forages used as energy sources in the dry seasons in the Caribbean is an additional constraint. Improvements in microbial genomics and biotechnology have made it possible to increase the areas and feed resources available to ruminant

animals through improvements in utilisation of forages and could become more mainstream in future ruminant production systems driven by carbon-constrained growing environments.

7.1.3 Disease

Control of animal diseases remains a critical factor influencing production, productivity, trade and marketing. This is exacerbated in Caribbean countries, as most of the livestock are reared under traditional subsistence methods. Varying climate, generally characterised by tropical humid climatic conditions, give rise to a multitude of viral, bacterial, fungal, parasitic, nutritional and management related diseases. Foot-and-mouth disease, bovine brucellosis and tuberculosis are serious livestock diseases of economic importance. Other diseases such as trypanosomiasis also pose a significant threat to livestock. They can spread quickly across borders, hence they are classified as Trans-boundary Animal Diseases and can decimate livestock populations, livelihoods and economies in entire regions. Control is usually difficult and expensive, requiring costly vaccines or eradication programmes, highly trained technicians, technical capacity and access to adequate funding, especially in emergencies.

The last few decades have seen a general reduction in the burden of livestock diseases, as a result of more effective drugs and vaccines and improvements in diagnostic technologies and services. The current global scenario regarding livestock diseases is focused on re-emerging and new diseases, such as bovine spongiform encephalopathy (mad cow disease), and highly pathogenic avian influenza (bird flu). Both diseases pose a threat not only to livestock trade, but also to humans because they are zoonotic in nature and can cross the species barrier from livestock to infect humans. Caribbean countries are favoured tourist destinations and because of limited technical capability at borders, are vulnerable in this respect. Travel, migration and trade will all continue to promote the spread of infections into new populations. Globally, the direct impacts of livestock diseases are decreasing, but the total impacts may actually be increasing, because in a globalised and inter-connected world, the effects of disease extend beyond animal sickness and mortality.

In the extensive livestock production systems of the Caribbean region, infectious diseases are a critical constraint that relies on public sector vaccination and disease control programmes. As production becomes more intensified, production-related diseases, such as pneumonia and mastitis, become more important and animal health programmes are best provided through private sector means linked to other inputs, such as veterinary care and fodder supplies. Improvements in organising production and marketing in value chains can allow for differentiated response to quality standards based on risk.

The intensification of poultry and pig industries, often in proximity to areas of increasingly dense human populations, in conjunction with the increasing ease of transport, has led to production environments in which the spread and impact of formerly uncommon diseases, such as avian influenza, is greatly increased and, which promote the emergence of new diseases. These factors either place animals in increased contact with previously unfamiliar disease agents or their natural host, and favour increased dissemination. Over the long term, future disease trends could be modified by climate change. For some vector-borne diseases such as malaria, trypanosomiasis and blue-tongue, climate change may shift the geographical areas where the climate is suitable for the vector. These developments challenge the traditional disease control methods and indicate that new ways need to be found to prevent or control these emerging diseases.

The veterinary service delivery and control systems in most Caribbean countries, including well-equipped veterinary laboratories, are inadequate and in some countries, almost non-existent. There is also little research cooperation for identifying and controlling animal diseases. Well-equipped

veterinary laboratories, which are suitably staffed and able to provide rapid confirmatory diagnosis or cutting edge research, are needed. Such infrastructure is expensive to maintain, and the efficacy of control systems is compromised as funding for their operations is not always factored into national budgets. Significant government and donor funding is needed to upgrade facilities and re-skill staff to minimize the potential negative impact of new and re-emerging livestock diseases.

7.2 Environment

The interaction of livestock with ecosystems is complex and depends on location and management practices. Most traditional livestock production systems are resource driven in that they make use of locally available resources with limited alternative uses or, expressed in economic terms, low opportunity costs. Examples of such resources include crop residues and extensive grazing land not suitable for cropping or other uses. At the same time, in mixed production systems, traditionally managed livestock often provide valuable inputs to crop production, ensuring a close integration between livestock production and cropping.

7.2.1 Land

There is likely to be minimal increases in land devoted to pasture in Caribbean countries. Some intensification in production is likely to occur on the most suitable land, where this is feasible, through the use of improved pastures and effective management. The mixed crop-livestock systems dominant in Caribbean livestock production systems will continue to be critical to future food security, with necessary responses through efficiency gains and intensification options. Increasing competition for land in the future will also come from biofuels, driven by continued concerns about climate change, energy security, urban expansion and alternative income sources for smallholder farming households. Pasture degradation in all Caribbean countries is generally a consequence of a mismatch between livestock density and the capacity of the pasture to recover from grazing and trampling. Ideally, the land-to-livestock ratio should be continuously adjusted to the conditions of the pasture, especially in dry periods. Pasture degradation causes soil erosion, degradation of vegetation, release of carbon from organic matter deposits, reduction in biodiversity and impaired water cycles.

Pressure on land resources for feed inputs has been mitigated in recent decades by the shift away from ruminants towards pigs and poultry, which have better feed conversion, and high-yielding breeds and improved management practices. Meeting future demand for livestock products will, however, require further improvements in livestock and land productivity as well as expanding feed production areas, most likely at the expense of pastureland and natural habitats.

7.2.2 Water

Increasing livestock numbers in the future will clearly add to the demand for water, particularly in the production of livestock feed. Competition for water is expected to grow as a result of changing patterns of livestock production and the demand for fodder. The fodder-animal protein conversion involves a loss – it takes five times more fodder to produce the equivalent calories for human consumption.[7] The expansion of land for livestock grazing has led to deforestation in many countries. The predominance of extensive livestock production systems in the Caribbean requires animals to expend more effort in search of feed and water and increases the need for water compared with intensive or industrialized systems. However, intensive production has additional water requirements for cooling and cleaning facilities, generally resulting in much higher overall water consumption than

7 FAO, *The state of the world's land and water resources for food and agriculture: Managing systems at risk* (Rome, 2011).

extensive systems. Both intensive and extensive systems contribute to water pollution through waste runoff, although the concentration of livestock associated with intensive systems exacerbates this problem. The processing of livestock products also uses large amounts of water.

Livestock water productivity needs to improve in the Caribbean, such as the increased use of crop residues and by-products, managing the spatial and temporal distribution of livestock feed resources in order to better match availability with demand, and managing systems to conserve water resources. The livestock sector's main use of water is for irrigation of feed crops. The growth of industrial production systems is increasing the need for water for feed-crop production. Rainfed crop-livestock systems prevalent in the Caribbean region can improve productivity through better integration of agriculture and livestock. Fodder productivity may be raised by integrated plant nutrition, better varieties and improved water control, employing supplementary irrigation or water harvesting. Institutional measures to improve research, technology transfer and investment in rural infrastructure are needed to help improve smallholder resilience. More research is needed related to livestock-water interactions and integrated site-specific interventions to ensure that livestock production in the future contributes to the sustainable and productive use of water resources.

7.2.3 Greenhouse Gas Emissions

An estimated 14.5 percent of global GHG emissions are due to livestock production, and about 11 percent come from farmed ruminants (Garnett *et al.,* 2017). Meeting the demand for livestock products in future carbon-constrained markets will require a mixture of adaptation and simple, effective and transparent mitigation strategies, including the following:

1. The intensification of animal diets can significantly reduce the amount of methane produced per unit of animal product produced. Caribbean livestock production systems will need to increase efficiencies through improved land-use management with practices, such as improved pasture management, including grazing rotations, fertiliser applications, development of fodder banks, improved pasture species and use of legumes, and through supplementation with crop by-products. Other options include manipulation of rumen microflora and the use of feed additives. For example, diet intensification can help increase milk production per animal, reduce methane production per litre of milk produced, and help reduce animal numbers under carbon-constrained markets.

2. Animal numbers is one of the major factors contributing directly to GHG emissions from livestock. For Caribbean countries, this would involve replacing a large number of low-producing animals with fewer but better-fed animals of higher potential that would reduce total emissions while maintaining or increasing the supply of livestock products. This will require changing breeds or implementing cross-breeding schemes in major livestock production areas of the Caribbean. The mitigation of GHG emissions will also be a key driver to affect livestock nutrition. Improved feeding practices (such as increased amounts of concentrates or improved pasture quality) can reduce methane emissions per kilogram of feed intake or per kilogram of product, although the magnitude of the latter reduction decreases as production increases. Many specific agents and dietary additives have been proposed to reduce methane emissions, such as compounds that inhibit methanogenic bacteria and methane formation. However, these various agents and additives are currently unproven for practical use.

Significant amounts of soil carbon could be stored in rangelands using a variety of management practices suited to local conditions in each Caribbean country. This not only improves carbon sequestration, but could also turn into an important diversification option for sustaining livelihoods of smallholders through payments for ecosystem services. Technical options for sequestering carbon

from livestock systems in developing countries, including Caribbean countries, need to overcome various problems concerning payments schemes, incentives, monitoring techniques for carbon stocks and appropriate verification protocols. Livestock systems can also help offset GHG emissions by converting manures into energy sources (biogas), or using crops and residues either directly or after conversion to biofuels. These biofuels have been tested and introduced by non-governmental organizations (NGOs) and government programmes in several Caribbean countries.

7.2.4 Waste Management

With increasing livestock production and intensification in Caribbean countries, managing manure becomes more important in order to minimise odour, nutrient losses and emissions. Otherwise, manure becomes a source of pollution and a threat to aquifers and surface waters as well as human and livestock health. Waste from animal processing, including wastewater and rainfall runoff, creates additional problems. In contrast, careful recycling of animal manure to land will contribute plant nutrients to crops and reduce the need for mineral fertilizers.

The trends towards specialisation and intensification on larger production units throughout the Caribbean region means that animal waste nutrient cycles traditionally achieved in mixed crop-livestock systems are being broken. The cost of transporting nutrients to cropland is often prohibitive (especially for water-rich slurries), and manure disposed in the local environment often exceeds the absorption capacity of soils. Therefore, government agencies implementing livestock development strategies need to try and bring the amount of waste generated into line with the capacity of locally accessible land to absorb that waste. Industrial livestock must be located as much as possible where cropland within economic reach can be used to dispose of the waste, without creating problems of nutrient loading, rather than geographically concentrating production units in areas favoured by market access or feed availability.

Holistic research into strategies and technologies is required for the different production environments in each Caribbean country and for the management and treatment of manures and other animal processing by-products. Effective management and treatment of manures and other animal processing by-products can ensure the sustainable use of nutrients and mitigation of environmental impacts, including odour and emissions of nitrates and GHG, and the spread of diseases.

7.3 Economic Constraints

Meat production from grazing animals calculated as energy or protein yield per hectare is inefficient when compared with plant products. Yields vary from one region to another and even from one farm to another in the same region. Pilu and Gavazzi (2017) report that animals are poor converters of energy into foods for human consumption, which is accentuated when cereal grain is fed to livestock (ranging from 16 kcal for beef production to 3 kcal for broiler chickens for each kcal of meat generated). One argument against industrial systems of meat production is the competition between animal feed and food for direct consumption by humans. However, certain animals like ruminants are valuable as converters of inedible agricultural and industrial by-products, such as bagasse, molasses, sugar cane rinds, poultry manure and urea, into products of high nutritional value, and they can graze on marginal land that is otherwise of little use for crop production.

7.3.1 Productivity

One aspect of meat yield is the age of the animal at slaughter in relation to maximum feed conversion efficiency, which applies to animals reared solely for meat. In young animals, when growth is rapid, there is comparatively good return of meat for feed consumed. This declines with increasing maturity of the animal and at a later stage the weight gain is largely fat – which may or

may not be wanted by the consumer but is, in any case, an inefficient procedure. Thus, efficiency of production of livestock products can be improved by appropriate livestock management to capitalise live weight gain potential of young animals, adequate assessment of marketing premiums for carcass characteristics, together with genetic selection and the use of multipurpose animals. Most smallholder livestock growers in the Caribbean do not consider their livestock production from such a business angle, preferring to sell their animals when they require cash or for special occasions.

While maximum feed conversion efficiency can be achieved by specialising in the production of one product such as milk, eggs or flesh, Caribbean small-scale growers use animals for multiple purposes, despite a small loss of efficiency of production of any one product, such as milk and meat or eggs and flesh. Therefore, the promotion of specialised, dual-purpose animals (for beef/milk or meat/eggs) are generally more energy efficient for the same mix of final products than specialist systems, and could provide smallholders with better livelihood outcomes. However, the choice between specialist and multipurpose animals will depend on the socio-economic aspects of the whole process and, to some extent, on the demands of the consumer. Slaughter of culled animals that have completed their life cycle as draught animals, milk or egg producers results in tough meat typical of old animals, which may or may not suit the consumer. Tough meat is often acceptable locally where the meat is cut into small pieces and thoroughly cooked.

7.3.2 Hygiene and Safety

The growing demand for meat, both per capita and due to growing populations, will increase pressure on abattoirs. There is an obvious gap between modern abattoirs in industrialised communities and traditional methods of meat processing in some of the more remote areas of the Caribbean. Custom-built abattoirs which allow separation of the various stages of the process to prevent cross-contamination and sophisticated techniques of quality control are far removed from slaughter under conditions where energy for refrigeration and adequate supplies of hot (potable-quality) water for cleaning purposes are not available. Such facilities might be made available in densely populated areas of the Caribbean where a regular throughput of animals justifies capital expenditure, but it is obvious that these standards must be regarded as long-term objectives in remote areas where slaughter and meat production follow tradition rather than scientific principles.

The safety of meat calls for control throughout the food chain: from the farm of origin and inspection before and after slaughter, to the handling and storage of meat and the products until the time the meat is consumed. The responsibility for the production of safe and wholesome meat is shared by the livestock industry and the government controlling authority in each Caribbean country. This requires a controlling authority that is adequately resourced and has the legal power to enforce the requirements, and which should be independent of the management of the meat processing establishment. The Codex Alimentarius Commission has elaborated (besides meat inspection codes) the Recommended International Codes of Hygiene Practice for Fresh Meat and for Poultry Processing, which describe the minimum requirements of hygiene for meat and poultry production. The application of these Codes can be an important step towards the targets, ensuring that food:

a) will not cause infection or intoxication when properly prepared;

b) does not contain residues (of pesticides, veterinary drugs and heavy metals) in excess of established limits;

c) is free from disease;

d) free from obvious contamination;

e) free from defects generally recognised as objectionable;

f) has been produced under adequate hygienic control; and

g) fulfils the expectation of the consumer in regard to composition.

With regard to meat production, HACCP systematically identifies potential hazards in the entire chain, from animal production to consumption, and ranks them according to severity and likely frequency. This covers facilities, equipment and operation and is intended to augment and refine the various codes of manufacturing practices undertaken by industry. The procedure is intended to enable management to take preventive measures rather than depend on intensive testing of end-products. The provision of refrigeration presents one of the major problems in many areas of the Caribbean since supplies of electricity are often inadequate to operate refrigeration facilities efficiently.

7.3.3 Trade in Livestock and Livestock Products

A sub-group of countries exists within the developing countries category of the World Trade Organisation (WTO) characterised as small and vulnerable economies (SVE), although the WTO does not afford the group any special recognition or treatment. Most Caribbean countries fall into the SVE category that is related to both their structure (physical area and population) and susceptibility to climate and economic shocks. These characteristics pose several challenges to SVE countries and impede their participation in world trade, particularly in relation to the agricultural sector– it is more difficult for them to benefit from some of the critical gains of increased trade, especially trade's important role as an engine of growth and development.

As a result of increased efforts by small economies, the Doha Round[8] agreed to establish a work programme on small economies. A notable provision in the Doha Round is the flexibility for developing countries and SVEs to designate an appropriate number of 'special products' based on criteria of food security, livelihood security and rural development needs. Many of the livestock products grown and processed across the Caribbean region are categorised as 'special products' that allow governments to apply high tariff levels to imports to support these product criteria.

The growing local and regional demand for meat and other livestock products in Caribbean countries reflects global trends. The rapid increase in demand associated with income growth, urbanisation and expanded regional markets, plus the relatively higher prices for livestock products compared to other agricultural products, presents new opportunities for growers in domestic, regional and international markets. However, throughout these different markets, the major challenge is to ensure the competitiveness of smallholder farmers. Increased requirements for sanitary and phytosanitary (SPS) compliance are required in higher value markets, which present challenges to smaller scale growers. An additional development challenge is whether small-scale growers, especially those living in risky marginal areas with high transaction costs or without access to adequate information and knowledge, can be productive and competitive, and subsequently benefit from market-driven opportunities.

Caribbean livestock trade is the least competitive in the international arena. As livestock production in most Caribbean countries is dominated by small producers, achieving economies of scale is a major limiting factor. The main limitation, though, is the inability of many Caribbean countries to meet international standards and effectively respond to non-tariff barriers, specifically SPS measures, principally in the areas of animal health and food safety. Stringent requirements need to be addressed in order to comply with technical standards and requirements, including certified

8 The Doha Round is the latest round of trade negotiations among the WTO membership. With a work programme covering about 20 areas of trade, the aim is to achieve major reform of the international trading system through the introduction of lower trade barriers and revised trade rules. For more information, see: www.wto.org/english/tratop_e/dda_e/dda_e.htm.

abattoirs, residue analysis and traceability, as well as growing concerns about animal welfare and negative environmental impacts, including GHG emissions. Caribbean countries, like all exporting countries, need to comply with most of these requirements in order to export meat to the European Union. Under the Economic Partnership Agreements, countries can be assisted to build capacity (human and infrastructure) to improve compliance with the European Union requirements for trade.

Developed markets have stopped the sub-therapeutic medical antibiotic use in livestock production, and proposed strict regulation and the phasing-out of other sub-therapeutic treatments, such as growth promotants. The extent of growth promotant use in Caribbean countries is unknown because appropriate surveillance and control programmes do not exist in the region. All antibiotics as growth promoters were banned in the European Union in 2006. Similarly, certain hormones can increase feed conversion efficiencies, particularly in cattle and pigs, and these are used in many parts of the world. The European Union has also banned the use of hormones in livestock production. The globalisation of the food supply chain will continue to raise consumer concerns for food safety and quality.

Caribbean countries are unlikely to export large volumes of meat or meat products to developed country markets in the European Union or North America in the near future. However, this should not detract from national or perhaps regional efforts to implement similar SPS mechanisms in order to protect the health of their citizens and visiting tourists. Regulatory authorities in each Caribbean country should ensure that local standards for meat, milk and egg products and facility designs are in place and properly regulated to safeguard the health of their citizens and visitors. Intra-regional trade provides opportunities for some Caribbean countries with more efficient livestock production and processing industries (e.g. Belize). Caribbean countries need to address local issues regarding policies on market access, public health and food safety and local human capacity. At present the regional capacity to challenge these food safety issues is limited, but open-mindedness and a willingness to invest in biotechnology and human resources should guide the region to develop rigorous standards in order to protect citizens in the Caribbean region.

A looming issue for Caribbean countries with substantial tourism industries is the requirement of many insurance companies for international hotel and resort chains working in the Caribbean to provide food to their guests only from certified suppliers. Therefore, foreign tourists visiting Caribbean resorts will only consume export-grade meats, which will help ensure their safety. Such a requirement will impose extra expense on local meat and other livestock product supply chains and reduce local competitiveness, with many resorts likely to narrow their supplier base and/or increase their imports of meat and livestock products. Therefore, national food regulatory agencies and stakeholders in livestock produce supply chains need to improve their food safety standards and practices in order to meet export quality criteria.

7.3.4 Access to Credit

The traditional approach usually implied a level of government intervention in the form of targeted credit, with government-owned and managed rural financial institutions receiving concessional loans and on-lending to rural customers at below-market rates. This form of intervention was often based on misconceptions of the challenges facing rural communities and was directed toward the symptoms rather than the causes of inadequate rural financial intermediation. For example, low participation in formal financial activities was erroneously seen as resulting from the inability of the poor to save or to pay market rates of interest. These traditional approaches pursued short-term objectives aimed at achieving agricultural production gains rather than long-term objectives aimed at sustained rural income expansion.

Caribbean governments and donors implementing livelihood projects with access to credit activities for smallholder farmers should be aware that the focus of credit activities has shifted from nurturing subsidised government-run institutions with cheap credit to developing institutional capacity and improving institutional performance for a broader range of rural financial institutions. Institutional capacity among Caribbean credit institutions is usually lacking without modes of operation to serve a specific rural target clientele, given the political and economic setting, the degree of maturity of the rural and financial sectors, and prevailing social and cultural conditions. Credit interventions are likely to succeed when financial institutions can hire staff with a good knowledge of the community and with solid finance and accounting skills.

Governments could facilitate the development of institutional capacity through assistance to support the initial training of employees or early innovators in rural finance, improved modes of operations, and lending instruments suitable for the target rural communities. These interventions are geared towards building knowledge and understanding within local financial institutions about agriculture and the particular commodities grown by the targeted rural communities in order to breakdown traditional misperceptions; they also build capacity to assess the productivity and potential profitability of farming operations so that appropriate loan packages can be developed for specific clientele.

7.4 Institutional Constraints

Institutional development is needed for the provision of credit, animal health services and genetic material, for example by artificial insemination. The introduction of new technology must be accompanied by the development or strengthening of the institutional framework needed for its implementation. The other key area where institutional change is essential for the success of livestock development projects and programmes is that of marketing, including transport, processing and selling. As there are economies of scale in these marketing activities, large commercial operations are most likely to be cost-effective.

However, because of the high transaction costs of individual spot market sales by small-scale producers to processing companies, there is a need for formal contracting or vertical integration. In negotiating contracts, small-scale producers are in a weak position and lack market power and information on patterns of supply, demand and prices. Thus, in promoting institutional development, there is a need for the dissemination of market information and encouragement of co-operative group action and participation of small-scale producers to strengthen their bargaining position. This might result in producer cooperative unions managing the processing and marketing operations. Additional benefits may be achieved by the development of linkages between different input markets, and between product marketing agencies and the delivery of inputs.

7.4.1 Policy Focus

Caribbean countries should focus on the following areas of policy to address some of the major challenges facing the livestock sector:

- Fiscal and trade policies that stimulate private investments and maximise benefits from livestock production, trading, processing and import/export. Fiscal policies may include tariffs, subsidies, guaranteed prices and tax exemptions. Trade policies may include export-support measures, export and import restrictions, sanitary and phytosanitary standards, disease-free export zones, livestock commodity-based trade, trade-enhancing infrastructure investments and quarantine zones.
- Institutional policies that promote representative smallholder institutions, inclusive leadership of women and youth (associations and cooperatives of smallholder livestock producers), common

interest commodity groups, traders and processors, or common resource management committees (e.g. watersheds).

- Natural resource policies that promote access to land, water, quality feed and inputs; landscape planning and legalisation of grazing rights; and private sector service provision.
- Environmentally-friendly and climate-smart policies that address the trade-offs between agriculture and environment (competition for resources) and between short-term revenue-generating activities and long-term ecosystem sustainability.

In most Caribbean countries the agricultural sector has declined, and national policies have not led to either revived traditional agricultural product sectors or to viable alternative production and trading activities. Losses of market access are much more visible than gains in the global trade policy environment. A number of explanations are offered for this failure, including:

- inadequate resources, whether technical or financial, to support new initiatives;
- unclear and imprecise priority areas and associated actions required to tackle constraints and access opportunities;
- unawareness among producers and traders of potential opportunities; and
- a lack of a truly integrated approach that effectively links resources and opportunities at the national, regional and international levels.

Tariffs are critical as a policy tool for Caribbean countries, both from a food security and a developmental objective standpoint, and as a source of government revenue. In Caribbean countries, where agriculture and food production are the mainstays of rural livelihoods and food security, tariffs are seen as critical to stability and further development. Most of these countries do not have adequate resources to provide domestic support and other forms of protection to their farmers, making it difficult for them to compete with (often subsidised) imports from countries with more developed livestock industries. For Caribbean countries, and especially for the smaller and less diversified economies, preferences have provided considerable incentives to develop local industries, which, in many instances, have become essential for the livelihood of local communities. In some countries, however, a matter of concern is the extent to which preferences, although continually eroded, have provided incentives that prevented diversification into other livestock or agricultural pursuits, particularly in those Caribbean countries where existing resources could have allowed different activities.

Table 9. Meat and milk self-sufficiency in selected Caribbean countries

	Meat			Milk (cows)		
	Demand MT	Local Production		Demand MT	Local Production	
		MT	% demand		MT	% demand
Grenada	8 303	1 182	14.2	2 689	559	20.8
Guyana	38 822	35 280	90.9	63 891	56 000	87.6
Haiti	212 103	105 928	49.9	89 760	49 425	55.1
Jamaica	176 876	134 682	76.1	15 585	12 191	78.2

Source: FAOSTAT (2016).

Government intervention in the livestock sector has been concerned primarily with the distribution of outputs among producers, consumers, processors and government (revenues). Pre-occupation with distributional aims has been motivated partly by long-standing social tensions and by an

apparent lack of other instruments with which to tackle distributional goals more efficiently. Equity is a valid concern, but efforts to utilise livestock prices as instruments of income redistribution have achieved distributional goals only partially and temporarily, and have incurred a high cost in terms of foregone production. A number of governments have begun to adopt actions with a positive production impact. Examples are as follows:

- Livestock sector policy analysis, including the identification of key constraints on livestock industry development; the provision to producers of information regarding national and international markets; and design of more efficient policies to achieve government goals.
- Applied and basic research which cannot be profitably undertaken by private firms.
- Animal health programmes involving the collection of industry and animal health data, policy definition, supervision of health regulations and quality controls on vaccines.
- Extension services to assist in the development, demonstration and communication of improved technologies and management techniques for producers, including owners of smaller farms.
- Infrastructure permitting, (improved) access to productive regions in order to reduce costs of inputs and outputs and to encourage the diffusion of new technologies.
- Negotiation with importing country governments regarding sanitary and commercial trade restrictions imposed on livestock products, with the purpose of achieving greater long-term access and market stability.

In view of the limited pool of well-trained, motivated scientists and personnel in policy formulation and with the majority of livestock farmers operating at the subsistence level, it is imperative that a programme of institutional strengthening and capacity building be developed in all Caribbean countries. This includes enhancing research capacity and access to technologies; training in policy formulation with due consideration to the poor; biosecurity control; promoting the use of agro-industrial products for livestock feed and alternative fuels (environmental impact); market-oriented training for farmers to appreciate competitiveness and the use of cost-effective production methods.

7.4.2 Research and Training

Animal research and development programmes in the Caribbean are primarily based on the systems that were setup during the pre-independence era. Inherently, livestock research was relegated to a proportionally smaller area when compared to plantation crops. Currently, in national agricultural research systems the budget allocated to livestock is low compared to other commodities, especially crops. This has led to poor development of capacity in livestock research, a scenario which is still evident in most Caribbean countries. These deficiencies help constrain agricultural research, which is mainly government-funded, plus internal institutional weaknesses and financial resources that tend to be oriented to cash crops. Agricultural research and development is weakly linked to extension, the farmer and other sectors such as agro-processing and tourism. The agricultural agencies in most Caribbean countries lack adequate statistical organisation and personnel, and coordination between statistical offices and economic analysis, planning and decision-making agencies. Particular attention should therefore be paid to establishing an institutional inter-disciplinary framework.

Caribbean countries are not entirely without institutional capacity in livestock research and development, but the number of trained livestock specialists has declined over the years. Capacity in genetics, breeding and reproductive science, nutrition and feeding and production and management systems exists but this is limited and scattered, and more needs to be done to build capacity and provide avenues for collaboration. Livestock research is slow, costly and difficult compared with crop research, and because technological advances are often piecemeal, Caribbean governments

and private agencies must expect support to research over substantial periods without expecting dramatic results.

The limited availability of scientific data and access to scientific evidence restricts policy formulation and implementation further contributing to low productivity and the sale of livestock products. In some ways, this can be attributed to low investments in animal science, research, education and training. Although local agricultural institutions undertake research and training, minimal research effort is devoted to livestock, while the remainder is focused on horticulture, which is perceived to have higher potential to increase farmer incomes and attract more people to agriculture. A further reflection of the current status of research and training in livestock production, health and safety in the Caribbean region is the absence of adequate budgetary provisions in government allocations. A noted constraint with regard to improving the livestock policy environment and education, research and training is the lack or absence of networking and communication amongst stakeholders within countries and amongst regional members.

Additionally, there has been significant technological innovation in livestock production in China, India and Brazil that could be available through South-South cooperation. Advances in information and communication technologies can enhance knowledge flows and overall technical capacity building in livestock science, from production to processing and marketing. The attainment of the full socio-economic potential of the livestock industry in Caribbean countries is dependent on the consistent use of scientific evidence in all spheres including compliance with health and food safety standards across the production to consumption chain. The productivity gap in Caribbean livestock industries relative to advanced market economies remains large, with much of the agricultural activity producing relatively limited value added. The penetration of modern retail and agro-processing is also limited, with rare opportunities to transfer technology and best practices along value chains. Accelerating technology transfers will have a large potential to positively impact agriculture.

8. Recommendations

The multiple functions of livestock underline the need for a systems approach in the elaboration of sustainable livestock development, because a modification in one function affects other functions. The challenge is to arrive at sustainable increases in production while avoiding environmental degradation. Driven by population growth, increasing demand, stricter quality and safety standards for animal source food and increasing competition for land and water resources, livestock production systems are transitioning, and in the Caribbean, smallholders with crops and livestock are central in this progression. Competition for feed resources in carbon-constrained environments implies that these systems will have to intensify to ensure an acceptable livelihood for its producers. But enhancing the quality and quantity of feed, as one of the most important factors of animal production, should not be seen in isolation, but rather be assessed as part of the greater value chain, including all stakeholders. Therefore, any interventions for development of improved livestock production need to be long term and include appropriate husbandry and management support for small-scale growers.

- **Establish national livestock identification, traceability and animal health certification.** Livestock identification and traceability systems (LITS) provide for the management of herds,

animal health programmes, disease control and food safety. These tools may improve the effectiveness of activities such as:

- Animal identification
- The management of disease outbreaks and food safety incidents
- Vaccination programmes
- Praedial larceny
- Herd husbandry
- Surveillance, early response and notification systems
- Legal and illegal animal processing
- Animal movement control, inspection and certification
- Fair practices in trade
- Control of the use of veterinary drugs and pesticides at farm level.

To be effective, a LITS requires animal identification (for example an ISO numbered ear tag) and movement monitoring of an animal, or groups of animals, along the value chain from birth to the final destination. It is only when these components are all put together that a LITS becomes functional. Implementing a LITS system requires a high level of organisation within an industry where all actors in the value chain must cooperate to make it work. All industry participants must be committed to abide by the rules, which must be supported by a legislative framework that enforces strict penalties for non-compliance.

Improved surveillance systems and disease control strategies at national and regional levels should be implemented at the same time. It is imperative to involve farmers in discussions from the start of any programme, so they understand the advantages of traceability and they are prepared to continue the identification and traceability scheme once any assistance has finished. Depending on the legislative arrangements and enforceability of any new animal identification law, the involvement and ownership of the systems by producers will drive viability and sustainability of LITS. The costs related to the implementation of traceability, however, will require substantial investment, and will be especially challenging for the small-scale agricultural producers targeted by assistance programmes.

- Recent developments within the Belize cattle industry offers a role model for the rest of the Caribbean community regarding animal identification and traceability in a relatively well-structured industry. In order to retain valuable beef export markets, Belize needed to acquire bovine brucellosis and tuberculosis-free status of its entire herd. A key ingredient of this exercise was an effective tagging programme to identify and trace movements of all cattle in the country. The Belize Livestock Producers' Association (BLPA) expects to receive certification during 2018. BLPA and the Government of Belize would welcome the opportunity to host training programmes for other CARICOM members to learn from their experience with both implementing their identification and traceability scheme, and the accompanying laws and regulations that needed to be legislated to support programme implementation.[9]

9 Based on discussions with representatives from the Ministry of Agriculture and Fisheries, Belmopan City, Belize on 30 August 2018.

- **Develop national long-term investment strategies for each selected livestock sub-sector.** The development of livestock in Caribbean countries is constrained by minimal public-sector investment and inefficient and poorly coordinated support services. This situation can, in part, be attributed to a lack of any consistent strategy for livestock development, which is exacerbated by inadequate analytical tools and a lack of information on which to base decision-making. Increased livestock production will depend ultimately on the adoption of appropriate technology, improved support services, market access and infrastructural development to stimulate increased productivity. However, there must be a framework of coherent policies and development strategies that facilitate such development and ensure that the full potential of livestock in developing countries is exploited.

  Therefore, for any Caribbean country seeking to invest in any of their domestic livestock industries, the first step is the development of a long-term strategy to provide a rational basis for livestock-sector planning that will assist governments in determining their own policies and priorities. Foreign industry experts, who have unbiased views about the local industry, but who will certainly engage with local industry stakeholders to formulate a national development strategy, should be hired to complete these strategies.

  The strategy starts with creating a "vision" (e.g. improving livestock commodity value chain development, community-based livestock-crop development, transforming goat production from a low output grazing system to a high-quality, efficient and market-oriented goat production system based on farm-grown fodders). Such a strategy gives clarity to all stakeholders and a roadmap for development towards the end goals for the industry. The development strategy helps define: the implementation roles and responsibilities for development of the sector, leveraging partners and resources from government, the private sector and/or other actors; establishing the scale or geographic coverage of the industry; and identifies the development modality (e.g. local, regional or other export markets; local processing); the necessary enabling conditions for sustaining the development process (e.g. certification, policies and regulations, technical support); and the results to be monitored and tracked to gauge performance.

- **Strengthen quarantine capacity for early detection of potential pests and diseases in livestock.** This involves strengthening public health measures by enhancing the quarantine facility, regular disease surveillance, capacity building of veterinary officers and microbiological surveillance of animal produce to ensure food safety. Livestock disease management can reduce disease through improved animal husbandry practices: controlled breeding, controlling entry to farm lots, and quarantining sick animals and through developing and improving antibiotics, vaccines and diagnostic tools, evaluation of ethno-therapeutic options, and vector control techniques. Preventing diseases entering and spreading in livestock populations is the most efficient and cost-effective way of managing disease. While many approaches to management are disease specific, improved regulation of movements of livestock can provide broader protection. There are some basic practices to aid in disease prevention:

  – Elaboration of an animal health programme.

  – Select a well-known, reliable source from which to purchase animals, one that can supply healthy stock, inherently vigorous and developed for a specific purpose. New animals should be monitored for disease before being introduced into the main flock.

  – Good hygiene, including clean water and feed supplies.

  – Precise vaccination schedule for each herd or flock.

- Observe animals frequently for signs of disease, and if a disease problem develops, obtain an early, reliable diagnosis and apply the best treatment, control, and eradication measures for that specific disease.
- Dispose of all dead animals by burning, deep burying, or disposal pit.
- Maintain good records relative to flock or herd health. These should include vaccination history, disease problems and medication.

In the event of a disease outbreak the precise location of all livestock is essential for effective measures to control and eradicate contagious viruses (i.e. animal identification and traceability).

Institutional and organisational requirements must also be taken into account: health care institutions and producer organisations should implement sanitation campaigns, hold training workshops and provide technical assistance, using adequate informative materials easily understood by farmers. Caribbean (and other neighbouring) countries should cooperate in programmes against transboundary disease either through formal organisations or networks. Neighbouring countries often have similar production systems and disease risk profiles and will be more likely to be affected by similar livestock diseases.

- **Support development of a more attractive business enabling environment** in order to attract more local and foreign investment into national livestock industries that support the farming, rural and agribusiness community. Farmers and public, private and community-based organisations in rural communities need support in strengthening their capacities to face the demands of evolving opportunities and challenges. One of the main weaknesses in developing more efficient livestock production in the Caribbean region is a lack of private investment, both from local and foreign sources. If Caribbean governments are serious about increasing livestock production and processing of livestock products, then they need to set regulation and policy settings to encourage investment and establish an attractive business enabling environment. Areas that need such policy support include:
  - delivery of veterinary services;
  - provision of credit;
  - delivery and uptake pathways of technologies;
  - improvement of market infrastructure;
  - strengthening the capacity of livestock keepers and communities to adapt to shocks and change; and
  - mitigation of the negative impacts and increases in the positive impacts on the environment.

Financial institutions rarely provide their services to smallholder farmers because it is difficult to assess their credit-worthiness as they lack collateral and accounts. Agricultural production activities are also risky owing to climatic variability, unpredictable pest and disease outbreaks, and other variables independent of farmer behaviour. The underpinning assumption is that, despite there being an untapped market for financial services in rural areas, unless they receive some kind of assistance, financial institutions find it too costly (and risky) to implement innovative models of financial intermediation in low-income areas. Therefore, public actions are required that aim at promoting new business models in rural areas through the provision of incentives (grants, subsidies, information, technical assistance, institution building, etc.) for financial institutions to

build their knowledge, experience and financial packages geared towards target communities in order to begin offering their services and products in low-income rural areas.

- **Support local livestock research capacity**. Even when basic technology is available in developed countries, a strong domestic research capability is essential to identify and adapt promising technologies to local conditions. Unfortunately, most livestock research and development institutions in the Caribbean are weak and a major effort is needed to strengthen them, especially, the number of qualified staff. The strengthening of local research capacities, usually focused on government livestock research farms, is essential. Development assistance can help improve technical capacities in terms of breeding and reproduction, and training in advanced reproduction technologies. For example, improving the genetic capacity of local herds would involve importation of embryos from identified breeds in more advanced livestock industries for transfer to local stock, establishing artificial insemination (AI) centres, and capacity building of officers on these improved breeding technologies, through local training courses and visits to improved production centres, such as in neighbouring Latin American countries. Livestock production (and agriculture in general) training and education at tertiary levels needs to be strengthened and supported in order to encourage the next generation of researchers, producers, processors and business support entrepreneurs.

- **Promote the growing of small ruminants** particularly for subsistence and semi-intensive growers as a means to graduate into more commercial ventures. Direct investments into improvements in small ruminant production systems, which offer the greatest potential to smallholder growers. Most Caribbean countries already have well-structured supply chains for some livestock produce (e.g. poultry, milk). The semi-intensification (and intensification) of goat and sheep rearing offers the opportunity for subsistence level farmers to graduate to semi-commercial and eventually fully commercial farming entities. This would encourage more downstream investment in these industries that could evolve into more structured and efficient supply systems.

  The same directions could be offered for pig growers, however, the initial investments and environmental regulations controlling waste management in intensively housed piggeries could deter small-scale growers from venturing into growing pigs or expanding their existing units beyond subsistence levels. Investment in large ruminant and poultry sub-sectors in larger Caribbean countries would need to be focused on commercial growers and companies seeking to expand their local operations. Some semi-intensive growers may seek support to move into fully intensive operations where they have sufficient resources, including finance and land.

  For smaller Caribbean island countries, opportunities additional to small ruminants and pigs exist in the poultry industry. Many growers are operating at semi-intensive levels combining broilers with egg-laying hens in the same enclosure of 500 to 1 000 birds. However, opportunities for these small growers may be more attractive for laying hens because of the flow of cheap chicken meat into these countries from the United States of America, which effectively stifles business opportunities in growing broilers as these countries cannot compete with this source of cheap meat. Governments in smaller Caribbean countries need to decide whether they should promote and protect their local broiler industries with high tariff levels (similar to larger Caribbean countries with established broiler industries) at the expense of cheaper meat for their local populations.

  Related to the intensification of small ruminants, but particularly goats, it is necessary to formulate smallholder goat development models that focus on improving productivity and economic returns from goats kept by families on small farms. Support is provided to smallholders to establish small, intensive dairy goat enterprises with housed goats, on-farm fodder development and conservation, and cross-breeding with an improved dairy or meat breed or dual purpose animals.

These small enterprises are linked to local markets and are provided with health care services, training and extension support.

- **Improve local feed and fodder conservation practices.** A range of different practices and technologies should be identified, researched, and developed based on prevailing agroecological environments in livestock growing regions of the Caribbean. Nutrition and the provision of adequate feed to livestock needs to be an integral part of the pre-dominant livestock-crop farming systems in the Caribbean. Nutritional constraints could be addressed, based on what is locally acceptable and available. **Recommended interventions include the following**:

  – Improving pastures, usually with a fertilised grass/legume mix, which offers potential for increased low-cost livestock production throughout the region, although land is the limiting factor. Technologies for pasture and fodder production are available, and include legume fodder banks and/or the inclusion of a forage legume or improved pasture in the (cereal) crop rotation or on fallow land. They provide a feed reserve in the dry season, when the quantity and quality of the natural pasture is at minimum. The introduction of forage legumes into the crop rotation may break crop disease cycles, provide nitrogen through atmospheric nitrogen fixation, raise soil organic matter content and reduce soil erosion by providing more effective ground cover. However, the cost of improved pasture establishment is high while persistence under grazing can be short, as they are subject to disease and require more sophisticated management than traditional pastures.

  – Pasture and forage conservation through hay or silage-making, although common on large commercial farms, is not generally practised by smallholders. Sown pastures and fodders as crop choices within the farming systems must be economically attractive to the farmer, and require the availability and timely supply of pasture and legume seeds of suitable varieties at reasonable prices. Adaptive research and extension to demonstrate technical and economic feasibility in the farming system is a pre-requisite.

  – Crop residues have low nutritional value and digestibility. Chopping and/or chemical treatment of straw with urea, supplementation of straw rations with green forages (legumes), molasses-urea blocks, by-pass protein and/or agro-industrial by-products are some of the technological options to improve intake and sometimes digestibility, and therefore animal performance. Implementation of straw treatment or supplementation techniques will depend mainly on farm(er) economics (straw availability, treatment costs, milk price, cattle productivity, etc.) and on the availability of labour.

  – Non-ruminant production needs the development of feeding systems based upon on-farm produced feeds, such as cassava and sugar cane, and on supplementation with limiting nutrients – proteins, essential amino-acids, minerals and vitamins.

  – To improve the use of agro-industrial by-products, problems of milling, keeping quality and mycotoxins have to be solved. Dehydration of by-products such as fruit pulps can be simple and cheap using solar drying. Slaughterhouse wastes, except rumen and intestinal contents, can be transformed into high-quality protein feeds, especially for monogastric animals. Similarly, it is technically possible to utilise poultry litter in ruminant rations. In most Caribbean countries, there is a lack of knowledge regarding by-products, and studies are required into the potential supply, seasonal availability and possible levels of consumption of the by-products.

- **Improve the quality of farmers' herds and flocks by supplying high genetic merit breeding stock**, through cross-breeding, developing and improving artificial insemination, embryo transfer (where feasible) and progeny testing systems throughout the Caribbean region.

Improvements in herd and flock genetics plays an important role in enhancing animal productivity, but Caribbean countries would need to have well-defined breeding strategies and a sound technical base to absorb and adapt these technologies to meet their needs. Artificial breeding systems are costly to maintain and require adequate investment in logistics, equipment, facilities, and maintenance because of the need to properly store and transport semen and embryos. Therefore, Caribbean countries would need assistance with the following: 1) an effective technology transfer mechanism; 2) integrating international support into their national germplasm improvement programmes; 3) building and maintaining infrastructure; 4) complementing improvements in animal nutrition and veterinary services; and 5) adequate economic incentives to justify development of such modern breeding systems.

- **Support upgrading capacity of local veterinary services particularly in more remote areas.** Investment in vaccination and the identification of risk factors contributing to disease occurrence. Livestock diseases impose significant economic losses and can present a threat to human health. Such losses and threats can be economically reduced by improved animal health programmes. However, programmes such as vaccination, sanitation and inspection require a deep commitment to implementation from producers and governments and often require regional cooperation. The availability of efficient veterinary services, staffed with competent and properly equipped personnel, is essential for the control, prevention and eradication of animal diseases. Moreover, motivated veterinary personnel must be available in all areas with large livestock populations. Middle-level personnel (para-veterinarians) could fulfil a pioneer function in the primary diagnosis of diseases, simple treatments, vaccinations and management improvements.

  Some animal diseases of high priority can be controlled with relatively cheap vaccines. But control of infectious diseases with vaccines cannot be seen in isolation from other technical inputs, such as breeding for resistance, better housing and hygiene, nutrition and proper marketing systems. The integration of these various inputs should be part of training in veterinary epidemiology. The approach to improving animal health should follow the pathway of reducing disease occurrence by identifying and controlling the risk factors which contribute to the occurrence in a given region.

  Ensuring the supply of animal health services in remote, low-income rural areas could be promoted through community animal health workers (CAHW): local people trained to deal with the most common livestock diseases, using a small range of simple equipment and drugs. They are less expensive than veterinarians as they have lower expectations in terms of income and face lower transaction costs because they act locally. The challenges of establishing a CAHW network in consultation with local communities include:

  – Training CAHWs, which can be from a few days to several weeks, and include disease detection and prevention, animal treatment, accounting and bookkeeping, which are necessary for operating a small business.

  – Providing regular refresher courses to review key topics, cover new treatments and husbandry practices, and provide opportunities for CAHWs to share their experiences.

  – Providing basic equipment in a kit of syringes, needles, thermometers and a small stock of basic medicines, thus allowing them to offer their services without delay.

  – Establishing an institutional and legal mechanism to facilitate cooperation among CAHWs, animal health auxiliaries and veterinarians, who always remain responsible for the more sophisticated diagnoses and treatments.

– Ensuring public support, such as grants, subsidies, preferential loans, tax rebates or exemptions, which offer different types of incentives to service providers.

▶ **Support adaptation and mitigation strategies to changing weather patterns.** Climate change will have severely deleterious impacts in most areas of the Caribbean region, even for small increases in average global temperature. The greatest impacts of climate change are going to be seen in livestock and mixed systems in Caribbean countries where people are already highly vulnerable. The need to adapt to climate change and to mitigate GHG emissions will undoubtedly add to the costs of production in different places. Responses to changing weather patterns needs to be cross-cutting in all development assistance interventions in the Caribbean region. More extensive adaptation than is currently occurring is needed to reduce vulnerability to future climate changes, and adaptation has barriers, limits and costs.

Responding to the challenges of global warming such as higher temperatures, elevated carbon dioxide levels, and uncertain precipitation changes, will necessitate a paradigm shift in agricultural practices. For livestock farming, more precise practices, such as matching stocking rates with pasture production, adjusting herd and water point management to altered seasonal and spatial patterns of forage production, managing diet quality, more effective use of silage, pasture seeding and rotation, and using more suitable livestock breeds or species, could result in a more diversified system that will be more resilient to altered weather patterns.

Adaptation measures involve production and management system modifications, breeding strategies, institutional and policy changes, science and technology advances, and changing farmers' perception and adaptive capacity. Some examples of adaptation options are as follows:

– Diversification of livestock animals and crops, integration of livestock systems with forestry and crop production, and changing the timing and locations of farm operations. Diversification of livestock and crop varieties can increase drought and heat wave tolerance, and may increase livestock production when animals are exposed to temperature and precipitation stresses. In addition, this diversity of crops and livestock animals is effective in fighting climate change-related disease and pest outbreaks.

– Improving feeding practices, such as modifying diet compositions, changing feeding time and/or frequency, incorporating agroforestry species in the animal diet, and training producers in the production and conservation of feed for different agroecological zones. These practices promote higher intake or compensate for low feed consumption, reducing excessive heat load, decreasing the feed insecurity during dry seasons, and reducing animal malnutrition and mortality.

– Shifting locations of livestock and crop production could reduce soil erosion and improve moisture and nutrient retention.

– Adjusting crop rotations and changing the timing of management operations (e.g. grazing, planting, spraying, irrigating). This measure can be adapted to changes in the duration of growing seasons, heat waves and precipitation variability.

– Changes in breeding strategies can help animals increase their tolerance to heat stress and diseases and improve their reproduction and growth development.

– Changing farmers' perceptions and adaptation capacity through education, family farm succession, and social interaction among farmers and farming communities.

– New ways of using weather information to assist rural communities in managing the risks associated with rainfall variability and the design of drought and flooding responses to mitigate the most deleterious impacts, and

– Piloting of weather-indexed livestock insurance schemes

Mitigation options may also have the following adaptive benefits:

– restoring soil organic carbon in cultivated soils through conservation tillage, erosion reduction, soil acidity management, double-cropping, crop rotations, higher crop residues, mulching, incorporating trees, improving plant species, legume inter-seeding, introducing earthworms, and fertilization;

– shortening manure storage duration, improving timing and application of manure, using of anaerobic digesters, covering the storage, using a solids separator, and changing animal diets;

– improving fertilizer application on animal feed crops, such as increasing nitrogen use efficiency, plant breeding and genetic modifications, using organic fertilizers, regular soil testing, using technologically advanced fertilizers, and combining legumes with grasses in pasture areas;

– growing agroforestry species that can sequester carbon and can also provide high-quality dietary supplements for cattle (such carbon payments could represent a relatively large amount of potential income for resource-poor livestock keepers in the Caribbean);

– increasing the efficiency of production that may involve shifting towards monogastric species; and

– shifting human dietary trends away from meat consumption because animals such as cows are the least resource-efficient animal protein producer.

9. Indicators

In setting up a monitoring and evaluation (M&E) system, it is important to establish relevant and specific indicators for each of the implementation stages – innovation, learning and scaling up:

- Impact (e.g. increased livestock production or productivity, increased income, improved market access for livestock products). M&E results should be used to inform the development and adjustment during implementation of any investment activities.
- If a geographic/horizontal/vertical expansion is pursued, the selected indicators should monitor the geographic and beneficiary coverage of the intervention, including:
  - the number of villages/districts/provinces/countries covered; and
  - the number of beneficiaries (e.g. livestock farmers/communities, households, producers' groups, etc.).
- If vertical expansion is chosen, the indicators could be:
  - the number of livestock producer groups aggregated into an apex organisation;

- the number of apex organisations established and their sustainability; and
- the type of policies or laws that are relevant to smallholder livestock development designed and/or approved.

▶ In case of functional expansion, the selected indicators could monitor whether additional area(s) of engagement have been integrated as planned (e.g. sustainable livestock service provision or insurance mechanisms established). Establish indicators to monitor long-term impact beyond project duration, such as:

- livestock producers' enhanced production and access to inputs, services and markets;
- the number of partnership/contract farming agreements between livestock producers and agribusiness investors established;
- the number of sustainable livestock producer organisations/cooperatives and/or pasture management groups established;
- the number of sustainable private-led/community-based service provision systems (e.g. for animal health and veterinary service) established; and
- the number of pastures managed sustainably.

▶ Link the project indicators to CDB's objectives to ensure strategic consistency. Development indicators for CDB are more likely to focus on the creation of an enabling environment for development, such as: the type of policies designed/approved that are relevant to pro-poor livestock development; institutional changes planned and expected in the public extension system; and the number of public-private partnerships established.

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Annex 7

Mainstreaming nutrition into agriculture investment in the Caribbean region

Acronyms and abbreviations

AAP	Agriculture Action Plan
AfDB	African Development Bank
ASPS	Agriculture Sector Policy and Strategy
BMC	Borrowing Member Country
BNTF	Basic Needs Trust Fund
CAHFSA	Caribbean Agricultural Health and Food safety Agency
CARICOM	Caribbean Community
CBO	Community-Based Organization
CDB	Caribbean Development Bank
CELAC	Community of Latin American and Caribbean States
COTED	Council for Trade and Economic Development
FAO	Food and Agriculture Organization of the United Nations
FBDGs	Food-Based Dietary Guidelines
FFS	Farmer Field Schools
GAFSP	Global Agriculture and Food Security Program
IDA	Iron Deficiency Anaemia
IDB	Inter-American Development Bank
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
MDG	Millennium Development Goal
NCDs	Non-Communicable Diseases
NFNSPAP	National Food and Nutrition Security Policy and Action Plans
NGO	Non-Governmental Organization
OECS	Organisation of Eastern Caribbean States
PAHO	Pan American Health Organization
PPP	Public–Private Partnership
RBA	Rome-Based Agencies
RFNSAP	Regional Food and Nutrition Security Action Plan
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SMEs	Small and Medium Enterprises
SUN	Scaling Up Nutrition
WHO	World Health Organization
WFP	World Food Programme

Background

Rational for action

With the growing importance of improving nutrition on the international development agenda, the Caribbean Development Bank (CDB) is now giving greater emphasis to integrating nutrition into its work as one of the cross-cutting issues. This annex serves to support and guide this commitment within the renewed Agriculture Sectoral Strategy.

Despite increases in global food production in recent decades, maintaining food security remains a huge challenge for the Latin America and Caribbean Region. A relatively high percentage of low-income families, particularly in the region's rural areas, suffer from deficiencies in micronutrients, such as iron, zinc and vitamin A (which can have serious implications for the health, survival and optimal cognitive development of vulnerable populations, such as pregnant women and children in the first 1 000 days of life). Obesity has also become a serious problem; the rural poor in the region have comparable obesity rates to those in high income countries. Poor nutrition is a significant determinant of poverty. Good nutrition is thus not just an outcome of economic growth and social development, but an essential input as well. Therefore, investing in nutrition through agriculture is a social good as well as sound development policy and good economics.

The Caribbean Development Bank recognizes that eliminating malnutrition in all its forms is imperative to break the inter-generational cycle of poverty, and to attain the Sustainable Development Goals (SDGs) by 2030. Improving nutrition can have a powerful multiplier effect across the SDGs, indicating that it will be a challenge to achieve any SDG without addressing this cross-cutting issue.

The role of the Caribbean Development Bank

The increasing demand by country governments and development partners for nutrition-enhancing agricultural investments reflects the recognition of the importance of agriculture and the food system to nutrition and the role that nutrition plays in economic and social development. Thus, CDB must be prepared to respond to these demands. Public institutions can play a dual role, both helping to bring better nutrition to people while also helping to ensure markets for farmers and food suppliers.

This annex is an initial attempt to better understand how agriculture and food systems can contribute to inclusivity, sustainability and effective nutrition, and mitigate against the double burden of malnutrition in CDB's Borrowing Member Countries (BMCs). Potential entry points for nutrition interventions are identified to address contrasting and confounding forms of malnutrition in the agriculture and food systems domain.

Based on literature review, this annex can be used as one of the tools to plan sustainable solutions that address the challenges of linking agriculture with entry points for relevant nutrition interventions. Prepared upon the request of CDB's Social Sector for the renewal of the Bank's Agriculture Policy and Sector Strategy, this annex was developed to inform CDB strategies and potential entry points for nutrition interventions. The renewed Strategy will lay out CDB's approach to agricultural sector development in BMCs, with a special focus on nutrition security as one of the key cross-cutting themes.

1. Landscape of nutrition in the Caribbean: The multiple burden of malnutrition

Malnutrition in the Caribbean Region

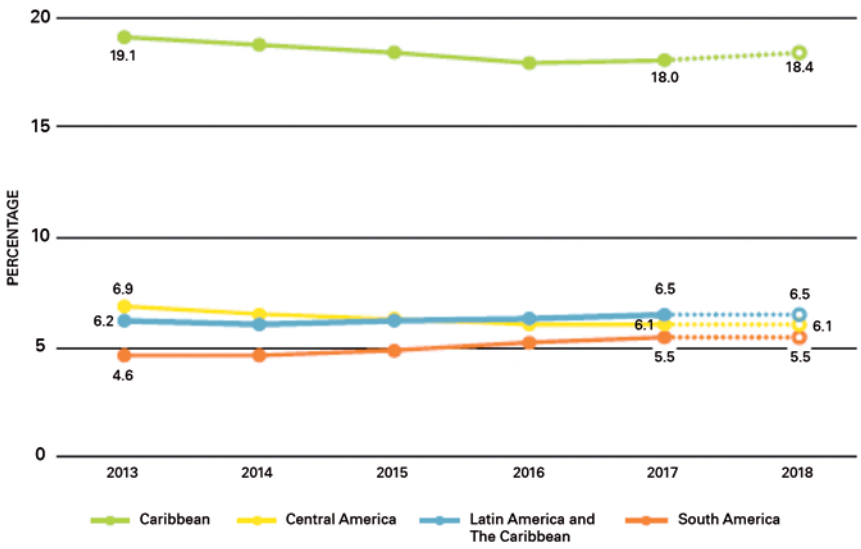
Poor nutrition can reduce a person's productivity and takes multiple forms: undernourishment (hunger), undernutrition (poor nutritional status due to nutritional deficiencies), micronutrient deficiencies (when a person does not get enough essential vitamins and minerals in their diet), and overweight and obesity (when a person consumes excess calories or lacks sufficient exercise). Caribbean countries, like most developing countries of the world, are experiencing a triple burden of malnutrition in the midst of a nutrition transition associated with economic development and urbanisation. The nutrition transition is bringing about increases in over-nutrition and related non-communicable diseases (NCDs). Further, undernutrition, micronutrient deficiencies, increasing overweight and obesity are fuelling the rise of NCDs, which can prevent individuals from reaching their full development potential.

Within this context and in line with international frameworks and goals for better nutrition and sustainable development, it has become imperative to consider the potential of food system-based policies and interventions to improve nutrition. In alignment with the overarching objectives of the CARICOM Regional Food and Nutrition Security Policy (2010) and its Plan of Action (2011), the following section will provide a snapshot of the dimensions of food and nutrition security: *food availability, food access, nutrition adequacy* and the *stability of food supply.*

According to The State of Food Security and Nutrition in the World (SOFI, 2019) report, **CARICOM countries have made overall progress in reducing undernourishment** and meeting the global hunger targets: the number of undernourished persons in the region declined from 8.9 million in 2000 to 7.8 million in 2018. Nevertheless, the region did not reach the United Nations Millennium Development Goal 1 (MDG1) target to halve the proportion of individuals suffering from hunger in the period between 1990 and 2015.[1] As shown in Figure 1, the prevalence of undernourishment in the Caribbean only decreased from 19 percent in 2013 to 18.4 percent in 2018 (SOFI, 2019).

1 See: www.un.org/millenniumgoals/poverty.shtml

Figure 1. Undernourishment in the Caribbean: regional average 2013–2018.



Source: SOFI (2019), p. 37.

*NOTE: * Projected values, illustrated by dotted lines and empty circles.*

Due to the diverse nature of CARICOM countries, however, each country shows different trends (Figure 2). In Jamaica, the percentage of undernourished people has remained relatively constant, with a slight increase from the 2005 level of 7 percent to 8 percent in 2016–2018 (SOFI, 2019). The SOFI (2019) report highlights that reductions in levels of undernourishment vary between countries for the 2004–2006 to 2016–2018 time period: Barbados (5.9 percent to 3.9 percent); the Dominican Republic (24.4 percent to 9.5 percent); Saint Vincent and the Grenadines (9.1 percent to 5.7 percent); and Trinidad Tobago (11.8 percent to 5.5 percent).

Despite the decreasing trends in undernutrition rates, stunting[2] levels are rather concerning in many BMCs: Haiti (49.3 percent, 2018); Guyana (8.1 percent, 2018); Suriname (8.5 percent, 2018); and Trinidad and Tobago (5.5 percent, 2018).[3] Haiti is a special case[4] in CARICOM; it is both a fragile country and a Small Island Developing State (SIDS), highly vulnerable to external shocks and climate change effects. With a per capita annual GDP of USD 870 in 2018[5] and 59 percent of the population living in poverty (Household survey of 2012), Haiti is the poorest country in the Latin America and Caribbean region (LAC) and one of the poorest in the world, which often skews average statistics when presented as part of CARICOM regional indicators.

2 Stunting is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation. Children are defined as stunted if their height-for-age is more than two standard deviations below the World Health Organization (WHO) Child Growth Standards median (WHO, 2018).

3 FAO, IFAD, UNICEF, WFP and WHO, *The state of food security and nutrition in the world: safeguarding against economic slowdowns and downturns* (Rome: FAO, 2019).

4 According to the World Bank Group, the poverty rate is even higher (75 percent) in rural areas, where access to basic services remains very limited, and where the poor are exposed to a vicious circle consisting of low agricultural productivity, high environmental degradation (deforestation and soil erosion) and poor nutrition. Food insecurity is widespread in Haiti. The country is ranked 115th out of 118 countries in the 2016 Global Hunger Index (GHI). Results of a recent World Food Programme (WFP) analysis (2015) indicate that approximately 47 percent of the households are moderately or severely food insecure. In addition, households with children below five years of age are more exposed to frequent food shortages and one fifth of children below five years of age are chronically malnourished.

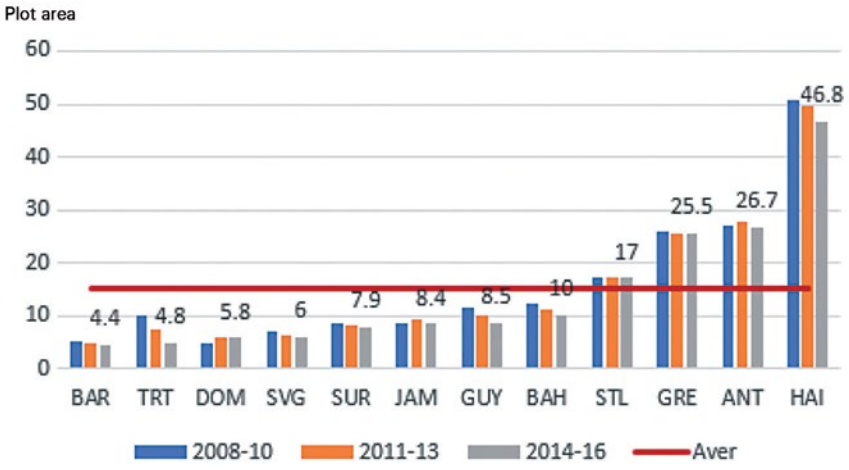
5 www.worldbank.org/en/country/haiti/overview

A nutrition transition has taken place in the CARICOM region, as the rising prevalence of overweight and obesity is escalating, especially in low- and middle-income countries.[6]

According to SOFI (2019), estimates of adult obesity in populations across the region range from 19 percent to 32 percent, the average being 24.8 percent. This is almost double the world average (13.2 percent in 2016) and is rapidly growing. In addition, 7.3 percent of children under the age of five are overweight in Latin America and the Caribbean – a figure that exceeds the world average of 5.6 percent (FAO, PAHO, WFP and UNICEF, 2018).

Data from the Caribbean Food and Nutrition Institute (CFNI) show that obesity prevalence in all age groups has increased to the point where it is considered one of the core underlying causes of death in the Caribbean (Henry, 2012). In addition to the number of people who are obese, approximately 27 percent are overweight, resulting in an estimated prevalence of 52 percent for overweight and obesity combined. Figure 3 shows that adult obesity prevalence averages 19.3 percent and rates have been increasing over the years in CARICOM countries; the exception is Haiti, which has the lowest rates (10.3 percent between 2012 and 2014). The highest obesity rates are in the Bahamas (31 percent), Antigua and Barbuda (27.8 percent), Trinidad and Tobago (27.7 percent), Barbados (26.7 percent), and Saint Kitts and Nevis (26.7 percent). Obesity prevalence is now the most important underlying cause of death in the Caribbean (Henry, 2012).

Figure 2. Prevalence of undernourishment, three-year average (%).



Source: FAOSTAT (2017a).

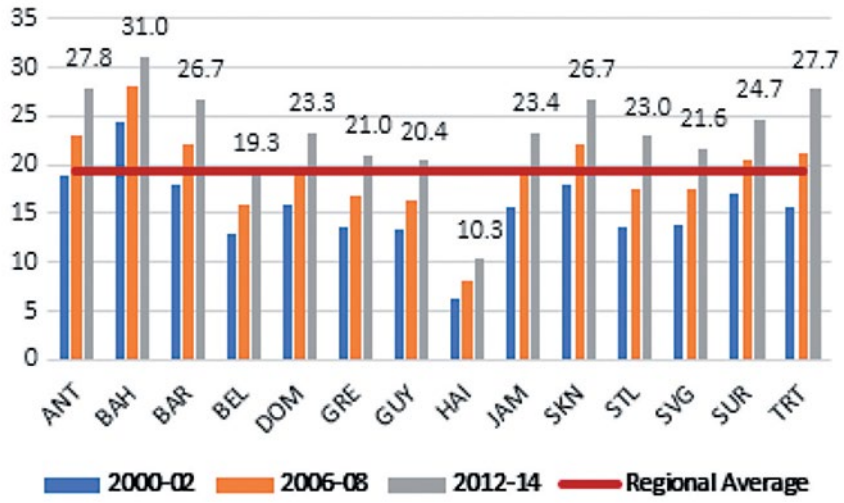
Drivers of overweight, obesity and non-communicable diseases

Diets rich in calories well beyond the body's metabolic needs drive the burden of overweight and obesity, while excess dietary fat, sugar, and salt can increase the risks of NCDs (Hawkes, Demaio and Branca, 2017). According to the SOFI (2017) report, excessive fat and sugar intake is particularly worrying in CARICOM countries, given their role as high energy sources and the prevalence of NCDs in the region. Some of the leading drivers of CARICOM's nutrition transition include rapid urbanization and the so-called Westernization of the diet (Misra and Khurana, 2008), introduced through the imported food items that are available in the market: calorie-dense, high-fat, high-sweetener foods. Moreover, unhealthy diets are linked to high rates of poverty and income inequality. In this regard,

6 Barry M. Popkin, Linda S. Adair and Shu Wen Ng, "Global nutrition transition and pandemic of obesity in developing countries," *Nutr Rev* (January 2012).

it must be noted that food expenditures among poor households are generally on low-quality foods, disproportionately in favour of foods that are generally low cost, comprising mainly calorie-dense foods (especially refined carbohydrates), and foods high in fats and sweeteners (Drewnowski and Specter, 2004). Such diets are more affordable than healthier ones, based on lean meats, fish, fresh vegetables, and fruits. In an observational study of Caribbean undergraduate students, Wright *et al.* (2015) demonstrate that there is a certain correlation between a high prevalence of obesity and a low prevalence of healthy behaviours, such as low consumption of fruits and vegetables, low levels of physical activity, and irregular breakfast consumption.

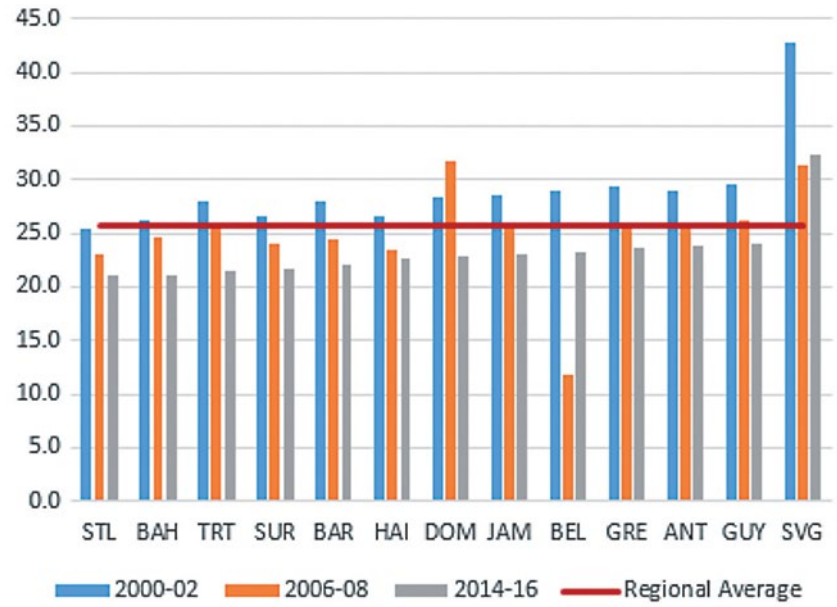
Figure 3. Adult Obesity in CARICOM SIDS (%)



Source: FAOSTAT (2017a).

Diabetes is a major cause of morbidity and mortality in the Caribbean subregion and was ranked as the leading cause of death among women and the third leading cause of death for men in 2009 (Henry, 2012). The prevalence of diabetes mellitus is estimated to be 7.9 percent among persons 15–74 years old, with the prevalence being higher among females (9.3 percent) compared to males (6.4 percent). Estimates from several national surveys have shown that approximately 25 percent of persons between the ages of 15 and 74 have hypertension, with prevalence estimates being similar for both men and women.

Figure 4. Prevalence of anaemia among women of reproductive age (%).



Source: FAOSTAT (2017a).

Iron deficiency anaemia (IDA) is the most prevalent micronutrient deficiency in the subregion and it is prevalent mostly among women of reproductive age,[7] children, and adolescents (see Figure 4). Although anaemia prevalence has been decreasing over the years, FAO (2018) finds that the rates are relatively high, ranging from 23 percent in Saint Lucia to 25.7 percent in Saint Vincent and the Grenadines. Information presented at the 2014 Second International Congress on Nutrition showed that anaemia among children less than five years old continues to be a major debilitating factor in young children's nutritional health. Iron- and folate-deficiency anaemia are caused by a lack of green leafy vegetables in diets or the inability to purchase supplements. Another study on zinc deficiency in Latin America and the Caribbean demonstrates that Belize, Haiti, and Saint Vincent and the Grenadines have the highest risk of zinc deficiency, which directly correlates with stunting (Cediel *et al.* 2015). Recently published data confirm the trends shown in the figures above – on the prevalence of undernourishment, obesity, and anaemia – which are a cause for concern in the region.

As of today, very few food consumption surveys have been conducted in the Caribbean; therefore, inferences about food consumption and utilization are made indirectly by an appeal to food disappearance data and nutrition-outcome indicators, such as undernutrition, overweight/obesity and nutrition-related diseases of the population (FAO, 2017).

Nevertheless, it has been surmised that the food items being consumed within the CARICOM region reflect a shift away from domestic root crops, tubers, fruits and vegetables in favour of food that is low in nutrients, energy-dense and high in fats, oils, sweeteners and sodium. This nutrition transition is driving the epidemiological transition, which is characterized less by infectious diseases and more by nutrition-related, chronic, non-communicable diseases, including diabetes (and its complications such as amputations and blindness), hypertension, stroke, heart disease and some forms of cancer. Obesity is also a main risk-factor for NCDs and is linked to unhealthy diets and sedentary lifestyles.

7 Prevalence of anaemia among women of reproductive age refers to the combined prevalence of both non-pregnant women with haemoglobin levels below 12 g/dL and pregnant women with haemoglobin levels below 11 g/dl.

Food security and nutrition challenges

There are multiple causal factors of food security and nutritional challenges in the CARICOM region, which are compounded by the scale of food imports and the related food import bill, vulnerability to natural disasters, and the high risk of fiscal crisis. The availability and affordability of nutritious staple foods and other crops need to be improved further through both the intensification of nutritious staple crop production and the development of imports, in a coordinated manner. Despite declines in the undernutrition rate, including the stunting prevalence, in most CARICOM countries food security and nutrition security face great challenges in the nutrition transition, caused by dynamic population growth, urbanization, and climate change.

- **Access** to food is severely constrained by high prices (especially for imported food items), unequal distribution, and the lack of ***diversity of affordable food*** at certain periods of time. A deeper understanding of the food system and its function is necessary to tackle these issues. Specifically, the understanding of food price dynamics based on production, food imports, local availably and the distribution system of food would be useful information to improve access to food for all, at all times.
- **Availability** relates to the promotion of the local production of ***diversified food items*** by the government, which entails relevant policy to support producers and nutrition education based on the proper dietary guidelines among consumers. In addition, due to the high dependency on food imports, especially for the SIDS countries, trade is an important element of food security and nutrition in the CARICOM region.
- **Stability** in some countries has been affected by recurring natural disasters. Relevant stakeholders need to join forces to develop an effective climate change investment strategy, including a resilience and risk mitigation strategy for food production systems, with particular focus at the household level.
- **Utilization** is characterized by nutritionally poor food choices and food consumption patterns influenced by limited knowledge of, attitudes and practices towards healthy diets. The food environment is filled with imported food which are calorie-dense, high in fat, and high in sugar.

Other Challenges

a) **Mechanisms are needed to fulfil political commitments:** While we know more than ever about how to combat malnutrition, too little of this knowledge is being put into practice. First, the political environment needs to be made conducive to reducing malnutrition. Second, malnutrition cannot be addressed in isolation; policies and practices in the many sectors that intersect with nutrition – from education to agriculture to climate and the environment – should also address malnutrition with effective mechanisms, including strategic planning, financial commitments, human resources and capacity development, and policy review. Finally, high-impact, targeted nutrition interventions must reach the people that need them. At present, the gaps between delivery and need are large.

b) **Data gaps in the subregion need to be closed:** There is a clear need for more and better data to be able to determine levels and trends in diets (i.e. what people actually eat), overweight and obesity prevalence, and NCDs, appropriately disaggregated by the main vulnerable groups (race/ethnicity, gender, age and other variables). A more homogenous approach to survey design and data gathering is also urgently needed, considering a social-debt approach to human rights and systematically collecting data on human development. Further, nutrition information systems are weak in the region, and countries needs to strengthen their capacity to monitor nutritional status indicators. Galicia *et al.* (2016) find that, overall, nutritional status has improved in LAC

countries with available information, but more efforts are needed to scale up nutrition-sensitive and nutrition-specific interventions to tackle malnutrition in all its forms. Stunting, anaemia, and vitamin A deficiency are still a public health concern in many countries, and overweight is an epidemic.

c) **Multiple challenges need to be addressed simultaneously:** The Caribbean region faces many challenges at the same time, including climate change, urbanization, and food price increases, which can force people to purchase imported, low-quality food items (empty calories[8]). This is one of the leading causes of the double burden of malnutrition.

2. Policy and strategy in the region

2.1 Regional strategy and policy

The international community has shown an enduring commitment to advancing the food and nutrition security and overall development agendas of developing countries through the Sustainable Development Goals (SDGs). These goals are also at the core of recent global mandates to which CARICOM SIDS are signatories, and which are discussed in this sub-section.[9]

The CELAC plan for food and nutrition security and the eradication of hunger by 2025, was adopted in January 2015 by 33 countries of the Community of Latin American and Caribbean States (CELAC).[10]The objective of the CELAC plan is to contribute to "achieving concrete results that translate into significant improvements in the quality of life of our peoples, aimed at the eradication of poverty, especially extreme poverty, guaranteeing food and nutrition security, with gender mainstreaming and respect for the diversity of food habits, tackling the challenges of food and nutrition security with a view to the eradication of hunger and the enjoyment of the Right to Food, especially by vulnerable sectors (CELAC and FAO, 2014, p. 2)." The Plan is based on the following four pillars: (1) coordinated strategies to strengthen in-country legal and institutional frameworks for food security, facilitate trade, prevent food losses and waste, and promote food supply programmes; (2) timely and sustainable access to safe, adequate, sufficient and nutritious food for all people through conditional transfer programmes, creating income and employment opportunities and strong support for family farming; (3) nutritional well-being and assurance of nutrients for all vulnerable groups, respecting the diversity of eating habits; and (4) stable production and timely attention to socio-natural disasters that can affect food availability.

Regional Food and Nutrition Security Action Plan (RFNSAP): At the special meeting of the Council for Trade and Economic Development (COTED) of the Caribbean Community, all the 15 CARICOM countries endorsed the Caribbean Regional Food and Nutrition Security Action Plan (RFNSAP) (2012–2026) in October 2011 to guarantee long-term food and nutrition security for all

8 When a food provides primarily calories, and little else of value to our health, that food may be described as having "empty calories".

9 FAO, *State of Food Insecurity, Caribbean region*, 2018 (forthcoming).

10 CELAC and FAO, *The CELAC Plan for Food and Nutrition Security and the Eradication of Hunger* 2015 (2014).

with adherence to good governance practice. The RFNSAP calls upon Borrowing Member Countries (BMCs) to implement a set of actions for: 1) food availability; 2) food access; 3) food utilization/ nutritional adequacy; and 4) stability of food supply. They include lines of action, such as programmes to develop regional population dietary (nutritional) goals in line with international standards to support public education programmes, and to control the identified nutrition conditions and influence food tastes and preferences starting in early childhood. At the country level, in response to the regional guidance, National Food and Nutrition Security Policy and Action Plans (NFNSPAP) have been developed in most countries of the subregion. In addition, FAO is assisting 12 of the 14 CARICOM countries to develop and implement the Policy and Action Plans.

2.2 Strategies and actions for development partners to promote nutrition-sensitive Investments

Strategic partnerships are key to ensuring CDB's support to BMCs and to promoting nutrition security through policy dialogue, research, and programme development. By joining forces with other international financial institutions, such as the World Bank, the International Fund for Agricultural Development (IFAD), and other regional banks, such as the African Development Bank (AfDB), CDB could fill the existing gaps in the region and create an enabling environment with corporate level goals to improve the nutrition status of client countries. With regard to the Pan American Health Organization (PAHO) and the Healthy Caribbean Coalition,[11] closer engagement to tackle the challenge of overweight and obesity, which are associated with non-communicable diseases, can be sought based on each other's comparative advantages.

The World Bank has embraced nutrition as a multisectoral agenda. Starting with the launch of the Scaling Up Nutrition (SUN) movement at its Spring Meetings in 2010, the World Bank has worked across sectors to address nutrition challenges, and to put into practice the understanding that addressing the underlying causes of malnutrition requires broader, nutrition-sensitive approaches, implemented through sectors in addition to health. Within the agriculture sector, the World Bank is actively promoting the role of agriculture and food systems in addressing malnutrition. As part of its efforts to achieve the 2030 Development Agenda, the World Bank's work is aligned around four strategic pillars: (a) ensuring a more climate-smart agriculture; (b) **improving nutritional outcomes**; (c) strengthening value chains and improving market access; and (d) promoting rural livelihoods and agriculture employment (World Bank, 2015). In addition, the World Bank is focusing on how food systems can contribute to improved nutrition and health; it lays out a spectrum of food system interventions to address different forms of malnutrition – including reducing energy deficiency (hunger), reducing micro-nutrient deficiency (hidden hunger), reducing excessive net energy intake (overweight/obesity), and improving food safety (World Bank, 2016).

FAO conducted an assessment of the World Bank's portfolio review of 55 agriculture investment projects (2012–2015) illustrating the increased share of the number of projects with an explicit focus on nutrition. The World Bank's Agriculture Action Plan (AAP) for Fiscal Years 2013–2015 included a commitment to "increase the share of agriculture projects with an explicit focus on nutrition (currently at 12 percent)." This was reiterated at the June 2013 Nutrition for Growth Summit in London as one of the World Bank's corporate commitments to reducing global malnutrition. Beyond 2015, the World Bank has continued to ramp up efforts to support a food system that can provide, inter alia, safe food and adequate nutrition, and to increase the share of agricultural projects with an explicit focus on nutrition.

11 See: www.healthycaribbean.org/

The World Bank has already been engaging with the challenge of overweight and obesity, along with the role and responsibility of agriculture and food systems to deliver safe, diversified, and healthy diets for all. In addition, the Inter-American Development Bank (IDB) has updated its Food Security Sector Framework document, which introduces the new approach to food and nutrition security based on a food systems perspective, encompassing not only food production, but also demand and the nutritional status of the population.[12] Preventing obesity and improving other forms of malnutrition can best be achieved by one common approach — the promotion of a high-quality, diversified diet. The World Bank (2017) reports that actions and policies which support the provision of, and access to a safe, diversified and healthy diet should be supported continuously across the entire food system as countries transition from focusing on undernutrition to overlapping malnutrition problems, including overweight and obesity.

The **Global Agriculture and Food Security Program** (GAFSP), managed under the World Bank, is a demand-led and recipient-owned global partnership dedicated to fighting hunger, malnutrition, and poverty by supporting resilient and sustainable agriculture in developing countries, thus benefitting and empowering poor and vulnerable smallholder farmers, particularly women. Out of close to USD 193 million of GAFSP funding, about three-quarters of the nutrition-related spending is on nutrition-sensitive agricultural activities, while about one-quarter is for direct nutrition-specific activities, including the distribution of micronutrient supplements (such as folic acid and iron to pregnant women, women of reproductive age, and adolescent girls, or sprinkles for children), behavioural change campaigns, and improving home conditions. More than half of the GAFSP Public Sector Window projects include nutrition-related activities, totalling USD 158 million (about 15 percent of funding from the Public Sector Window financing). Currently, GAFSP is available only for Haiti in the Caribbean region.

>> Box 1. GAFSP – Nepal and Rwanda

GAFSP – Nepal** project is working to enhance the food and nutritional security of vulnerable communities by increasing food availability and the productivity of high-nutrient crops and livestock. The project commissioned a study to analyse the nutritive value – including moisture, ash, fat, protein, carbohydrate, crude fibre, energy, iron, phosphorus, and vitamin C content – of locally available foods. Based on the findings of this study, nutritious recipes from locally available underutilized food were developed and disseminated through the project, including for the preparation of weaning food for infants.

GAFSP – Rwanda project supports kitchen gardens to increase the availability of nutritious foods for self-consumption, the production of fruits and vegetables, seed multiplication for iron-enriched beans, and training about growing and consuming nutritious foods, especially by children. To date, 84 percent of households have an acceptable diversity of food consumption, and over 12 000 kitchen gardens have been constructed.

Source: GAFSP (2018).

Through private sector engagement, GAFSP aims to address the issue of chronic malnutrition and its negative impact on human capital development. In 2015, the Private Sector Window made an investment in Africa Improved Foods Limited (AIFL) to establish a nutritious food processing plant in Rwanda that will feed 700 000 malnourished children there each year. The AIFL project promises

12 See: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-1849803653-22

significant development impact – using maize and soybeans grown and sourced locally by Rwandan farmers, the processing plant will develop fortified blended foods for young children and their mothers, supporting the prevention and treatment of malnutrition in this vulnerable population.

The principal objective of IFAD is "improving the nutritional level of the poorest populations in developing countries" under its Founding Agreement. IFAD's Strategic Framework 2016–2025 articulates the organization's contribution to the 2030 Agenda for Sustainable Development. In particular, nutrition is an essential component of Strategic Objective 1 (to increase rural people's productive capacities), as the approach recognises the importance of nutrition in building not only productive capacities, but also physical and intellectual capacities, envisioning nutrition as an outcome and as an essential input for sustainable rural development. The objective of IFAD's work is to increase the nutritional impact of its investments and its advocacy and policy engagement at global and national levels, working primarily through agriculture and food-based approaches to improve the dietary adequacy – in terms of both quality and quantity – of rural families.

>> Box 2. Five action areas of IFAD's Nutrition Action Plan

1) Increase the impact of IFAD investments on nutrition

2) Contribute to strengthening capacity in nutrition-sensitive agriculture

3) Advance policy coherence and advocacy on nutrition

4) Build evidence and share knowledge

5) Strengthen organizational capacities at IFAD.

Source: IFAD (2016).

The International Fund for Agricultural Development's efforts towards mainstreaming nutrition-sensitive agriculture are guided by its Nutrition Action Plan 2016–2018, which aims to ensure that IFAD's country programmes and projects systematically promote the availability, accessibility, affordability and consumption of diverse, nutritious foods throughout the year. In collaboration with governments and relevant partners, IFAD intends to contribute to improving the diets and nutritional status of its target group, and shaping more nutrition-sensitive food systems, through investments in nutrition-sensitive agriculture, as well as selective engagement in evidence-based policy dialogue, knowledge management and support to capacity development. The following are the four strategic outcomes of IFAD's nutrition strategy:

- Nutrition-sensitive projects shape agriculture and food systems in ways that contribute to nutritious diets;
- Projects promote behaviour change communication to improve food choices and related preparation and post-harvest practices.
- Projects promote the equality and empowerment of women in ways that improve nutrition for themselves, their children, and their families.
- Activities in policy engagement, advocacy, and partnerships, as well as research and knowledge management, contribute to better governance, a supportive enabling environment for projects, and more effective projects.

Moreover, IFAD's Caribbean portfolio includes a spearheaded project co-financed by CDB in Grenada (pipeline), Climate Smart Agriculture and Rural Enterprise Programme (SAEP),[13] which aims to tackle the issues of the double burden of malnutrition. Based on the nutrition situation analysis, the SAEP mainstreams nutrition education in all the training activities of the SAEP, in close collocation with health sector counterparts, to raise awareness of the long-term dangers of emerging nutritional habits, which are detrimental to health, by providing the poor with a better understanding of, and alternatives to cheap imported processed foods, sugar and fats. The IFAD project in Haiti (IFAD/ Inter-American Development Bank) includes some nutrition actions through Farmer Field Schools (FFS) to introduce nutrition and diet diversification, household methodologies, household and farm economies, as well as environmental and other special topics that farmers consider important.[14] Rome-Based Agencies[15] are also interested in working with IFAD to design and implement a joint nutrition-sensitive project in Haiti.

The African Development Bank (AfDB) provides an example of an International Financial Institution, which – under its agriculture sector strategy – places nutrition as one of the key enablers to achieving SDG 1 and SDG 2, in partnership with alliances including farmers, agribusiness, and civil society, exploiting regional comparative advantages and opportunities for trade and collaboration. With the high-level commitment to the stunting challenge, the AfDB has repositioned grey matter infrastructure as a critical factor for human capital development and as part and parcel of its 10-year Strategy. In 2016, the President of the AfDB launched the African Leaders on Nutrition (ALN) together with former Ghanaian President, John Kufour, and Kofi Annan, calling on all African leaders and Ministers of Finance to declare a hunger-free Africa. The AfDB has also formed exciting partnerships – with the Bill and Melinda Gates Foundation, the Dangote Foundation and Big Win Philanthropy, the Global Panel and the Scale-Up Nutrition Network – to provide analytical evidence and research on improving nutrition standards across the continent.

>> Box 3. African Development Bank – Action on nutrition

***African Development Bank (AfDB)* –** Action on nutrition

Madagascar: Establishment of effective mechanisms to promote better nutrition through increased access to fortified foods.

Zambia: Investment through Skills Development and Entrepreneurship Project: Supporting Women and Youth. Along with increasing cassava production and productivity, the project aims to establish a centre to produce fortified *garri* by women's cooperatives. By engaging with the private sector, the project seeks market-based solutions to better promote nutrition in Africa.

Source: AfDB.

In particular, the AfDB stresses the importance of ending hunger and malnutrition by increasing year-round access to nutritious and sufficient food, doubling the agricultural productivity and incomes of small-scale food producers, and increasing investment in rural infrastructure, agricultural research and extension services, and technology development.

13 See: https://operations.ifad.org/documents/654016/96271ea4-7ff9-4439-8bc0-2cebc5e90d1f

14 See: https://operations.ifad.org/documents/654016/27a64d5e-a209-46ec-9145-c80de821ebd7

15 Rome-Based Agencies (RBA) include FAO, IFAD and WFP.

The specific key actions identified to improve nutrition for the vision of agricultural transformation are as follows:

- Scale up and replicate successful programmes to raise access to quality nutrition and end hunger, including community-based nutrition programmes to promote breastfeeding and nutrient supplements for infants and children in their first 1 000 days; vouchers or subsidies for biofortified maize, cassava, and other staple food; school meal programmes; and advocacy for greater Regional Member Country (RMC) government allocation to nutrition interventions; and
- Support increased production of nutrient-rich foods.

With the subsidiary assistance of the Subregional Office for Mesoamerica (SLM), Regional Office for Latin America and the Caribbean (RLC), and headquarters, **FAO's** multidisciplinary team (based in the Organization's subregional office in Barbados) provides BMCs with technical expertise and support in many areas of food and nutrition security, including policy engagement and knowledge and information sharing. In particular, within the food and nutrition security realm, FAO, in collaboration with the University of the West Indies, provides technical guidance for national school food and nutrition education programmes in six CARICOM countries through pilot projects which promote institutional procurement to support smallholders by linking them to markets.[16]

>> Box 4. FAO Caribbean sustainable school feeding and nutrition initiative

FAO Caribbean to pilot sustainable school food and nutrition initiative

1. **Inter-institutional and inter-sectoral coordination** among ministries (such as agriculture, education, health, social development, and others), private sector, schools, parliamentarians and others.
2. **Social participation** for community involvement and monitoring, including the participation of students and their families, school principals and teachers.
3. **Adoption of adequate and healthy menus** that respect local culture; menus should be developed based on reality, availability and preferences of the communities.
4. **Establishment of school gardens** as a tool to promote the independent and voluntary practice of healthy eating habits.
5. **Improvement of school infrastructure** including kitchens, dining halls and storage rooms in schools.
6. **Direct purchasing of products from smallholders** through support to create an enabling environment for local procurement.

See: www.fao.org/3/a-i5288e.pdf

For more information, see: www.fao.org/right-to-food/resources/resources-detail/en/c/1051498/

In Barbados, FAO assisted the Ministry of Agriculture and Food Security in launching a campaign based on the facts from the national **food-based dietary guidelines (FBDGs),** called, "Grow Well, Eat Well, Live Well - Right Here in Bim". The initiative included a School Gardening and Recipe

16 Belize, Grenada, Guyana, Jamaica. Saint Lucia, and Saint Vincent and the Grenadines.

Competition, which encouraged Barbadian children to develop agricultural skills, eat nutritious foods and cultivate their own crops.[17]

In addition to its work in the areas of school feeding programmes and more, FAO's subregional office in the Caribbean assists in revising and creating **FBDGs** in eleven countries, within the range of country technical support.

>> Box 5. FAO Workshop – Leveraging SMEs to improve nutrition

FAO Workshop – Leveraging Small and Medium Enterprises (SMEs) to improve nutrition (November 2017)

In order to ensure that food systems are conducive to healthy diets for better nutrition, it is crucial to strengthen the knowledge and capacities of key stakeholders, in particular Small and Medium Enterprises (SMEs) of the agri-food sector and students, as agents of change.

FAO hosted a workshop gathering about 60 representatives from governmental institutions, development partners, research organizations, and seven African agri-food SME entrepreneurs.

Among the SMEs producing healthy foods, many are socially-oriented companies, which are also aimed at contributing to a public good. Participants argued that these SMEs should be provided preferential public support, not necessarily in financial terms, but rather with enabling policies, programmes and technical assistance.

Participating agencies discussed how they could steer their ongoing work to better support SMEs, identify what the trade-offs are for integrating nutrition in the food business, and explore what the incentives for SMEs are to engage in nutrition, while considering sustainability issues, including risk mitigation strategies.

See: www.fao.org/3/CA2880EN/ca2880en.pdf

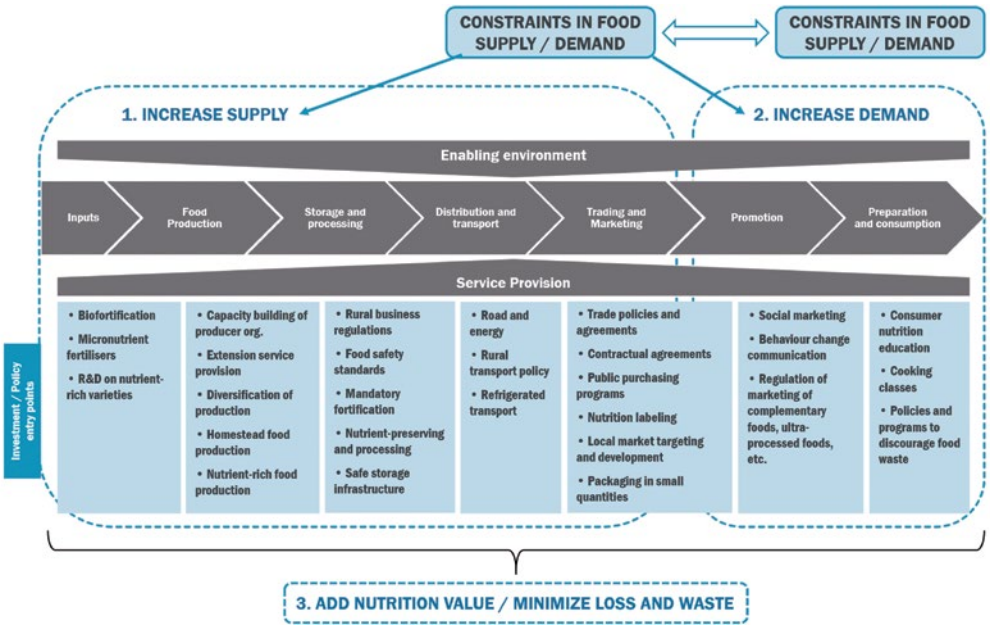
The **FBDGs** translate the population's nutritional needs, such as Recommended Dietary Allowance (RDA), into daily food portions illustrated by pictures and graphics. On the basis[18] of current "national guidelines for healthy diets and physical activity" for each country and results of county-based nutrition assessments with available traditional nutrient-dense crops, a set of food guides can be developed and presented with user-friendly visual material, such as infographics as posters, which can be disseminated among schools, caregivers, churches and community-based health service centres. These can be used as an educational tool that is practical and comprehensible, with culturally acceptable recommendations (including serving sizes for locally available nutrient-rich food items). Food guidelines also enhance the awareness and understanding of what healthy eating is about, and help assess the possible macronutrient and micronutrient deficiencies of vulnerable groups within communities. Lastly, dietary guidelines permit the development of healthy eating scores or indexes on the basis of adherence to the recommendations, which can be used for monitoring purposes.

17 See: https://gisbarbados.gov.bb/blog/gardening-recipe-competition-for-schools/

18 ***Food-Based Dietary Guidelines (FBDGs)*** are a set of evidence-based, easily understood, behaviour-focused messages for the general public (often accompanied by an illustration such as a food pyramid), which takes into account a country's food availability, diet patterns and food culture, and nutrition-related issues. FBDGs focus on providing recommendations about foods not nutrients, and many FBDGs now include a wider perspective including food combinations (meals), eating modes, food safety, physical activity and sustainability aspects (Wijesinha-Bettoni *et al.* 2017).

FAO, with the support of the Japanese government, is working towards developing a mechanism to build capacity for nutrition-sensitive agriculture and food systems among university faculties of agriculture as well as small and medium enterprises (SMEs). The project aims to contribute to better and healthier food systems by fostering an enhanced understanding of the synergies between the food companies and sectors in selected countries through public–private partnerships. The project operates at the global level to develop training resources relevant across countries; it also works in three countries (Ghana, Kenya, and Viet Nam) to pilot the uptake of these materials with local universities and local SMEs.

Figure 5. Nutrition-sensitive value chain (NSVC) framework, strategies and potential interventions.



Source: De la Peña and Garrett (2018).

The Rome-Based Agencies Working Group on Sustainable Food Value Chains for Nutrition (RBAs) – the FAO, IFAD, the WFP, and Bioversity International in collaboration with the International Food Policy Research Institute (IFPRI), are convinced that a value chain approach is a useful way to analyse and navigate the complexity of the food system in order to improve food security and nutrition outcomes. Though the traditional focus of value chain development has been on increasing economic value, nutrition-sensitive value chains (NSVCs) leverage opportunities to enhance nutrition value as well, increasing supply and demand for safe and diverse food, and adding nutrition value, or minimizing nutrition losses. Recognizing that collaboration among the RBAs, at both global and country levels, is crucial to achieving a food system which delivers diverse and nutritious foods for a hunger-free world, the agencies have formed a Working Group on Sustainable Food Value Chains for Nutrition. The Group was created to undertake joint actions in the area of NSVCs, including support to investment and policy processes, capacity development, the generation of knowledge products, harmonized tools and guidance, and joint advocacy, all in the context of country-led processes and international policy fora.

The group has developed the analytical framework presented in Figure 5, which was disseminated through the Committee for World Food Security (CFS) in October 2016 and through an online consultation on the Food Security and Nutrition Forum.[19]

The Pan American Health Organization (PAHO)[20] engages in technical cooperation with its BMCs to fight communicable and non-communicable diseases and their causes, to strengthen health systems, and to respond to emergencies and disasters. ***Nutrition*** achieved higher visibility on the political agenda of countries, with recognition of the critical role of unhealthy nutrition in the etiology of cardiovascular diseases, cancers, and diabetes by the 2011 UN High-level Meeting on the Prevention and Control of NCDs. Further, PAHO's technical cooperation with Member States has addressed the implementation of the effective ***policy options to prevent obesity***, including taxation of sugar-sweetened beverages (SSBs) and unhealthy food products (Barbados, Chile, Dominica, Ecuador, and Mexico); front-of-package labelling (Chile and Ecuador); innovative FBDGs (Brazil and Uruguay); regulation of the marketing of unhealthy products, especially to children (Chile and Mexico); open streets/"*ciclovías recreativas*" (Brazil, Chile, Colombia, Ecuador, Guatemala, Mexico, Peru, and the United States of America); and school nutrition (Brazil, Chile, Costa Rica, Ecuador, Trinidad and Tobago, the United States of America, and Uruguay).

The Plan of Action for the Prevention of Obesity in Children and Adolescents was adopted in 2014, which seeks to halt the rapidly growing obesity epidemic in children and youth in the Americas. It targets the increasingly "obesogenic" environments in the region, which are the result of urbanization, modernization, and global marketing and trade. These forces have increased both the availability and the affordability of energy-dense, nutrient-poor, ultra-processed foods and beverages, at the expense of whole, fresh foods, while also reducing opportunities for physical activity. To counteract these conditions, the Plan of Action proposes five strategic lines of action: 1) primary health care and promotion of breastfeeding and healthy eating; 2) improvement of school nutrition and physical activity environments; 3) fiscal policies and regulation of food marketing and labelling; 4) other multisectoral actions; and 5) surveillance, research, and evaluation.

In addition, CDB can explore synergies with PAHO in reshaping the food systems and healthy diets within the region using data generation, evidence building, and the creation of innovative policy options around trade as well as engagement with the private sector, including SMEs.

2.3 Opportunities to build on CDB's instruments to deliver nutrition-sensitive investment

- **The Basic Needs Trust Fund (BNTF)** Programme targets its sub-projects directly to communities in need through a socially inclusive development process, which empowers the poor and vulnerable, and supports institutional development. Community participation is essential to every sub-project, as this facilitates local ownership of BNTF investments and enhances social capital within each community.[21]

  Potential entry points for nutrition-sensitive interventions:

  – **Use Nutrition assessment/diagnostic** for the targeting of nutritionally vulnerable groups (e.g. women and infants);

19 See: www.fao.org/fsnforum/activities/discussions/NSVC

20 See: www.paho.org/hq/index.php?option=com_content&view=article&id=91:about-paho&Itemid=220&lang=en

21 Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and the Turks and Caicos Islands.

- **Include nutrition considerations in the project development objective** and possible actions to improve nutrition (accompanied by the appropriate indicators); and
- **Incorporate nutrition education** in the school curriculum **through existing school feeding programmes** or cooking skills training for vulnerable women's groups (e.g. Corazon Creek Technical High School Enhancement – Belize; Ptolemy Reid Vocational Training Centre by Vulnerable Groups, Wesley – Guyana). Further, institutional food procurement[22] for linking small farmers to markets can be introduced for potential rural transformation.

▶ **The Community Disaster Risk Reduction (CDRR) Fund** finances projects which reduce the risks of natural disasters and support climate change adaptation efforts in communities across the Caribbean. Eligible organizations include non-governmental organisations (NGOs) and community-based organisations (CBOs) registered and based in BMCs, regional and national research institutions, and government agencies. A requirement for approving project proposals is the identification of the priorities and needs of both men and women as well as a gender equitable participation in project development, planning and implementation.[23]

Potential entry points for nutrition-sensitive interventions:

- **Review the *Enhanced Country Poverty Assessment (ECPA) Toolkit***[24] to incorporate a nutrition perspective into poverty assessments;
- **Review and update the syllabus for the *Community-based Disaster Resilience course***[25] to better inform policy-makers working on resilience – building on the social, economic and human costs of all forms of malnutrition;
- **Promote nutrition-friendly resilience project design,** strengthening household livelihoods and promoting dietary diversification to contribute to the prevention of both chronic and acute malnutrition and the reduction of vulnerability to shocks;
- **Incorporate nutrition education** to improve dietary practices;
- **Link food and agricultural interventions with social protection measures** to help protect the assets of the target population from shocks;
- **Include indicators of food consumption,** such as dietary diversity in early warning systems to increase their ability to detect forthcoming shocks; and
- **Understand the causes of malnutrition** in different livelihood groups to analyse early warning ng indicators and anticipate impact on specific groups.

▶ **The Caribbean Technological Consultancy Services** (CTCS) facilitates the transfer of knowledge and skills within the private sector by linking people who have business and technical experience with businesses that need consulting advice and assistance. These Consultancy Services connect business and technical experts with Micro, Small and Medium Enterprises (MSMEs) that need

22 See: Siobhan Kelly and Luana F.J. Swensson, *Leveraging institutional food procurement for linking small farmers to markets: findings from WFP's and Brazil's food procurement programme* (Rome: FAO, 2017); FAO and WFP, *Home-grown school feeding: Resource Framework (*Rome: FAO, 2018), at www.fao.org/3/ca0957en/CA0957EN.pdf (developed in partnership with WFP, IFAD, NEPAD, PCD and GCNF); FAO, *School feeding and possibilities for direct purchases from family farmers* (Rome: FAO, 2014), at www.fao.org/3/a-i3413e.pdf.

23 www.caribank.org/programmes/cdrr1/who-we-are

24 www.caribank.org/news-cdrr/cdb-oecs-commission-advance-new-tools-improve-poverty-assessments-caribbean

25 www.caribank.org/news-cdrr/142291

consulting advice and assistance. In addition, workshop attendees have the knowledge and skills to train other MSME development partners in their respective countries.

Potential entry points for nutrition-sensitive interventions:

- Leverage the potential of SMEs to improve the nutrition of vulnerable population groups; create an environment for nutrition-related business opportunities (such as a potential partnership with FAO and the Global Alliance for Improved Nutrition – GAIN).
- Replicate Food Safety and Training *Workshops* for food service businesses[26] to enhance the hospitality sector and improve opportunities for tourism investment.

▶ **The CDB and Youth 'VYBZING' Outreach Programme** is a platform for youth engagement with emphasis on youth empowerment and participation in the development process. It facilitates communication among youth and with CDB on social and economic development issues and challenges that are impacting their lives. This outreach programme has good potential to raise political awareness and advocate for solutions to overcome both economic and socio-cultural obstacles to youth's participation in the agriculture sector.

>> Box 6. Empowering young people to secure food for the future

Innovation from practice – Empowering young people to secure food for the future

The Rikolto, through the ***'Food for the Future'*** programme, organized a three-day workshop where they gathered ***young people***, experts, farmers, and consumers to look for ways to feed the growing global population in a sustainable way.

The Rikolto believes that the involvement of young people in the food system will empower them in securing food for the future. Young people can make a difference to improve the food system at multiple levels towards a positive outcome for humanity.

See: www.rikolto.org/en/news/why-empowering-young-people-key-securing-food-future-0

Potential entry point for nutrition-sensitive intervention:

- Create youth forum to discuss their vision of "food for the future", and to raise awareness of their role and responsibilities in reshaping their own food environments and dietary patterns.
- Provide young people with the opportunity to come up with recipes for healthy snacks based on local healthy ingredients, involving *Rikolto's* various stakeholders, such as academia and supermarkets – see the box on the *Rikolto*.

▶ **Regional Public–Private Partnership (PPP) facility** is based on the fundamental principles of PPPs: there must be a significant transfer of investment – and risk – from the public to the private sector. Government engages in PPPs to unlock private sector investment in order to achieve three goals in the delivery of infrastructure: a) innovation and the adoption of new technology; b) improved climate resilience; and c) better value for money – for both governments and consumers

26 www.caribank.org/news/cdb-funds-training-for-food-service-professionals-in-dominica-2

alike. Together with its development partners,[27] CDB aims to build a PPP implementation team which will work with government to develop and implement sound policies and transactions.

Potential entry points for nutrition-sensitive interventions:

- Review *the Caribbean web-based PPP Toolkit* to mainstream nutrition.
- Organize *seminars and workshops* to increase technical capacity in nutrition-sensitive business among governments to deliver better technical advice to the private sector, especially SMEs, thus helping them unleash their potential to reshape food systems. Questions to be raised include: *Is it possible to shape markets to produce and sell foods that contribute to a healthier diet? Can "nutrition" be a business opportunity for SMEs that are reaching the hungry? What support do they need to do this in a successful and sustainable way?*
- Create a forum, with the PPP implementation team, to discuss "***nutrition-sensitive infrastructure",*** especially for post-harvest handling, supported by appropriate transport and logistical operations, including efficient cold chain infrastructure, which is critical to maintaining the quality of food.

▶ **UK Caribbean Infrastructure Programme (UKCIF)** will support eight ODA-eligible Commonwealth Countries and one ODA-eligible Overseas Territory[28] to create critical economic infrastructure in the Caribbean to set the foundations for growth and prosperity, reducing poverty and increasing resilience to climate change. The expected outcome is improved critical infrastructure which spurs increased trade, tourism and private investment.

Potential entry point for nutrition-sensitive intervention:

▶ Organize a consultation session or forum with relevant stakeholders (including the Government of the United Kingdom of Great Britain and Northern Ireland) to explore nutrition-sensitive infrastructure, which could contribute to the nutrition improvement of vulnerable populations among the BMCs.

- Cold chain infrastructure to maintain the quality (nutrient content) of food as it moves from the producer to the fresh produce market.
- Infrastructure to facilitate and support post-harvest handling operations to minimize the food loss along the value chains.
- Infrastructure and regulations for the physical sale of food – e.g. wholesaling, retailing (farmers' market and wet market facilities), catering (innovative boxes to carry perishables) – and its promotion, through discounts, display of products, branding and packaging, advertisement and the use of media.

▶ **Five CSO-led childhood obesity prevention interventions**[29]

In collaboration with the Healthy Caribbean Coalition (HCC), CDB supports capacity building efforts to address childhood obesity prevention in four countries: The Bahamas, Barbados, Belize, and Jamaica. The project will strengthen the ability of civil society organisations (CSOs) to contribute to non-communicable disease prevention and control, with a specific focus on childhood

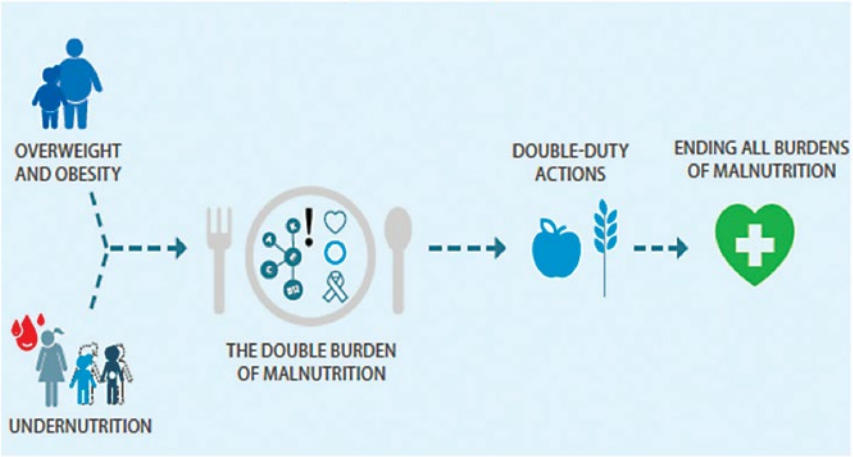
27 The World Bank, the Inter-American Development Bank, Multilateral Investment Fund, and the Public–Private Infrastructure Advisory Facility.

28 Antigua and Barbuda, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, Saint Vincent and the Grenadines, and the Overseas Territory of the United Kingdom of Great Britain and Northern Ireland – Montserrat.

29 www.caribank.org/news/grant-childhood-obesity-prevention

obesity programmes. The expected outcomes include the development of CSO-led action plans on childhood obesity, the hosting of a meeting of regional participants to discuss and finalise childhood obesity prevention strategies and plans, and the documentation and dissemination of project successes and lessons learned.

Figure 6. Double-duty actions for nutrition.



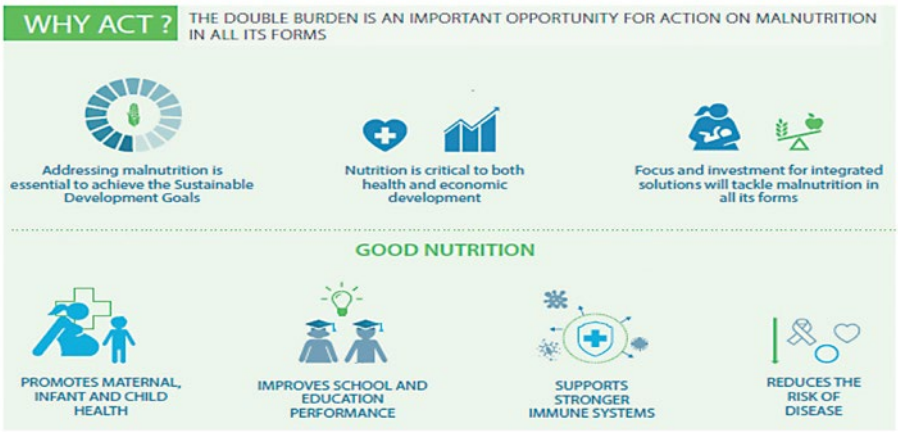
Source: WHO Policy Brief – The Double Burden of Malnutrition (2017).

Potential entry points for nutrition-sensitive interventions:

Double-duty actions offer an integrated approach to addressing malnutrition and child obesity, incorporating the concept of "double-duty actions" interventions, programmes and policies.[30] Addressing the double burden of malnutrition should also be regarded as a catalyst for addressing policy challenges beyond health – including reducing health and social inequities within populations, and raising educational attainment (WHO, 2017). In addition to the lifespan approach, CDB – with its multisectoral expert team – can take the lead in the consultation process for developing the regional strategy and action plan. The role of agriculture, which underpins food security and nutrition, shall be emphasized through the measures and policies that improve food security and ensure access to healthy foods by all individuals and families, and through initiatives that ensure access to healthy and sustainable diets from appropriate and resilient food systems.

30 http://apps.who.int/iris/bitstream/handle/10665/255413/WHO-NMH-NHD-17.3-eng.pdf?ua=1

Figure 7. Why is it important to act?



Source: WHO Policy Brief – The Double Burden of Malnutrition (2017).

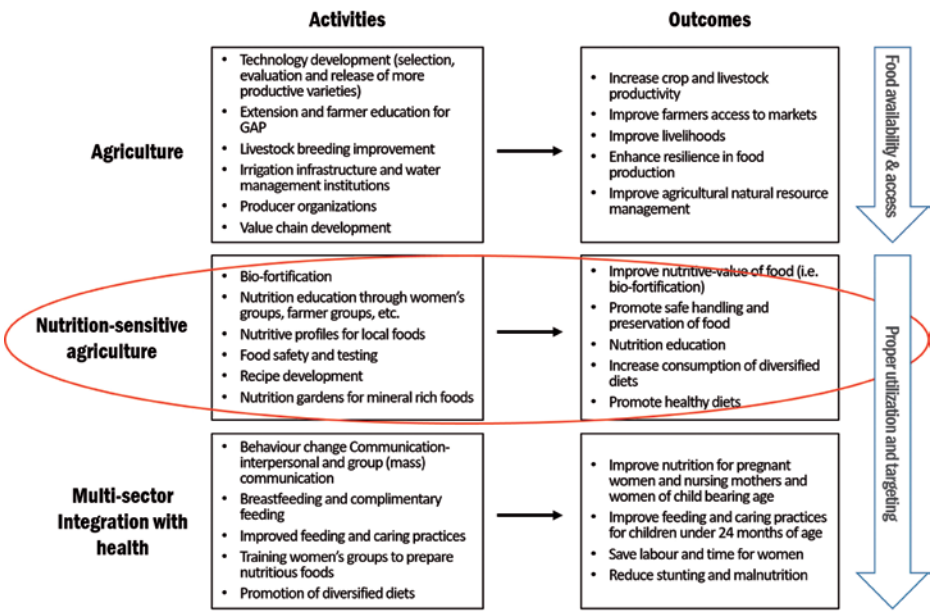
3. Clarifying the strategy: Nutrition-sensitive food systems framework

Nutrition-sensitive agriculture is an approach that seeks to ensure the production of diverse, affordable, nutritious, safe and culturally appropriate foods in adequate quantity and quality to meet the dietary requirements of the population in a sustainable manner. FAO (2017) reports that to make agriculture and food systems nutrition sensitive and deliver safe and nutritious foods all year round to consumers, it is essential to take appropriate action, addressing input quality, production, post-harvest handling, processing, retailing and consumption. Nutrition-sensitive agriculture and food systems contribute to improving health outcomes through the production of diverse, safe and nutrient-rich food, income generation (which facilitates access to health services), the reduced contamination of water sources, and the application of labour-saving technologies.

There are many different ways for agriculture projects to improve nutrition. Although there are gaps in knowledge of exact interventions and combinations thereof, there is consensus that achieving a nutrition-sensitive food system requires interventions at all stages of the farm to fork chain, from inputs and production, to processing, retail and consumption. This encompasses adopting a nutrition lens in agricultural practices and policies to enable a conducive institutional environment and capacity for nutrition-sensitive agriculture. As such, there are a variety of entry points to improve nutrition through agriculture,[31] and some of the examples of nutrition-sensitive agriculture projects by other International Financial Institutions (IFIs), such as the World Bank, and IFAD reflect the diversity of approaches below.

31 Unintended negative consequences on human nutrition may arise from agriculture projects. These might stem from increasing women's workload, crop choice, zoonotic disease, agricultural water use, or other causes. "Do no harm" considerations, although universal, are very context-specific, so they were not the subject of this review. An indicative, but not exhaustive list of resources on the matter include: Alderman *et. al.* (2013); USAID (2011); and Dury *et al.* (2015).

Figure 8. Examples of leverage points for the agriculture sector.



Source: World Bank, Improving Nutrition through Agriculture (Agriculture GP Learning Days, 2018).

The Caribbean Development Bank's agricultural and related sector interventions could play a key role in facilitating nutrition-sensitive investment in BMCs, and by extension, unleash the potential of the agriculture sector. The focus of CDB interventions is supporting BMCs to increase the availability, affordability, and consumption of diverse, safe, nutritious foods and diets, aligned with dietary recommendations and environmental sustainability. **The 10 principles** in Box 8 can guide the CDB through the design of potential investments, which can strengthen resilience and contribute to sustainable development.

>> Box 7. Ten principles to make agriculture and food systems nutrition sensitive

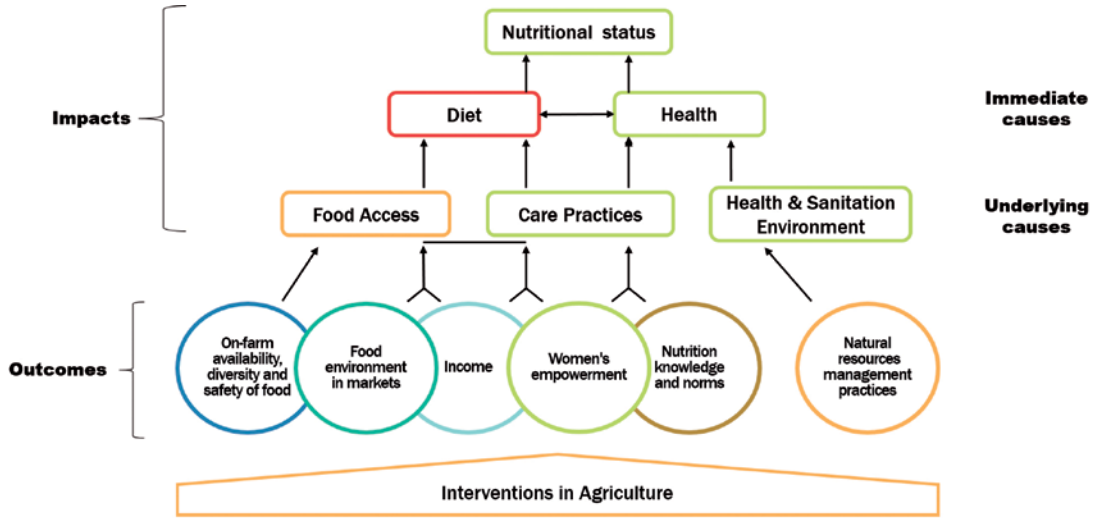
To ensure that agriculture policies and programmes have a positive impact on nutrition, and avoid negative impacts, the following principles are applied:

1. **Incorporate explicit nutrition objectives and indicators into their design,** and track and mitigate potential harms.
2. **Assess the context at the local level, to design appropriate activities to address the types and causes of malnutrition.**
3. **Target the vulnerable and improve equity** through participation, access to resources, and decent employment.
4. **Collaborate and coordinate with other sectors and programmes.**
5. **Maintain or improve the natural resource base.**
6. **Empower women** by ensuring access to productive resources, income opportunities, services and support their voice in decision making.
7. **Facilitate production diversification, and increase production of nutrient-dense crops and small-scale livestock.**
8. **Improve processing, storage and preservation.**
9. **Expand markets and market access for vulnerable groups, particularly for marketing nutritious foods.**
10. **Incorporate nutrition promotion and education.**

See: www.fao.org/3/a-i4922e.pdf

Five **major pathways** linking agriculture to nutrition have been identified; each pathway shows increases in the following:[32] (1) overall macroeconomic growth; (2) access to food through higher production and/or decreased food prices; (3) household income (due to agriculture-related incomes); (4) production and consumption of nutrition-dense foods; and (5) women's empowerment through targeted agricultural interventions. Most agricultural projects already address the first three pathways, just by the nature of their investments. However, less attention has been paid explicitly to the pathways of production and consumption of nutrition-dense foods and empowering women through agricultural investments.

Figure 9. Simplified impact pathways from agriculture to nutrition.



Source: Compendium of Indicators for Nutrition-sensitive Agriculture, FAO (2017b).

During the World Bank agriculture portfolio analysis conducted by FAO in 2017, the following preliminary findings were observed:

- Implementing **activities under more than one impact pathway** from agriculture can enhance the nutrition potential.
  - Projects which are aimed at increasing on-farm work availability, diversity and food can enhance nutrition outcomes if they add an activity to improve nutrition knowledge and norms. Further, introducing labour-saving technology for women can be introduced as part of on-farm productivity investments.
  - Campaigns directed at consumers about healthy diets can increase the effective demand for nutritious food, supported by projects which invest in the food environment and the production of diverse foods.
- **There are many ways for agriculture to improve nutrition.** Achieving a nutrition-sensitive food system requires interventions at all stages of the farm to fork chain, from inputs and production, to processing, retail and consumption. Adopting a nutrition lens in agricultural practices and policies can help to create a conducive institutional environment and capacity for nutrition-sensitive agriculture.

32 Anne Herforth and Terri J. Ballard, "Nutrition indicators in agriculture projects: current measurements, priorities and gaps," *Global Food Security* (September 2016).

- **There is no one-size-fits-all type of investment that works best for nutrition impact**. There are many ways to make a project nutrition sensitive; investment in agriculture technology, extension and research, value chains, multi-sector rural or livelihood development, safety nets, and natural resources can all improve nutrition.
- **Diagnosing the nutrition situation** is key to proposing the most effective and relevant solutions or interventions; CDB can collaborate with partner agencies, including other IFIs, PAHO, FAO and WFP, which support country efforts to collect essential data.

Some of the nutrition-sensitive projects will be introduced along the food systems framework illustrated in Figure 10.

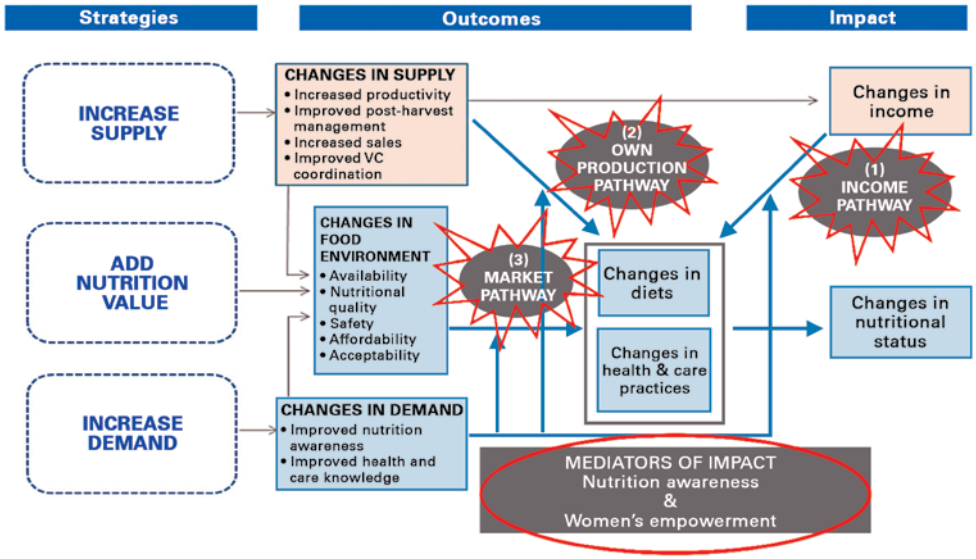
Another useful tool to develop nutrition-sensitive investments is the framework of the ***Nutrition-Sensitive Value Chains (NSVCs),*** introduced in Figure 10. The NSVCs framework aims to improve nutrition primarily by improving the diet quality of beneficiaries.[33] While traditional value chain approaches are used to increase economic returns by enhancing efficiency, the NSVCs approach is aimed at maximising the nutrition benefits delivered from value chains. This entails promoting value chains for nutritious food products, such as fruits and vegetables, and identifying entry points to increase nutritional value at any step of the value chain.

This framework demonstrates three possible impact pathways which can lead to changes in the consumption of nutritious foods: *the income pathway, the own-production pathway* and *the market pathway*. In addition, there are two cross-cutting mediators of this impact: *nutrition awareness* and *women's empowerment*. Figure 10 identifies these impact pathways, relating them to the three NSVC strategies – increasing supply, adding nutrition and increasing demand – and to their expected outcomes and impacts. Each investment project which can introduce NSVCs will need to develop its own theory of change, which will likely entail some combination of these three impact pathways and the two mediators of impact.[34]

33 Isabel de la Peña and James Garrett , *Nutrition-sensitive Value Chains: A guide for project design* (2018).

34 Mediators of impact: 1) **Nutrition awareness** – Food and nutrition awareness among consumers is a key mediator of impact for all three impact pathways. Be it consumers in producer households or other consumers in the community, increased nutrition awareness affects food purchases and willingness to pay, as well as food preparation and food distribution within the household. Without adequate knowledge or awareness of nutrition and healthy dietary practices, increases in production and incomes will have limited effect on food choices and diets; and 2) **Women's empowerment** – Women are in a unique position at the nexus of agriculture and nutrition. In addition to their economic roles as agricultural producers and, often, their roles as processors, marketers and vendors, they are responsible for food choice, consumption and preparation within the household, as well as for childcare and feeding practices. This means that improvements in women's decision-making power and control over resources can have significant positive effects on their own nutrition and that of other household members, especially children. Yet, increasing women's engagement in agriculture and VCs can also have negative effects on nutrition, if it leads to situations where women are overburdened, or if it reduces the time they can dedicate to caregiving and food preparation. Careful consideration and understanding of women's time allocation and control over resources, as well as their social status and roles in and outside the household, are essential for ensuring that development of NSVCs promotes women's empowerment in ways that are conducive to positive nutrition outcomes.

Figure 10. Nutrition-sensitive value chains – pathways to improve nutrition.



Source: De la Peña and Garrett (2018).

4. Potential entry points for nutrition-sensitive interventions[35] in four key areas of the agriculture sector

Specific recommendations along the ASPS strategic pillars and cross-cutting themes are presented below. These are aligned with the nutrition-sensitive entry points for intervention in food and agriculture that have the potential to improve nutrition along with the four functions of food systems: *food production*; *food handling, storage, and processing*; *food trade and marketing*; and *consumer demand, food preparation and preferences*. Best practices are also introduced. It should be noted that political engagement is key to the long-term success of nutrition-sensitive interventions, not only in terms of investments, but also in relation to multisectoral policy coherence as well as political endorsement and support for nutrition education campaigns, front-of-pack nutrition labelling, social protection measures to increase access to healthy foods, and more.

4.1 Area 1: Facilitate the participation of agricultural entrepreneurs in markets and value chains

Targeted outcomes	Increased investments in the agriculture sector; value chain infrastructure; value chain financing; increased entrepreneurship
Instruments	PPPs; sovereign lending; co-financing; partial credit guarantees; investment loans; equity; intermediary loans; new financial instruments

35 FAO, *Nutrition-sensitive agriculture and food systems in practice – options for interventions* (2017c). www.fao.org/3/a-i7848e.pdf

Value chain for nutrition approaches are often implemented in the context of public–private collaboration. The Caribbean Development Bank can explore the application of the NSVC framework to existing or future investment projects. It is necessary to ensure transparent and inclusive policy frameworks are in place to manage potential risks and trade-offs between (private) economic objectives and (public) health goal.

Potential entry points for interventions for CDB:

- Value chain analysis ***with a nutrition lens*** can help to re-design existing value chain interventions to achieve greater nutritional impacts – such as through assessing the nutrition implications of an existing value chain and introducing appropriate changes in the way the chain is organized – or design new value chain projects.

  Suggested steps to design nutrition-sensitive investment projects are as follows:

  - Perform a situation analysis to characterize the nutrition problem of the target population.
  - Identify key foods that can help solve this nutrition problem – such as foods which are currently under-supplied or under-consumed by those most in need.
  - Conduct a value chain analysis of the targeted foods to identify bottlenecks and propose relevant and tailored market-based interventions that offer supply-side or demand-side solutions.

- Strategies to be adopted for the supply- or demand-side of value chains include:
  - Enhancing the supply of nutritious food (e.g. increasing and improving production, processing, storage and transport capacities);
  - Increasing the demand for nutritious food; and
  - Biofortification – add nutritional value (e.g. ensuring food safety, minimizing food and nutrient loss and waste, and applying nutrition-sensitive processing methods, such as reformulation and fortification (see the section below on biofortification).

>> Box 8. Kenya and Uganda – CIAT Making Value Chains Work for the Food and Nutrition Security of Vulnerable Populations

This project aims to improve the diets of vulnerable rural and urban consumers at the bottom of the pyramid, specifically women of reproductive age and children 6-59 months old, in Kenya and Uganda. It also aims to generate economic returns for the various actors involved in the value chain, including smallholder farmers.

The project works at all stages of the value chains of commodities used to manufacture a multi-composite, nutritious and affordable porridge, made with locally sourced ingredients including beans, amaranth, maize, millet, cassava and sweet potato. To ensure sustainability, the project is working with private-sector processors who are the producers and marketers of the porridge. The project has introduced an efficient and eco-friendly solar drier with farmers, processors and commodity aggregators to reduce post-harvest losses, improve food safety, and reduce nutrient loss.

In order to reduce transaction costs along the chain, the project also links smallholder farmers to buyers using an inclusive business model (LINK Methodology: http://ciat-library.ciat.cgiar.org/articulos_ciat/LINK_Methodology.pdf), enabling producers to supply their produce to the buyers in an equitable

and fair-trading relationship. The value chain and product development activities have been informed by consumer research to characterize consumer diets, understand their consumption behaviour, and identify the nutrition gap and consumer willingness to pay for more nutritious products.

See: http://ciat.cgiar.org/what-we-do/value-chains-for-nutrition/

▶ Diversification and sustainable intensification of agricultural production

Diversification and sustainable intensification of food production have the potential to improve the availability, affordability, stability and consumption of diverse foods and to promote healthy, nutritional and sustainable diets, while increasing climate resilience and enhancing the provision of ecosystem services. Diversification at farm level can offer a seasonal coping strategy in contexts where income streams and the availability of nutritious foods vary within annual cropping cycles.

To make a project nutrition sensitive, the enhanced production of food should correspond to the specific dietary deficiencies of the target population identified through a careful, and preferably participatory, nutrition situation analysis.

>> Box 9. Nigeria – World Bank Additional Financing for the third Fadama Development Project III

The project focuses on investing in production and **value chain development** for four main food crops: rice, cassava, sorghum and horticulture crops. Specifically, the project is aimed at:

- encouraging the use of fortified crop varieties, and investing in the four priority value chains to reduce post-harvest losses, enhance access to markets, and improve processing;
- promoting women's empowerment, which is clearly spelled out as a means to enhance nutrition and project activities designed for this purpose; and
- supporting and developing a nutrition module to be integrated into the training of extension agents.

The effectiveness of nutrition messaging is aimed to be measured through an intermediary result indicator: "by the end of the project, 50 percent of Additional Financing beneficiaries would have increased nutrition awareness (disaggregated by gender)."

Source: World Bank.

See: http://projects.worldbank.org/P130788/third-national-fadama-development-project-additional-financing?lang=en

Potential entry points for interventions for CDB:

The Caribbean Development Bank can support investments that foster the production of a diversity of nutrient-rich foods. Food-based dietary guidelines are an effective tool to introduce the way of promoting diversified diets and to ensure better nutrition._

▶ Horticulture

– **Strengthen the focus on the horticulture sector,** given the importance of fresh fruits and vegetables in healthy diets and preventing micronutrient deficiencies and diet-related, non-communicable diseases.

– **Introduce year-round, high-nutrient content for the most vulnerable**: Place emphasis on nutrient-dense varieties of vegetables and fruit.

>> Box 10. Nicaragua – World Bank Caribbean Coast Food Security Project: Food Diversity and Nutrition Knowledge and Norms

- Based on the solid diagnostic study and mapping of the nutrition and food security situation, the project promoted sustainable production, processing and commercialization improvements and innovations for family agriculture/ livestock and artisanal fisheries.
- Nutrition education for behavioural change was introduced to increase local knowledge of the importance of an adequate, high-quality diet.
- Crop diversification with highly nutritious foods was promoted through the introduction of improved seeds and biofortified crops and the use of zinc fertilizers.

Source: World Bank.

See: http://projects.worldbank.org/P148809?lang=en

▶ Nutrition-sensitive livestock and fisheries

These two sectors provide the largest contribution to production and consumption of nutrient-rich animal source foods (***ASFs***), including meat and organ meat, eggs, fish and dairy products such as milk, yoghurt and cheese.

– ***ASFs*** can be an excellent source of selected micronutrients (easily absorbable iron, zinc, calcium, vitamin A, vitamin B12 and various essential amino-acids).

– ***Fish*** products are good and natural sources of long chain omega-3 and iodine, both important for optimal brain development in children.

A nutrition-sensitive approach to livestock and fishery development implies promoting the moderate consumption of ASFs in accordance with food-based dietary guidelines, while possible health and environmental risks are taken into account.

Potential entry points for interventions for CDB:

The Caribbean Development Bank can promote the development and usage of national FBDGs, which can be a guide for the healthy and sustainable consumption of ASFs and fish, thus shaping people's dietary patterns.

▶ Fishery

– **Support interventions** that lead to improvements in food safety standards.

– **Conduct a valuation** of the nutritional importance of fisheries to Caribbean diets.-

▶ Livestock

– **Explore opportunities for the rearing of small ruminants and perhaps pigs,** incorporating measures to prevent and reduce risks to human health, such as food and water safety issues and environmental contamination, waste disposal problems, and zoonosis).

► Biodiversity for food and nutrition

Biodiversity can play a key role in ensuring dietary diversity and nutrient adequacy. While the importance of eating different foods is generally recognized, less attention has been paid to differences in nutrient composition among various foods and among varieties/cultivars/breeds of the same food – which can differ dramatically. For example, some varieties of bananas can contain up to 1 000 times more pro-vitamin A carotenoid then the most globally consumed variety. Therefore, the intake of one variety rather than another can mean the difference between micronutrient deficiency and micronutrient adequacy. The globalization of diets and intensive production models have encouraged the substitution of a great number of foods and locally adapted landraces and cultivars with a few, highly productive and commercialized species.

Potential entry points for interventions for CDB:

Globally investments in agricultural production and research is concentrated on major staple grains and selected animal species. It is, however, well recognised that policy support for other foods (including fruits, vegetables, pulses and underutilized species) is key to realizing the full potential of nutrition-sensitive agriculture and biodiversity to improve nutrition and health. The Caribbean Development Bank can promote the mainstreaming of biodiversity into all relevant policies, programmes and national and regional plans of action addressing malnutrition in all its forms.

- **Raise awareness of the importance of biodiverse foods for nutrition**, and incorporate biodiversity into extension systems.
- **Use market-based approaches**, such as short supply chains and community-based agriculture, to increase incentives for – and thus stimulate production and consumption of – biodiverse nutritious foods.

► Urban and peri-urban agriculture

Urban and peri-urban agriculture offers an opportunity to increase the availability of fresh and nutritious foods in proximity markets, and access to a diversified and nutritious diet for urban residents. This intervention supports the prevention of both undernutrition and micronutrient deficiencies as well as the prevention of overweight, obesity and non-communicable diseases. It can also be a good income-generating activity for poor urban households.

Potential entry points for interventions for CDB:

Partner with local institutions playing a critical role in supporting and scaling up innovative forms of production and marketing in urban areas – for example, by facilitating access to finance for urban producers and enterprises, ensuring preferential local procurement and facilitating the establishment of farmers' markets.

- The provision of assets, such as small livestock and inputs (e.g. seeds), as well as technical support for micro-gardens and rooftop gardens, grey-water recycling systems, and other space and resource-saving techniques can be used to promote diverse urban food production and consumption. Nutrition education can be integrated in order to enhance nutrition outcomes.

► Biofortification

The consumption of biofortified crops allows many people to increase dietary micronutrient adequacy simply by substituting a micronutrient-poor staple with its micronutrient-rich counterpart. A growing body of evidence demonstrates the efficacy and cost-effectiveness of this strategy.

>> Box 11. Cameroon – Agriculture investment and market-development project

Nutrition is well integrated, from diagnosis to beneficiary targeting (women's groups), and in the various activities to enhance nutrition.

- Linkages within different value chains have been identified and proposed for the different stakeholders.
- The development and adoption of bio-fortified crop varieties are promoted as well as their use in processed food (such as flour).
- Technical and institutional support is provided at a high political level to promote a broader vision of nutrition encompassing different sectors and disciplines.

Source: World Bank.

See: http://projects.worldbank.org/P143417?lang=en

Potential entry points for interventions for CDB:

Closely engage with partners to explore the potential to introduce biofortified crops; CDB can invest in impact research to evaluate the impact of biofortification on the micronutrient status of target groups and on other key variables (e.g. farmer adoption rates, consumer acceptance, cropping and seed systems).

▶ Biofortification is best promoted as part of a broader portfolio of sustainable, food-based approaches to nutrition.

- Biofortification promoted together with production diversification maximizes synergies between these two complementary strategies and increases nutrition impact.
- Biofortification implemented together with conservation policies that provide explicit support to biodiversity can mitigate the inherent risks of genetic erosion due to selective breeding focused on a few varieties and crops.
- Biofortification can increase the market supply of fortified foods with adequate micronutrients.

>> Box 12. Jamaica – Root Crop Biofortification Sensitization Workshop (April 2018)

Inter-American Institute for Cooperation on Agriculture (IICA) hosted a workshop on the biofortification of the sweet potato and other root crops, to improve nutrition. The project aims to alleviate micronutrient deficiencies for vitamin A, iron and vitamin C through evidence-based plant breeding.

Immense potential for the technology was introduced based on the success in countries including Brazil, China and India.

Under the guidance of Harvest Plus, the concept note for the project called, "Establishment of HavrestPlus CARICOM – Leveraging experiences to alleviate micronutrient deficiencies in school nutrition programmes, enhance food security and climate resilience" will be developed.

Source: Press Release IICA April 2018.

See: www.iica.int/en/press/news/iica-promotes-root-crop-biofortification-caricom

▶ Nutrition-sensitive post-harvest handling, storage and processing

Potential entry points for interventions for CDB:

The Caribbean Development Bank can facilitate and support post-harvest handling operations through building a good infrastructural support base, including efficient cold chain infrastructure and storage to maintain the quality of crops.

▶ Post-harvest handling, processing and storage to:

– maintain a secure supply of food (and thus of nutrients) throughout the year;

– preserve the quality of harvested raw material as it moves along the food supply chain from the producer to the market;

– reduce losses; and

– make fresh produce available in local markets as well as in distant locations.

▶ Working with the food industry to improve or reformulate the food composition of processed foods to reduce or eliminate the use of certain ingredients, such as salt, trans-fats, sugar and additives, is imperative.

▶ Food loss and waste: prevention, reduction and management

>> Box 13. Jamaica's national food loss and waste reduction strategy

Jamaica developed a national food losses and waste reduction strategy during 2017, with support from FAO's project, *"Towards the Prevention and Reduction of Food Losses and Waste – Latin America and the Caribbean Component"*. The strategy received validation at a National Stakeholder Consultation in November 2017.

The following five key components were identified: (1) research and development; (2) awareness and knowledge; (3) governance/legal and institutional framework; (4) economic growth and planning; and (5) private sector expansion and employment creation. In early 2018, the final strategy document was shared with the Government of Jamaica for integration into relevant national programmes.

Source: FAO Subregional Office Brief on Nutrition.

Potential entry points for interventions for CDB:

The Caribbean Development Bank can assist BMCs in developing and implementing actions required to reduce food loss and waste across the value chain supported with adequate monitoring and evaluation frameworks, and coordinated both vertically (from national to local levels), and horizontally (between sectors) along the projects.

– **Strengthen the supply chain through direct investment in public and private goods** – such as post-harvest handling, produce storage and transportation facilities – to ensure compliance with modern food safety standards.

– **Build stakeholder capacity through nutrition education**, including sensitization about production, transformation, distribution and purchasing behaviors with the potential to reduce food loss and waste.

▶ Nutrition and resilience

Potential entry points for interventions for CDB:

- ***Strengthen*** the legislative and policy environment to ensure that nutritional considerations are fully taken into account in developing policy, programme and coordination frameworks for resilience and food security.
- ***Integrate*** nutrition in food and agriculture **information systems** to improve the monitoring of threats and situation analysis for resilience planning.
- ***Make*** prevention, preparedness and response activities more nutrition sensitive to reduce the impact of shocks and threats on the nutrition situation of individuals and households.

>> Box 14. Examples of nutrition-friendly resilience programming

- **Strengthen household livelihoods and promote dietary diversification** to contribute to the prevention of both chronic and acute malnutrition and the reduction of vulnerability to shocks through direct consumption or income generation.
- **Incorporate nutrition education to improve dietary practices**, especially for vulnerable groups, and contribute to improved food utilization and prevention of acute and chronic child malnutrition short and long term.
- **Link food and agricultural interventions with social protection measures** to help protect the assets of the target population from shocks and to positively improve their nutritional status.
- **Link food and agriculture to other programmes** that address other determinants of malnutrition (health, water and sanitation, and education), and create partnerships to enhance nutritional impact.

See: www.fao.org/3/a-i3824e.pdf

4.2 Area 2: Contribute to good governance and support public sector reforms

▶ Policy level

As the leading catalyst in reducing poverty through the inclusive and sustainable development of BMCs, CDB can explore the following levers (at the policy level) and opportunities to introduce nutrition into the agriculture sector, building on partnerships with various partner agencies between the agriculture and health sectors.

a. Strengthen inter-sectoral collaboration to achieve nutrition outcomes

The Caribbean Development Bank can engage in effective global governance mechanisms for nutrition and promote an enabling environment for nutrition-sensitive investments based on regional perspectives.

- Mainstream nutrition into country strategies and invest in projects (by partnering with FAO).
- Strengthen engagement with markets and private sector actors to make food systems more nutrition sensitive, incorporating trade issues (reducing import bills, promoting nutrition-

sensitive markets with a territorial approach and the introduction of legal framework etc.), in partnership with IFAD/the World Bank, IDB and FAO).

- Learn from indigenous peoples how best to support their traditional foods systems to improve their nutrition and to promote biodiversity for sustainable agriculture.
- Host regional- and country-level roundtable meetings with representatives of multisectoral ministries and partner agencies; conduct mapping exercises for effective coordination and resource mobilization for the necessary actions to promote quality diets and to tackle both malnutrition and NCDs.

b. Increase knowledge and awareness of linkages between agriculture and nutrition

The Caribbean Development Bank can advocate for the role of agriculture and food in addressing problems of malnutrition, particularly for smallholder farmers and rural women.

- Capacity at the Ministry of Agriculture: Increase nutrition knowledge at the policy level by incorporating nutrition experts and training into agriculture policy decision-making.
- Linkages between nutrition agriculture: More evidence is required to demonstrate the impact of agriculture policies and investments on nutrition outcomes in the region; data collection and impact analysis needs to be emphasized.
- Incentivize produce reformulation to reduce unhealthy ingredients in the processing stage.
- Build more awareness towards unhealthy ingredients for food processing, food and products.

▶ Food price policies for promoting healthy diets

▶ Healthy diets are often less affordable than unhealthy diets, and high prices for nutritious foods (e.g. fruits, vegetables and animal source foods) are one of the main barriers that prevent vulnerable populations from adopting healthy food choices. In this context, **food price policies** have the potential to create incentives for increasing the supply of, and demand for, nutritious food products. Countries have traditionally used subsidies, imports and price ceilings to keep staple foods, such as bread and rice, affordable; however, research shows that untargeted subsidies on staple foods are expensive to maintain and risk increasing overweight and obesity. Food price policies to promote healthy diets can be introduced to the region to encourage the consumption of healthy and nutritious foods and discourage the consumption of certain highly processed, sugar-rich products.

Potential entry points for interventions for CDB:

Single and short-term price changes focusing on one or few foodstuffs might have limited effects on a population's diet. Creating an enabling environment to achieve long-term impact requires a coherent package of policies and investments, including the following: agriculture policies; subsidies; taxation laws; investments in infrastructure for healthy foods; financial incentives and disincentives to business, including for food loss and waste prevention and reduction; education campaigns aimed at the population; and other measures.

- Subsidies for selected nutritious foods can increase the affordability of healthy diets or incentivize purchase. These subsidies might be at various levels: production (e.g. agricultural subsidies); retail (e.g. subsidies to facilitate the establishment of markets for fresh food supermarkets and shops in poor and underserved neighborhoods); catering (e.g. for lowering the cost of healthy meals at the workplace); consumption (e.g. vouchers for fresh foods).Advocate to eliminate subsidies and other production or price support measures for the production of unhealthy

ingredients for processing. Well-designed and well-targeted consumer information campaigns, which stimulate demand for nutritious foods, shall be accompanied by the introduction of subsidies. Taxes on ultra-processed foods (e.g. sugar-sweetened drinks) can also be used to increase prices and restrict consumption.

▶ Food quality, safety and hygiene

>> Box 15. Codex Alimentarius Commission – Food standards

Codex Alimentarius Commission develops internationally recognized food standards, guidelines and codes of practice that contribute to the safety and quality of the food trade. While private food safety standards play an increasingly important role, national legal frameworks, which establish minimum safety and quality requirements, are the foundation for national food control.

These should build on well-established international codes and standards developed by the Codex Alimentarius Commission that promote practices such as Good Agricultural Practices, (GAP), Good Manufacturing Practices (GMPs), Good Hygienic Practices (GHP) and Hazard Analysis and Critical Control Point (HACCP).

See: www.fao.org/fao-who-codexalimentarius/en/

Potential entry points for interventions for CDB:

To ensure synergetic and holistic approaches, ***CDB*** can liaise with relevant actors and support their efforts, especially the SMEs, in terms of compliance capacities with regulation, without compromising consumer health and safety. It is further recommended to ensure a regional harmonized approach to food controls to facilitate trade by linking with the Caribbean Agricultural Health and Food safety Agency (CAHFSA).

Risks related to food safety and hygiene need to be controlled all along the food supply chain, from production to processing, trade, preparation and consumption. A risk-based rather than a hazard-based food control approach allows for better resource allocation. Risks can be mitigated at various points of the supply chain, including through the following: reduced pesticide use in cultivation and antibiotics in animal production; the prevention of harvest contamination by animals; implementation of basic sanitation; air circulation and humidity controls in storage and processing facilities; aflatoxin control; improved hygiene and safety practices of street food vendors; and the delivery of messages to households with regard to safe food handling and preparation.

4.3 Area 3: Promote research and innovation, education and training and an enabling agri-business environment

Targeted outcomes	Knowledge products; increased innovation
Instruments	Capacity building through TA grants and loans; economic and sector work

▶ Agriculture research and development

Agriculture research affects the relative profitability of different crop choices, farmer decision-making, and consequently, the relative prices of the raw material supply to food systems which

likely influences the processed food produced.[36] In collaboration with partner agencies, CDB can explore:

- Incentivizing more public sector research on high-quality and underserved foods (legumes, fruits, vegetables) to increase productivity and shift relative prices;
- Ensuring that cereal research and the provision of inputs include a nutrition focus, and not just a yield focus, and that results are communicated to producers; and
- Encouraging private sector advances in research favouring high-quality and underserved foods.
- Agriculture extension and information services

>> Box 16. Innovation for reshaping food systems – "Food for the Future": Rikolto and the University of Leuven

Rikolto, in collaboration with the University of Leuven together with young people, experts, and farmers, look for ways to feed the growing global population in a sustainable way.

The initiative looks for tasty and nutritious products from developing countries that have a low environmental impact and, at the same time, offer the farmers producing the products new opportunities.

Criteria: nutritious and healthy; ecologically sustainable and climate-proof; economically viable; relevant to the development of the local market in the South; social, economic or ecological added value for the local producer; added value for the Belgian consumer; complementary to products from the North; ecological, economic and/or social innovation.

See: www.rikolto.be/en/project/food-future

Extension agents, both private and private, often provide good coverage and direct links to famers and rural households. By incorporating food security and nutrition modules, an agriculture extension training curriculum can increase nutrition knowledge at the local level. Further, in conjunction with the health sector (e.g. Ministry of Health), social marketing and nutrition education, which can promote and advertise nutritional benefits and potential problems, can be included to improve and raise awareness among local consumers (through nutrition-sensitive Farmer Field Schools – with FAO and IFAD as partners).

36 World Bank, *An Overview of Links between Obesity and Food Systems – implication for the food and agriculture global practice agenda* (2017).

>> Box 17. Rwanda – World Bank Transformation of agriculture sector programme phase 3-PforR

Nutrition considerations are taken into account throughout the project components and translated into concrete activities according to the different impact pathways.

- The project offers several entry points to mainstream nutrition, given the focus on different and nutrition-relevant value chains, such as meat, dairy and fishery as well as food safety of staple crops.
- Regarding nutrition education and behavioural change communication initiatives, communication will be delivered using different channels and using cross-sectoral collaboration; this will help to amplify the message and possibly reach out to the larger population – those who are not directly involved in the activities of the project.
- The involvement of agriculture and health extension workers is essential to reach out to the most remote communities and ensure sustainability in the project's results in the long run.

Source: World Bank.

See: http://projects.worldbank.org/P148927?lang=en

▶ Nutrition education and behaviour change communication

Effective nutrition knowledge and ***awareness building*** can be an important factor for demand creation for high-quality, safe and nutritious foods. It can ensure that increased food production/ income translates into improved diets and improved nutrition status. Many causes of poor nutrition are rooted in attitudes and practices that can be influenced by education: socio-culturally rooted food taboos, long-established dietary and snacking habits, agricultural production decisions, food distribution in the family, ideas about child feeding, misleading food advertising, ignorance of food hygiene or negative attitudes towards fruits and vegetables.

Potential entry points for interventions for CDB:

The Caribbean Development Bank can be the leading catalyst to facilitate the school-based immediate actions, in collaboration with existing networks and collaborative partnerships with relevant ministries and agencies. Along with partner agencies, CDB can promote relevant investment in the form of nutrition education components or farmers' training (e.g. Farmer Field Schools). Together with partner agencies, CDB can promote national FBDGs which can underpin public food and nutrition, health and agricultural policies and nutrition education programmes to foster healthy eating habits and lifestyles.

– School food and nutrition programmes to promote diversified diets (school lunch through local procurement from smallholders, school gardening, etc.), which can involve teachers, parents and the community. Further, regulate or limit access to unhealthy foods in the school environment.

– Agriculture project interventions to incorporate nutrition education and promote the consumption of healthy foods and the related nutrition impacts of healthy food choices. Interventions can also incentivize households to diversify their production and retain more food for their own consumption, with the involvement of agriculture and health extensionists.

▶ School food and nutrition

Potential entry points for interventions for CDB:

– Nutrition education and training to promote healthy eating habits. Hands-on activities, such as school gardening, can be leveraged within comprehensive and culturally appropriate nutrition and health awareness programmes that provide opportunities to learn about hand washing, personal hygiene, food safety and physical activity. Training on nutrition, food safety and other relevant topics also needs to be provided to food service personnel involved in procuring, storing and preparing food in schools.

4.4 Area 4: Support the coordination and implementation of complimentary policies that promote improved nutrition

Reduction in trade costs; access to high-value markets; improved water resource management
Investment loans; PPPs; technical assistance; subsidies; equity

▶ Trade for nutrition

Trade and trade policies can promote better nutrition, but can also have negative nutritional outcomes. For example, freer trade broadens food choice, thus promoting a more diversified diet, but, at the same time, it is associated with the increased availability of cheaper foods characterized by high calorie and low nutritional content, which can lead to an increased incidence of obesity and other diet-related chronic diseases. The links between trade policies and actions designed to address malnutrition are complex and generate considerable controversy. In a context of globalization, urbanization and increased market reliance, looking at trade through a nutrition lens is increasingly important for maximizing benefits and reducing risks.

>> Box 18. Brazil – Zero Hunger

Brazil – Zero Hunger (Fome Zero) is a Brazilian government programme with the objective to eradicate hunger and extreme poverty in Brazil. The programme is coordinated by the Ministry of Social Development and Hunger Combat and puts into action the government's strategy to guarantee the right of access to basic food.

The programme takes a number of forms, ranging from direct financial aid to the poorest families (*Bolsa Familia*) to diverse strategies, such as creating water cisterns in Brazil's semi-arid areas, creating low-cost restaurants, educating people about healthy eating habits, distributing vitamins and iron supplements, supporting subsistence family farming and giving access to microcredit.

1. **Brazil's Food Acquisition Programme (Programa de Aquisição de Alimentos, PAA)** was created in 2003. The PAA allows the public purchase of food items for targeted family farmers, without a competitive bidding process, for distribution in the social assistance network and to build a strategic food reserve.
2. **National School-Feeding Programme (Programa Nacional de Alimentação Escolar, PNAE**) is aimed at fulfilling the nutritional needs of students as well as teaching healthy eating habits. In order to ensure the connection between school feeding and family farming, the regulations now require that 30 percent of the school-feeding budget be used for purchasing family farming production.

See: www.fao.org/3/a-i3023e.pdf

Potential entry points for interventions for CDB:

The Caribbean Development Bank can assist in stronger institutional capacities and governance mechanisms to enable not only joint analysis, but also greater coordination in the implementation of complimentary polices; CDB can also provide an enabling environment for negotiation between ministries (nutrition/health, trade and agriculture) to expand the policy space for nutrition action in trade agreements.

- Lowering trade barriers for fruits and vegetables has great potential to improve nutrition through increasing their availability in importing countries, especially in counter-seasonal periods.
- Increased import tariffs and import bans on some "unhealthy" foods have been used in some Pacific Islands in response to the obesity epidemic, along with lowered tariffs on specified "healthy foods".

▶ Food marketing and advertising practices

The way that food is sold to consumers is changing. Supermarkets and fast food restaurants are rapidly spreading, particularly in urban areas. Transformations in the retail environment are accompanied by increased use of food advertising and promotional strategies to encourage consumers to buy more industrialized food products, including ultra-processed foods that are high in sugars, fats and salt. This results in increased exposure to obesogenic diets. Understanding the impact of marketing and advertising on consumer preferences, eating habits, diets and nutrition is crucial to designing policies and strategies that can shape healthy food environments and leverage both traditional and modern retail sectors to facilitate the consumption of healthy diets.

>> Box 19. Samoa – Agriculture competitiveness enhancement project

The project aims to support fruit and vegetable growers and livestock producers to improve their productivity and take greater advantage of market opportunities.

- Both commercial as well as subsistence-oriented farmers are targeted since malnutrition is likely to be a challenge for both groups.
- Animal Source Foods and fruits and vegetables are key to addressing malnutrition; these value chains have been selected with the purpose of improving diets.
- Proposed awareness raising/Behaviour Change Communication will be important during implementation to sensitize consumers about the benefits of consuming fruits and vegetables. Overweight and obesity are major health issues in Samoa.
- The project could join forces with the existing health project in the country.

Source: World Bank.

See: http://projects.worldbank.org/P115351/samoa-agriculture-competitiveness-enhancement-project?lang=en

Potential entry points for interventions for CDB:

The Caribbean Development Bank can facilitate an enabling environment by promoting farmers' markets, small shops and traditional retailers and caterers. Public support aimed at these small and medium enterprises can create a more balanced retail environment where the healthy choice becomes the easy choice (e.g. purchasing the right quantity of foods, choosing fresh

over ultra-processed items). The Bank can also promote international standards, such as the Set of Recommendations on the Marketing/advertisement of Foods and Non-alcoholic Beverages to Children, and the International Code of Marketing of Breastmilk Substitutes; it can also provide guidance to develop policy recommendations at national level.

- **Establish subsidy schemes for healthy foods**, which can encourage street food vendors and other caterers to reformulate their recipes and use healthy ingredients (especially if trained to do so – for example, through training in food preparation).
- **Restrict the advertising and promotion of foods and beverages that are high in fats, salt and sugars** to children and adolescents, which can help to limit their exposure to, and curb the power of, marketing.
- **Link local food production to social safety nets, food aid programmes and school feeding initiatives**, and create incentives for the market to sustain agricultural investments in food quality.
- **Support and include market analysis** (or tie up with the private sector and consumer associations) to understand consumer behaviour, which can assist in better identifying or prioritizing value chain interventions.

► Women's empowerment and gender equality (see the Annex on Gender and Youth)

In the food and agriculture sector, gender equality refers to the equal participation of women and men as decision-makers in rural institutions, and to equal access to productive resources, assets, decent employment opportunities, income, goods and services for agricultural development and markets. The pathway from women's empowerment to improved nutrition consists of three interrelated components: women's use of income for food and non-food expenditures; women's ability to care for themselves and their families; and women's energy expenditure.

Potential entry points for interventions for CDB:

The Caribbean Development Bank can assist in ensuring that projects take women's nutrition into due consideration, including women's nutritional requirements (especially during pregnancy and lactation), nutritional risks, and stress linked to women's multiple responsibilities as producers, wage earners, caregivers, and more.

- Targeting women for income-generating opportunities and ensuring equitable access to decent employment as well as extension, rural advisory and financial services, and control over earned income are important.
- Nutrition education for vulnerable families could significantly contribute to solving the nutrition problems of the region, as the primary problem is not quantity, but rather quality of the caloric intake. Given their direct link with the nutrition status of the family, women should be at the center of nutrition education and extension programmes.
- Cooking and nutrition education in school curriculum or during training within community-driven projects or rural development projects can be effective.

>> Box 20. Brazil – Bahia Sustainable Rural Development Project

A specific focus on **women's empowerment** through the CDD approach led to solid gender disaggregated data. The allocation of matching grants to social and environmental sub-projects prioritized the proposals from women's producer organizations.

- Access to markets is promoted by the "market-oriented sub-projects". The three value chains, which were previously analysed, are nutrition-sensitive apiculture, fruit, and goat and sheep.
- As the project development objective was to improve food security, various implicit pathways were introduced to improve nutrition: agriculture production and diversification; food environment (access to markets/value chains by the most vulnerable groups); increased incomes; women's empowerment; and water and sanitation.

Source: World Bank.

See: http://projects.worldbank.org/P147157?lang=en

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