Regional Synthesis of ICT Uptake and Usage in Agricultural Value Chains in the Caribbean

A Component of the CTA/CARDI Project:

Strengthening ICTs in Value Chains in the Caribbean – Study and Promotion

Produced by:
Infocomm Technologies Ltd.

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BDS – Barbados GUY – Guyana
JAM – Jamaica SKN – St Kitts and Nevis
TT – Trinidad and Tobago

Acronyms and abbreviations

ABIS	Agricultural Business Information System (Jamaica)99
ACP	African, Caribbean and Pacific Group of States
ACS	Association of Caribbean States
ADS	Agricultural Development Strategy
AMIS	Agriculture marketing information service
BADMC	Barbados Agricultural Development and Marketing Corporation
BAS	Barbados Agricultural Society
BBM	BlackBerry Messenger
BDS	Barbados
BGSFA	Barbados Goat and Sheep Farmers' Association
BTU	British thermal units
BVI	British Virgin Islands
CARDI	Caribbean Agricultural Research and Development Institute
CARG	Compound annual growth rate
CARICOM	Caribbean Community
CCCCC	Caribbean Community Climate Change Centre
CCRIF	Caribbean Catastrophic Relief Insurance Facility
CCTV	Closed-circuit television
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CFC	Common Fund for Commodities
CIB	Coffee Industry Board
CIDA	Canadian International Development Agency
CIMH	Caribbean Institute for Meteorology and Hydrology
CPGCA	Christina Potato Growers Cooperative Association
CRM	Customer relationship management
CTA	Technical Centre for Agricultural and Rural Cooperation
CUG	Closed user group
CWA	Caribbean Week of Agriculture
DOA	Department of Agriculture
DRM	Disaster risk management
EPA	Environmental Protection Agency
ESCAP/CICT	Economic and Social Commission for Asia and the Pacific/Committee on

	Information and Communications Technology
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GAPA	Guyana Agricultural Producers Association
GDP	Gross domestic product
GGBA	Guyana Goat Breeders Association
GIS	Geographical information system
GLDA	Guyana Livestock Development Agency
GMC	Guyana Marketing Company
GSA	Guyana School of Agriculture
GUY	Guyana
ICT	Information and communication technology
IDB	Inter-American Development Bank
IHP	Internet household penetration
IICA	Inter-American Institute for Cooperation on Agriculture
IM	Instant messaging
IPPC	International Plant Protection Convention
ITU	International Telecommunications Union
IVR	Interactive voice recording
JAM	Jamaica
JAMIS	Jamaica Agricultural Marketing Information System
JAMPRO	Jamaica Promotions Corporation
JAS	Jamaica Agricultural Society
JGFA	Jamaica Goat Farmers' Association
JLA	Jamaica Livestock Association
JSFA	Jamaica Sheep Farmers Association
KPI(s)	Key performance indicator(s)
LNG	Liquefied natural gas
LSC	Land Survey Commission (Guyana)
MFCL	Ministry of Fisheries, Crops and Livestock (Guyana)
MMS	Multimedia messaging service
MoA	Ministry of Agriculture
MoAF	Ministry of Agriculture and Fisheries
MOH	Ministry of Health
MSMB	Mona School of Business and Management (Jamaica)
MSMEs	Micro-, small- and medium-sized enterprises
NAHFCP	National Agricultural Health and Food Control Programme

NAMDEVCO	National Marketing and Development Corporation (Trinidad and Tobago)
NAMIS/NAMISTT	National Agricultural Market Information System for Trinidad and Tobago
NAREI	National Agriculture Research and Extension Institute (Guyana)
NDIB	National Drainage and Irrigation Board (Guyana)
NGMC	New Guyana Marketing Corporation
NGO	Non-governmental organisation
NOW	Network of Women for Food Security (Jamaica)
OECS	Organisation of Eastern Caribbean States
OLPF	One Laptop Per Family
PA	public address
PEST	Political, economical, social and technological
RADA	Rural Agricultural Development Authority (Jamaica)
RFID	Radiofrequency identification
SALIS	State Agricultural Land Information System (Trinidad and Tobago)
SHOCS	Strengthening of Hydro-meteorological Operations and Services in Caribbean SIDs
SIDs	Small Island Developing States
SKN	St Kitts and Nevis
SKFCS	St Kitts Farmers' Cooperative Society
SMS	Short Message Service
SRC	Scientific Research Council (Jamaica)
TDC	Trade and Development Company
TT	Trinidad and Tobago
TTABA	Trinidad and Tobago Agribusiness Association
TTSGFA	Trinidad and Tobago Sheep and Goat Farmers' Association
UK	United Kingdom
UN	United Nations
USA	United States of America
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UTECH	University of Technology (Jamaica)
UTT	University of Trinidad and Tobago
UWI	University of the West Indies
VoIP	Voice over Internet Protocol
WEF	World Economic Forum
WINDALCO	West Indies Alumina Company (Jamaica)
WTO	World Trade Organisation

Message from the Partners

The Caribbean Agricultural Research and Development Institute (CARDI) and the Technical Centre for Agricultural and Rural Cooperation (CTA)are pleased to present the *Regional Synthesis Report of ICT Usage and Uptake in Agricultural Value Chains in the Caribbean*. This report presents an overview of ICT usage and profiles in the Region subsequent to investigations conducted in 2013 in five countries, Barbados, Guyana, Jamaica, St Kitts and Nevis and Trinidad and Tobago, as part of a CTA/CARDI project entitled **'ICTs in Agricultural Value Chains in the Caribbean – Study and Promotion**'. The main purpose of this collaborative project is to increase the productivity of agricultural value chains in the Caribbean through meaningful integration and engagement of micro-, small- and medium-sized enterprises (MSMEs) through information, communication, technology (ICTs) applications.

Over the last 40 years of agricultural research and development activities in the Region, CARDI has maintained a robust programme of strong linkages with like-minded organisations. For the last 28 years, one such organisation has been CTA, with a complementary mandate to CARDI's, especially in the areas of information management and transfer.

Both institutions have seen many changes in the structure and emphasis of agricultural development. One newly emerging strategy is the integration of ICTs in agricultural value chains as a means of disseminating information. This development requires the validation of the integration of ICTs into the agricultural sector. Fortunately, the option of widespread integration of ICTs in the Region's food production and marketing systems is attractive due to their increasing affordability and availability which places them within reach of the majority of CARDI's and CTA's MSME stakeholders.

Discussions between CTA and CARDI on a viable strategy to support such integration indicated that the first critical step was to determine how ICTs are being used among our client stakeholders and what factors impact on their decisions to use ICTs. We also decided to capture any innovative use of ICTs by Caribbean stakeholders, which could influence successful ICT integration with the Region's agricultural sector. To authenticate the findings of the investigations, they were subjected to an intensive consultative process or validation and the generation of proposals to upscale 'usage' and the determination of supportive policies.

It is our sincere hope that this regional synthesis will (a) provide a platform of baseline information (b) highlight specific areas of stakeholder needs and infrastructural challenges and (c) offer useful analyses and comparisons. As such it will be a valuable resource for policy makers in the fields of agricultural development and communication which could be used to guide the development of ICT based interventions for increasing agricultural productivity in the Region. The ultimate beneficiary will be the Caribbean people whose livelihoods will be improved.

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Executive summary

The Caribbean Agricultural Research and Development Institute (CARDI) with support from the Technical Centre for Agricultural and Rural Cooperation (CTA) commissioned a Trinidad-based consulting firm (Infocomm Technologies Ltd.) to conduct a regional study on ICT usage in Caribbean agriculture value chains, with a specific focus on the value chains associated with domestically produced root crops and small ruminants (sweet potato and cassava and sheep and goats, respectively). The targeted value chains were: (1) fresh use and primary processing enterprises for cassava and sweet potato and;(2) meat (lamb, mutton and chevron) for sheep and goats. The use of ICT in the broader agricultural value chains, irrespective of commodities, was also investigated. This study was part of a larger CTA/CARDI project that aimed to strengthen agricultural value chains through increased ICT integration within the agricultural sectors of the region.

The study focused in particular on the discovery of the actors and associated ICT usage within the targeted value chains in each of the five focal countries (Barbados, Guyana, Jamaica, St Kitts and Nevis and Trinidad and Tobago). In addition to a comprehensive review of available documentation, the team met with actors along these two targeted value chains. The categories of respondents interviewed were input suppliers (40%), producers (31%), post production (12%), marketing stakeholders (12%) and consumption (5%).

This report presents an amalgamation and analysis of national findings as well as a synthesis of ICT usage and uptake in agricultural value chains in the Caribbean, with innovative uses highlighted and the inclusion of some appropriate international best practices, which could serve as a reference for the region. The report also presents a comparison of e-readiness findings of the focal countries. e-readiness is defined as the ability and preparedness of the agricultural sector to use ICT for its modernisation. Additionally, elements for a regional e-agricultural strategy are proposed and a case is made for the need for a harmonised approach for the development and implementation of any proposed ICT integration strategy.

The report is intended as a basis for recommending and undertaking appropriate policies, strategies and actions to be implemented both at the national and regional levels for increased ICT integration within the regional agricultural sector. African, Caribbean and Pacific (ACP) States that have similar characteristics can leverage the findings of this report as a guide to develop ICT capacity for their own agro-sectors and value chains.

Study methodology

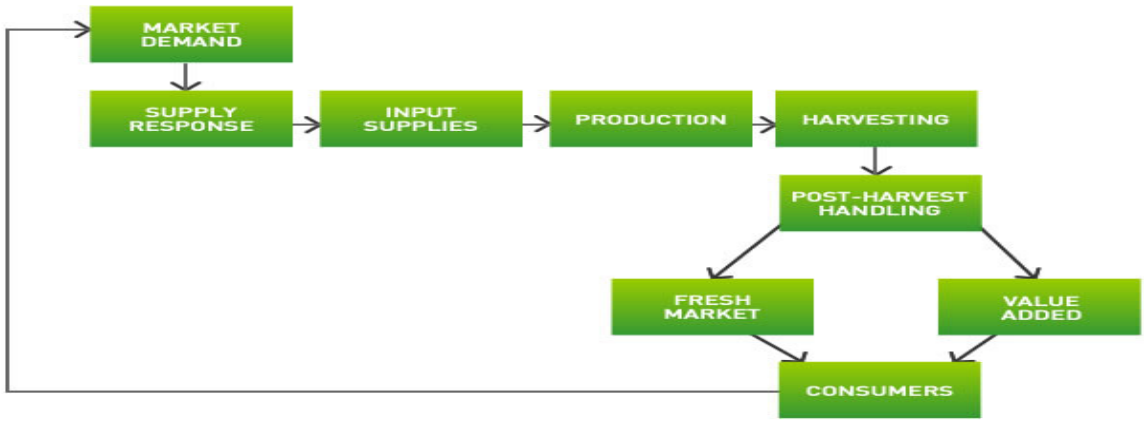
The logical project structure of the study, which was developed with stakeholder input, required the following activities and outputs from the study:

- the identification and mapping of the actors within the nodes of the root and tubers and small ruminant value chains in each focal country;

- an in-depth analysis of each node of the target value chains in each focal country for the determination of ICT use;
- capturing and recording innovative ICT use and the identification of best practices in the broader agricultural sectors;
- e-readiness analyses for each focal country with correlation to ICT usage in agriculture;
- cross-analysis among the five focal countries with benchmarking regional use with international best practices.

The selection of the methodologies used by the study was guided by the logical project structure and an appreciation of the high degree of interdependency and connectivity that characterises successful value chains. It was therefore decided that the investigational framework would use a value chain model that illustrates the defining features of a value chain and would facilitate:(1) the identification of the individual nodes;(2) an agreement on the location and function of these nodes; and (3) an appreciation of the value of information procurement, transfer and storage at all levels within the value chain.

The CARDI value chain model (see below) was used to as a guide to develop a more study –specific models to facilitate mapping the two target value chains.

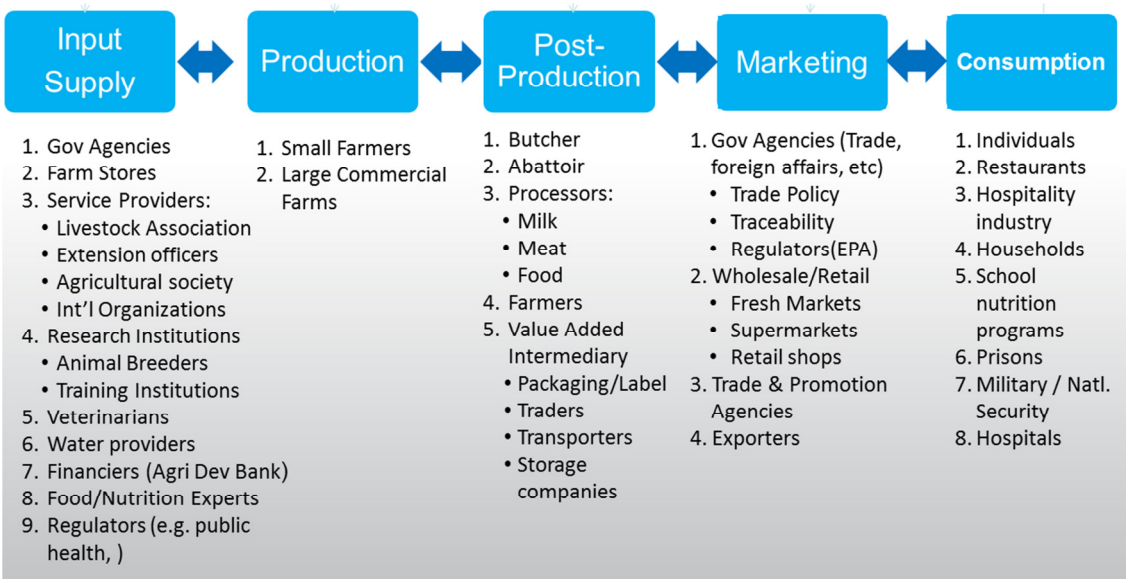


The CARDI value chain model

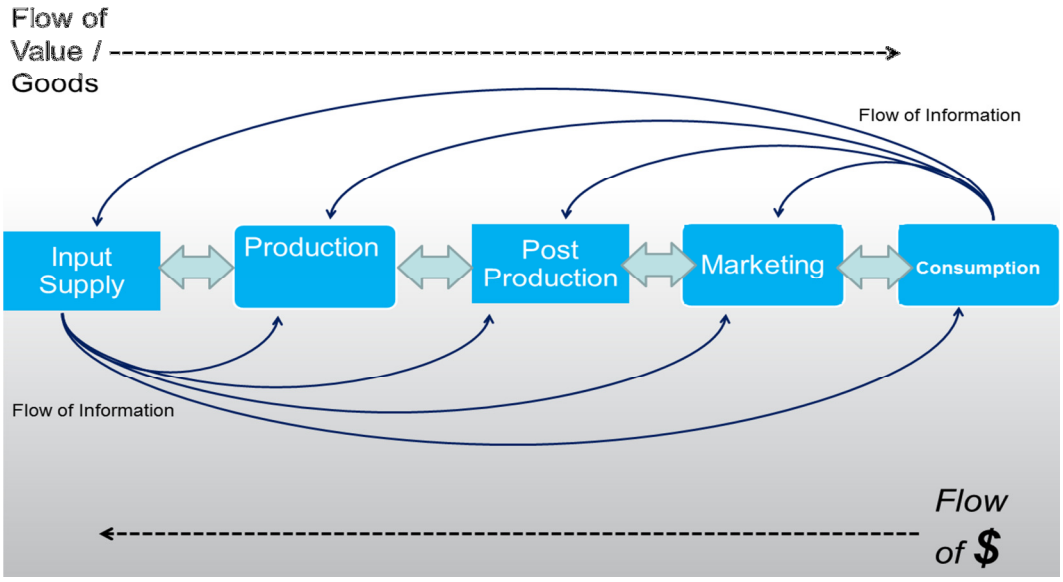
Preliminary investigations indicated that with regard to the two target value chains, the key value chain nodes are

i) Input Supply, ii) Production, iii) Post Production, iv) Marketing and v) Consumption.

Consequently, two study-specific models were generated which facilitated the stakeholder-interview process. See below -Study-related value chain model 1 and Study-related value chain model 2.



Study-related value chain model 1, highlighting nodal chain categories.



Study-related value chain model 2, highlighting the flow of information, the flow of capital and the flow of value.

Study related investigations were carried out through

- **engagement with the in-country support team comprising** national focal points (stakeholders with extensive knowledge of the domestic state of affairs on the targeted value chains and ICT usage) and in-country CARDI personnel;
- **a desk study** which included internet research and reviews of available documents;
- **country visits** by the consultants to each of the five focal countries for face-to-face interactions and confirmation of data procured by desk study and the gathering of additional information;

- **expert stakeholder feedback** for validation of findings, recommendations for strategies and pilot projects. The complete drafts of all reports (i.e. the five country reports, the ICT directory and this regional report) were the subject of a two-day seminar during the Caribbean Week of Agriculture (CWA) 2013 in Guyana.

To facilitate the further analysis of the information gathered from the study countries, the Infocomm Technologies Ltd. e-Readiness framework was used. This framework assesses the current level of sophistication of ICT use within a sector, industry or organisation and assesses its preparedness to use ICTs to achieve operational effectiveness and efficiency gains and to improve information collaboration and management capacities. The e-readiness assessment was executed in the following five core areas:

- business environment
- governance
- human resource capacity
- psychographics
- infrastructure.

Agriculture in the Caribbean

Agriculture remains an important sector for the 20 members and associate member States of the Caribbean Community (CARICOM) despite the economic diversification thathas taken place over the last four decades (particularly with the growth of service industries, notably tourism and financial services). The study focused on determining the main factors which impact on the performance of the agricultural sector as reported by the stakeholders.

The study found that, apart from the more established/traditional commodities (such as poultry, banana, sugar cane, rice and cattle) the following realities largely characterise agricultural value chains in the Caribbean – particularly for smallholder farmers:

- farmers produce commodities that are 'pushed 'into the marketplace (supply push).
- farmers are generally isolated from the majority of end consumers, particularly from the larger, more sophisticated, consumers (e.g. hotels, large restaurants, cruise ships) and their associated demand preferences (with regard to quality, size, quantities etc.).
- famers have little control over input costs or prices received for their goods.
- generally, there is a direct link to the consumer only where farmers sell produce in local markets.
- farmer/producer production quantities are constrained by the capacity in the local market.
- farmers/producers tend to receive minimal profit; farmers often complain of 'gluts' in the market and associated low prices.
- economic transactions between actors, or between nodes, tend to be independent of any awareness of what is happening in the wider value chain.
- there is little (or no) production scheduling in some countries (particularly for the focal commodities).
- There is insufficient (or a complete lack of) processing facilities, as well as inadequate storage facilities.

- Research and development is focused on production and on reducing the costs of production.
- There is little (or insufficient) consumer education.

The exploitation of opportunities in the regional market is hampered by issues related to availability and cost of transportation, presence of non-tariff restrictions and poor facilities for storage and handling, amongst other things.

The agro-food subsector is growing through intra-regional trade due to increasing cross-border investment in manufacturing industries

ICTs in the Caribbean

The Caribbean displays some of the highest mobile service penetration rates in the world. According to ITU data releases in 2011, mobile phone subscription rates in some Caribbean States are close to 166%, compared to 128% in Europe, 104% in the United States of America and 76% in China. Information presented in the World Economic Forum's (WEF) *Global Information Technology Report (GITR) 2013* suggests that mobile network coverage across the region averages between 95 and 100%.

Investigations determined that while mobile service penetration is high, ICT integration in the agricultural sector is limited and not familiar to the majority of stakeholders.

The study proposes that the issues of ICT capacity in the Caribbean must be considered when designing and implementing plans and strategies to support the advancement of regional agriculture. Such items to be considered include: the state of mobile voice and data services; broadband deployment; the availability of digital repositories of agricultural data; and the human capacity of the various key actors in the agro-food space.

ICT usage in the value chains

- **Weak integration of ICTs in roots and tubers and small ruminant value chains**: There is little usage of ICTs in the roots and tubers and small ruminants value chains. This may be because these value chains primarily involve smallholder famers producing for their own or local consumption. ICT usage is stronger, although still weak, in value chains for international export commodities and in the hospitality industry (use of procurement management systems, inventory management software, etc.). However, it has also been observed that many ICTs are not commodity specific.

  At the production level, the main ICTs used are mobile applications used by extension services. Institutions such as the Rural Agricultural Development Agency in Jamaica and the National Agricultural Marketing and Development Corporation in Trinidad and Tobago, are working in this area. In the marketing/trade segment, the public sector is also using mobile phones to disseminate price and other market information. However, such services are facing a number of challenges in scaling-up, including how to pay the telecom costs in the long-term. Advocacy for these services to be considered as public goods has yet to bear fruit.

- **Increasing experimentation with ICTs and mobile applications**: Despite current weaknesses, use of ICTs in agriculture is increasing. Agricultural institutions are improving their websites, moving beyond providing mere administrative information. Cooperatives and other agricultural stakeholders (such as the Trinidad and Tobago Agri-Business Association and the Caribbean Poultry Association) are using Facebook, YouTube and blogs. Mobile applications are being used for fisheries (mFisheries) and livestock. E-commerce platforms such as TTGrocery.com, Trini Trolley and D'Market Movers are connecting consumers with markets in Trinidad and Tobago. Extension workers and input suppliers are using messaging applications (e.g. WhatsApp and BlackBerry Messenger) to connect with peers. These are just some examples of innovative ICT use in the Caribbean.

- **Trinidad and Tobago and Jamaica lead ICT usage in agriculture**

  ICT usage in the value chains studied is most pervasive in Trinidad and Tobago, where end-users have widespread access to affordable mobile and broadband internet. Several ICT-based services have been developed specifically for the agro-food sector. What the country lacks, however, is appropriate governance structures that allow the services to drive greater value in the value chains and hence boost usage of the agro-food-sector ICT services that are available.

  Jamaica had the second highest usage of ICTs in the agro-food sector. Like Trinidad and Tobago, Jamaica has a number of ICT-enabled services developed specifically for the sector. Jamaica has also implemented governance frameworks that facilitate information gathering and dissemination. However, producers still lack the ability to access the services that are currently in place.

  ICT usage in Barbados is somewhat comparable with that in Trinidad and Tobago and Jamaica. Value-chain stakeholders are taking advantage of the nation's connectivity infrastructure, personal devices and software to benefit their activities. Unlike Jamaica and Trinidad and Tobago, however, Barbados does not have substantial ICT-enabled services specifically for the agro-food sector.

  Guyana has developed some ICT services for the agricultural sector, but uptake and usage are limited by the weakness of its infrastructure. Because of its relatively large landmass, connectivity infrastructure is more limited and many producers cannot afford the cost of access. Guyanese input suppliers, however, especially in the public sector, have taken advantage of the mobile technologies available, maximising use of the devices and connectivity available.

  St Kitts and Nevis has the lowest ICT usage of the study countries. Apart from the Ministry of Agriculture's website, no ICT services specifically for the agro-food sector have been identified. Producers and other value-chain stakeholders make little use of ICTs to support their activities.

e-Readiness: analysis and findings

National findings on ICT usage and uptake were subjected to analysis utilising the Infocomm Technologies Ltd. e-Readiness framework. The framework was used to make an assessment in five core areas at the country level, of preparedness to use ICTs to achieve operational effectiveness and efficiency gains in the agricultural sector.
The major findings are reported below:

1. Business environment

Across all five countries, the business environment is faced with issues of mistrust between value chain stakeholders, particularly between producers and State sector input suppliers and sometimes with marketers. There were incoherent structures for information-sharing within and between State institutions and to some extent with the public.

Jamaica and Trinidad and Tobago are the two territories that stand to gain the most by successfully implementing ICT services to connect their producers to markets. Both countries have large market opportunities (agro-processing, tourism, domestic consumers and export markets) that they can exploit. These two countries also have the land resources to more consistently meet the opportunities, unlike the smaller territories (Barbados and St Kitts and Nevis).

2. Governance

Across all five territories, there is a coherent set of strategies and organisational structures to govern the agri-sector and execute sector policy. However, as it relates to information gathering, collation, sharing and dissemination, there is a general lack of predictability. There are incoherent structures for information-sharing within and between State institutions and to some extent with the public. Many stakeholders are not entirely sure of where to get certain kinds of sector-specific information and who the responsible stakeholders are. These are challenges that will need to be resolved; this will facilitate the sharing of timely and accurate data/information through ICTs.

3. Human resource capacity

Human resource needs vary significantly across the five study territories. In all territories, except for Jamaica, there is a critical need for skilled ICT personnel within the State sector – both technical ICT resources (to design, implement/install, configure and maintain ICT systems) and strategic ICT resources (to develop ICT strategy, policy, legislation and turn strategic goals into system requirements). Further, there is the need for training current State sector personnel at the strategic, technical and end-user levels. Also, training activities for producers and other value chain stakeholders will be necessary to inject capacity to benefit the functioning of the Guyana agriculture value chains. In general, the weakest link in ICT capacity rests with the production node, especially with regard to smallholder farmers.

4. Psychographics

Across the study countries, there is a willingness to learn about and apply new innovations and technologies that can lead to sector benefits. The Jamaican State sector appears to be the most interested in applying new technologies and innovations. There is also a demonstrated understanding of the link between ICTs and national productivity by influential State sector personnel and the business community. This is less true of St Kitts, Barbados, Guyana and Trinidad. Smallholder farmers are generally less interested in technology (with the possible exception of Trinidad); on a cognitive level,

they believe it represents the future, they do not see the practical link between up-skilling their ICT literacy/skill and achieving enhanced livelihoods.

5. Infrastructure

All five territories possess the minimum network infrastructure to support ICT systems and services that can advance the sector. Barbados, Guyana and St Kitts and Nevis are lacking in the number and quality of e-services available to the agro-food sector. For these countries it will be necessary to develop the services that can provide a rich set of timely data and information to all relevant stakeholders. Jamaica and Trinidad and Tobago offer an array of e-services that supply relevant information to most value chain stakeholders. The challenge of Jamaica and Trinidad is to ensure that systems are in place to ensure that the information and data supplied is up-to-date and that it is adapted to the needs and dispositions of the target stakeholders. Also, further development of the current services is necessary to match buyer and seller opportunities online.

Policy and strategy recommendations

Several recommendations were identified through the research and some project ideas that aim to address the challenges identified are presented in the report. The recommendations were also presented to a representative cross-section of regional stakeholders at a validation and follow-up workshop held in October 2013 at the 2013 Caribbean Week of Agriculture in Guyana. Project ideas have also been discussed and are included in the report.

The key recommendations are:

- *Increase awareness of the benefits of applying ICTs in the agricultural sector*– Overall, the deployment and use of ICTs in the regional agricultural sector is not pervasive. In order to take advantage of the potential of ICTs to assist with value chain communication, coordination and enhancement, there is a clear need to communicate with agri-sector value chain stakeholders about the role of ICTs in developing the Caribbean agri-business sector.

- *Build ICT human capacity*– The current constraint to deeper, more pervasive, technology usage can be mitigated with targeted training and promotion and awareness activities, especially for producers. Further, there is a need in the region for additional strategic and technical ICT personnel in the State sector particularly at senior levels, to provide policy and strategy guidance and translate high-level objectives into ICT requirements.

- *Build agriculture e-services*– Creating streamlined services to agriculture stakeholders (including information on land issues, special incentives and rebates, agri-business support, etc.), can go a long way in easing the administrative bottlenecks and transportation difficulties currently associated with accessing necessary information and services with the government/Ministry of Agriculture.

- *Build an enabling environment for producers to be able to sell their produce online* – Looking at the success of businesses such as D'Market Movers, TriniTrolley and ttgrocery.com, the government and

business sector should seek to build the capacity of farmers/farmer groups to be able to connect with end consumers online

- *Enhance extension services and market information systems*– ICTs offer new tools that can be used by extension officers in order to communicate to producers more effectively and efficiently. The strong mobile phone penetration and popularity of SMS use in the Caribbean offer a unique opportunity in that perspective. Various initiatives are being tested such as information transfer via mobile phones, but as the cases described illustrate, these need to be strengthened. A key challenge is how to meet farmers' telecommunications costs when they use their mobile phone to access advisory services. Market information services should also be strengthened.

- *Better coordinate and harmonise regional approach to e-agriculture*– While each CARICOM State has primary responsibility for its own economic and social development, intra-regional cooperation, including cooperation with international support agencies is critical to a harmonized regional approach for e-agriculture. Such co-operation is key to providing the environment and incentives as well as in developing the knowledge, capacities and motivation needed to build a resilient regional agricultural sector; no single nation of the region can achieve its food and nutrition security goals by acting alone. In order to attract the engagement of international agencies that fund e-agricultural initiatives, there should be agreement on regional priorities and these must be clearly articulated.

- *Continue to modernise ICT infrastructure*– It is important that the region continues to develop the infrastructure that will ensure universal coverage and availability of mobile telephony and broadband connectivity at an affordable cost. The telecommunication infrastructure should be more accessible to practitioners in the agricultural sector.

1. Introduction

Information and communication technologies (ICTs) are popularly considered to represent the sophisticated and computer-based technologies that have developed over the last two decades, but the term also encompasses 'old' communication tools such as television, radio and telephones. A useful definition of ICTs is provided by the United Nations Development Programme (UNDP) which states that the term refers to "information-handling tools – a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information." One new and exciting feature of modern ICT devices is their capability to connect and work with each other, which, together with increasing affordability and availability, has contributed to the exponential growth in capacities for information management in many sectors of the economies of member States. It is therefore of great concern to the development community of the region that comparatively, the integration of ICTs in the agricultural sectors of member States has been so limited, because many long-standing challenges which characterise the region's food production and trading systems (such as fragmentation, isolation and the lack of appropriate technical and marketing support) are related to the challenges in information management.

ICT applications and systems that facilitate the production and sharing of accurate and timely information can bring significant efficiency and productivity advances to the regional agricultural sector if utilised effectively. A few areas where ICTs can enhance the sector are as follows:

- coordinating production efforts
- matching opportunities with suppliers
- gathering market intelligence from extra-regional markets
- assessing the impact of disease on types of crops
- storing and projecting farm yields per crop and availability for market
- accessing customer preferences and aggregate demand information
- accessing information about the productivity of different cultivation methods
- accessing knowledge about climate-aware farming techniques.

Improvements in the majority of the areas outlined above will result in a significant increase in the productivity of the sector at national and regional levels. Such improvements can only be facilitated by the integration of ICTs within existing and upgraded agricultural development frameworks in order to benefit from the enhancement of information and communication capacities. Therefore, there is a key role for ICT integration in sector development programmes aimed at increasing the productivity and market reach of the regional agricultural enterprises. Increased integration of ICTs in agriculture can also be used to introduce more dynamism to state and private agricultural enterprise thatcan be expected to make the sector more attractive to a broader base of stakeholders, including youth.

Positive impacts on a regional level will however depend on a harmonized strategy for ICT integration which explicitly elucidates (1) regional sector priorities (2) protocols for the integration and use of ICTs (3) protocols for the coordination of ICT based initiatives inclusive of policy, infrastructure and human skills development and (4) guidelines for national ICT programmes that complement regional objectives.

In support of the goal of meaningful integration of ICTs inclusive of the development of an enabling environment, the Caribbean Agricultural Research and Development Institute, CARDI commissioned Infocomm Technologies Ltd. to conduct an ICT environmental scan and regional study. This activity can be considered pioneering research as for the first time an attempt is made to comprehensively map the applications, actors and usages of ICT by value chain. Research was conducted in five countries representative of the range of agro-socioeconomic environments of the region, (Barbados, Guyana, Jamaica, St Kitts and Nevis and Trinidad and Tobago) and targeted two value chains, which are largely operated by micro, small, medium enterprises (MSMEs), namely, root crops (represented by cassava and sweet potato) and small ruminants. The focus on MSMEs is in recognition that these systems dominate the profiles of regional agricultural enterprise and therefore improved productivity in these systems can be expected to translate into significant positive impacts at the regional level.

The logical project structure of the study, which was developed with stakeholder input, required the following activities and outputs from the study:

- identifying and mapping of the actors within the nodes of the root and tubers and small ruminant value chains in each focal country;
- an in-depth analysis of each node of the target value chains in each focal country for the determination of ICT use;
- capturing and recording innovative ICT use and identifying best practices in the broader agricultural sectors (*ICT Directory*);
- e-readiness analyses for each focal country with correlation to ICT usage in agriculture (Five national reports);
- cross-analysis among the five focal countries, with benchmarking regional use with international best practices (*Regional Synthesis Report*).

The consultants were charged with the responsibility of producing a series of reports which present (1) national findings on ICT usage within the target value chains and an assessment of the e-readiness of each focal country;(2) a directory of ICT-enabled applications and services currently available to the regional agricultural community and;(3) a regional synthesis, which summarizes national findings and presents useful comparisons, highlights innovations and best practices and states the need for a harmonized e-agricultural strategy and proposes elements for such a strategy.

CARDI intends to raise awareness and stimulate action among various value chain stakeholders to integrate ICTs into their respective operations through the promotion and dissemination of the information contained in the above outputs. It is expected that the information will be used as a basis for recommending ICT policies, strategies and applications to be implemented both at the national and at the regional level. African, Caribbean and Pacific (ACP) States that have a similar background or profile can leverage the findings of this report as a guide to develop ICT capacity for their own agri-sectors and value chains.

2. Study methodology

The selection of methodologies and the analytical frameworks used in this study was guided by the logical project structure (Figure 1).

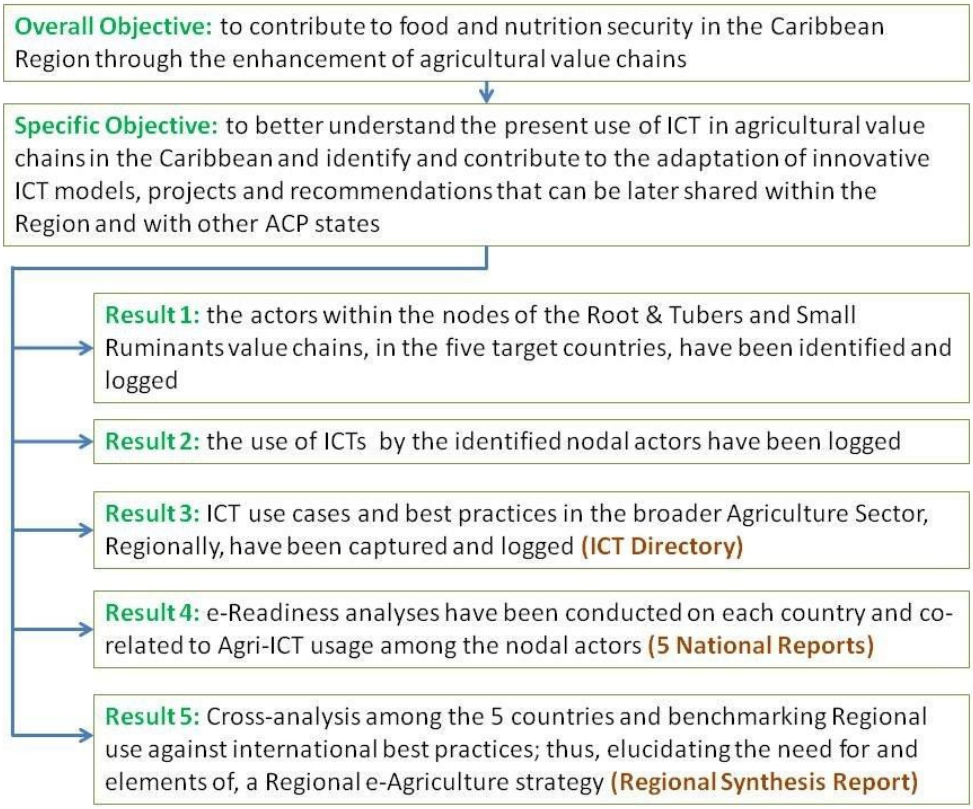


Figure 1. Project structure

Data collection methodologies

The required results of the project as shown in Figure 1, necessitated an in-depth analysis of each node of the target value chain in each focal country. To facilitate the procurement of the required information, CARDI, with the assistance of State and private sector stakeholders, assigned an in-country support team comprising national focal points (stakeholders with extensive knowledge of the targeted value chains and ICT usage) and in-country CARDI personnel. The national focal points were engaged to facilitate data gathering and in-country access to key agriculture stakeholders; CARDI personnel assisted in data procurement and were responsible for in-country logistics and coordination related to the country visits by the consultants.

Information about ICT usage within the effective nodes along the value chains being investigated was gathered through:

1. **engagement with the in-country support** team to facilitate the circulation and completion of an in-depth questionnaire. The full *National Focal Point Questionnaire* designed to provide key baseline data for the study can be viewed in Appendix 3 to this report.

2. **a desk study** which included internet research, a review of existing documents made available through national focal points or CARDI country representatives and voice calls and e-mails with key stakeholders of the studied value chains in the five countries. The collected information was analysed in preparation for in country visits.

3. **country visits** by the consultants to each of the five focal countries (Jamaica, Barbados, St Kitts and Nevis, Trinidad and Tobago and Guyana). These visits facilitated face-to-face interaction with practitioners along the small ruminant and roots and tubers value chains for confirmation of data procured by a desk study and the gathering of additional information

   Stakeholder interactions took the form of both in-depth interviews as well as the administration of a short 7-question survey. Questions (5) and (6) specifically ask respondents about the ICTs that are available to stakeholders in their country and the ICTs that they use in their work as agri-sector stakeholders. The survey questionnaire can be found inAppendix4.

   A list of all value chain actors engaged during the in-country visits across all five territories is included in Appendix 2.

4. **expert stakeholder feedback** for validation and finalisation. The complete drafts of all reports (i.e. the five country reports, the ICT directory and this regional report) were the subject of a two-day seminar during the Caribbean Week of Agriculture (CWA) 2013 in Guyana. During this period Infocomm's consultants interacted with experts, government officials and representatives from farmer groups from study countries and around the region and received feedback on the study analysis, conclusion and recommendations. The study documents were also made available to this stakeholder group for their detailed perusal and participants were given a three-week window in which to submit further feedback, as needed.

   The feedback and guidance from this group and from CARDI and CTA have been incorporated into the final version of this document.

Frameworks utilised

As these investigations required an appreciation for the concepts of value chain analysis on the part of all stakeholders involved in the study, the following frameworks were utilised to provide guidance.

Data collection and analyses were initially guided by CARDI's value chain model which presents a farm-product based value chain as basically a circuit of nodes, each with discrete functions which are interconnected through market-driven signals generated by consumers (Figure 2). With the exception of the consumer node, value addition activities (or inputs to such activities) generally take place.

The nodes presented by the CARDI value chain model are: market demand, supply response, input supplies, production, harvesting, post-harvest handling, fresh market, value added and consumers.

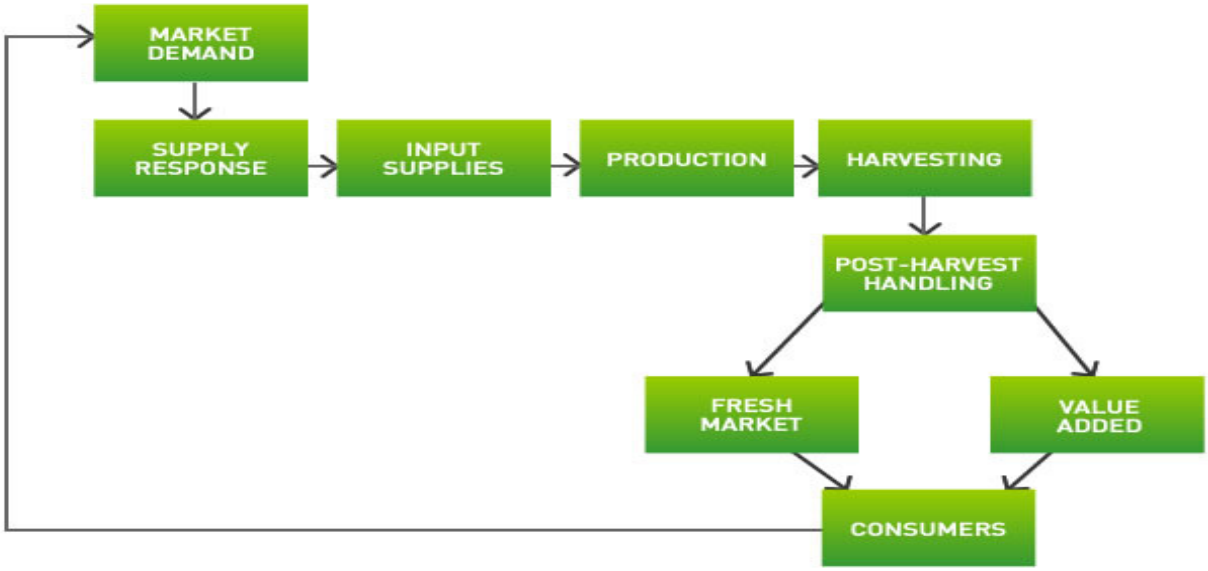


Figure 2. CARDI value chain model

This framework presented challenges in the execution of the data collection methodologies as early in the course of the in-country face-to-face interviews, it was discovered that

- many of the value chains in the study countries were not significantly developed, particularly at the post-harvest and value nodes and as such, did not allow for this discreet categorization of stakeholders.

- there is a generally low level of understanding of the concepts of value chain analysis and value chain management and how they apply to the various nodes.

Given the need to standardise the investigations across all focal countries, the consultants, using the CARDI model as a template, developed a' simplified' representation more suited to the general level of understanding of the stakeholders being interviewed (Figure 3). The modification involved (1) the merging of the 'Harvesting', 'Post-Harvest Handling 'and 'Value Added 'nodes of the CARDI model into a single node called 'Post-Production 'and (2) the re-classification of the node known as, 'Fresh Market 'into 'Markets/Marketing'. Additionally, as an example, a list of major actors within each node (as would normally apply in the targeted value chains) was included to function as recognisable descriptors so that stakeholders may more easily and accurately self-identify their nodal positions and functions within the overall chain.

Working with the modified value chain model proved to generate faster understanding of the information being requested thus facilitating the procurement of responses which could be used to make credible cross-country comparisons.

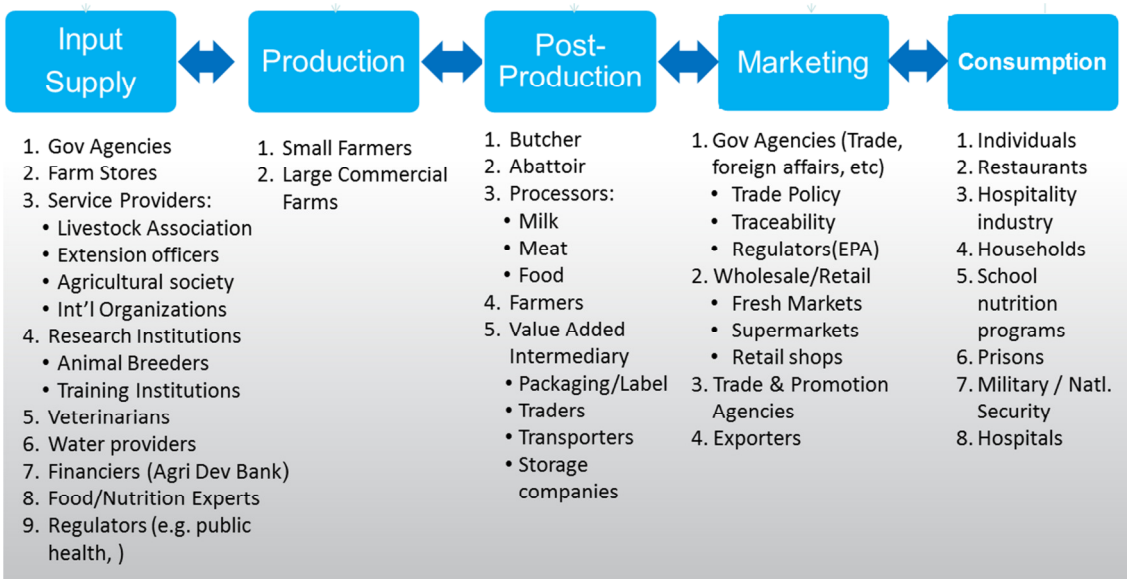


Figure 3. Study-related value chain model 1, highlighting nodal chain categories.

Another analytical framework used in the study is presented in Figure 4,which illustrates the forward flow of goods (with ever increasing value)towards the consumer and in reverse, the backward flow of capital originating from the consumer through the value chain towards the inputs or raw materials (goods and services) used in the creation of the product.

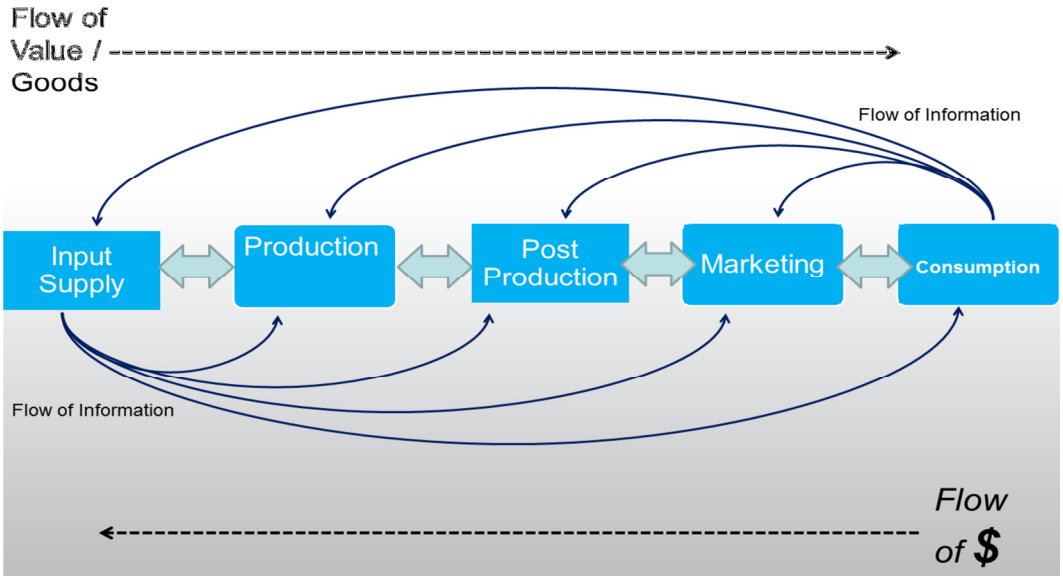


Figure 4. Study-related value chain model 2, highlighting the flow of information, the flow of capital and the flow of value. It should be noted that the flow of information will originate from nodes other than Input Supply and Consumption as shown but to retain visual clarity of the diagram for the purpose of this Report, the information flow from the other nodes are not represented.

To facilitate the further analysis of the information gathered from the study countries, the Infocomm Technologies Ltd. e-readiness framework was used. This framework assesses the current level of sophistication of ICT use within a sector, industry or organisation and assesses its preparedness to use ICTs to achieve operational effectiveness and efficiency gains and to improve information collaboration and management capacities. The e-readiness assessment was executed in five core areas:

- business environment
- governance
- human resource capacity
- psychographics
- infrastructure.

Description of the value chain nodes

A description is provided below of the working definitions of the value chain node categories used by the consultants with regard to the investigations of the study.

Input supply
The input suppliers are those stakeholders who provide a range of support goods and/or services, not only to the primary production process but also to other nodes of the value chains. The main service providers include the government that provides policy, legislation, regulations, research and subsidies (both material and technical). Regional and international organisations are also major service providers that assist mainly in research and development and technical and financial support. Farm stores provide a range of physical inputs for sale to farmers and other users (such as farm equipment, chemicals, seed, etc.) usually for profit.

Production
The farmer represents the principal producer of produce and meat on the value chain. We include here the small farmer, farmer groups/associations and large commercial farms.

Post-production
The post-production node represents those stakeholders who perform various activities on the commodity from the point of readiness in the field to the point where the commodity arrives at the market. Such activities may include harvesting, post-harvest handling, processing (value added), packaging and transportation to the final market. In practice, this includes abattoirs, transportation and logistics (air, sea and land), processing plants and storage facilitates.

Marketing
The marketing node represents actors who acquire the commodity (either in its primary or processed form) and will make it available to the final consumer. The main stakeholders represented at this node include wholesalers, retailers and exporters. Government is an actor on this node as it negotiates bilateral and multilateral trade agreements for country produce and it provides market infrastructure to facilitate buying and selling.

Consumption
The consumption node intends to capture the various points where the commodity is finally used up (from the plate to the fork), either in the processed or unprocessed form. The main players identified at this node included individuals, restaurants and hotels. This node will also include instances where some nutritional programmes (schools, hospitals and prisons) are in place.

Study limitations

The following key limitations of the study, which could have affected the findings and interpretations are acknowledged:

Limited overall budget
Though the study is a pioneer study of the uptake and usage of ICTs in agriculture in the Caribbean region, encompassing the in-depth focus on five countries in the region, limited resources were structured for the project which constrained the time available to gather and analyse the data required.

Limited time spent in country
The time afforded to the consultant team for in-country investigations generally did not exceed three (3) business days in each country. Value chain actors who could not be available within the limited in-country period therefore could not be met in person.

Type of stakeholders available
It turned out consistently, based on arrangements made through national focal points and CARDI, that fewer representatives from nodes later in the chain (post-production, marketing and consumer) were available to meet with the consultants during in-country visits. As such, the feedback throughout the study is more than proportionately given by stakeholders earlier in the value chain (i.e. input suppliers and producers).

3. Background

This section of the report presents the backdrop against which the study and its overall project, 'Strengthening ICTs in agricultural value chains in the Caribbean – Study and Promotion' were conceptualised and designed. The following information highlights the need for efforts aimed at increasing the production and productivity of regional food production systems through initiatives that are acceptable, affordable and accessible to regional agricultural stakeholders through well-executed strategies that take into account regional priorities and the interdependent nature of the systems involved in food production and trade.

Food and nutrition security is one of the most basic concerns of humankind and is a priority at the individual level as well as on the level of families, communities, nations and regions. Indeed, it is a global concern.

The global food industry is a complex collective of diverse businesses that supply much of the food energy consumed by the world population. Only subsistence farmers (those who survive on what they grow) can be considered outside of the scope of the modern food industry.

The food and drink supply chain is complex and ends with a number of different food retail formats. The most popular retail outlet is the supermarket, but in recent decades, other retail formats have emerged, including hypermarkets, discounters, convenience stores and service stations. Supermarkets and hypermarkets account for just over 5% of all grocery retail sales. Independent food stores take a 16% share and the rest of the market is shared between convenience stores, standard convenience stores, service stations, discounters and other outlets.

The total value of the food retail industry is approximately US$4 trillion annually, with supermarkets and hypermarkets dominating the retail sector. The food retail market is relatively concentrated, with the top 15 global grocery retailers taking over 30% of global grocery retail sales. Many of the largest global grocery retail companies are owned by US and European interests.

Growing concerns regarding obesity have increased public awareness about healthy and nutritious foods. Consequently, the diet food segment is positioned to grow in developed markets. The total US and European diet-related food and beverage market is predicted to reach US$128.5 billion by 2014. While Europe is estimated to increase at a compound annual growth rate (CAGR) of 3.4% from 2008 to 2014, the US is expected to expand at a CAGR of 4.1% over the same period.[1]

Globally, the need for food is misaligned with the production capacity of the world's food production systems. According to statistics from the World Technology Network Hunger Initiative there are 870

[1] Source: Bodimeade M. 2013. Global Food Industry. An article prepared for Companiesandmarkets.com http://uk.finance.yahoo.com/news/global-food-industry-000000272.html

million hungry people in the world and 98% of them are in developing countries.[2]They are distributed as follows:

- 578 million in Asia and the Pacific
- 239 million in sub-Saharan Africa
- 53 million in Latin America and the Caribbean
- 37 million in the Near East and North Africa

Further, the International Fund for Agricultural Development gives the following statistics:[3]

- The world population is expected to increase to 9.2 billion in 2050
- Food production will need to nearly double by 2050 in developing countries.
- About 40% of the world's arable land is degraded to some degree and will be further affected by climate change.
- There are 500 million small farms in developing countries, supporting around 2 billion people.
- Gross domestic product (GDP) growth generated by agriculture is up to four times more effective in reducing poverty than growth generated by other sectors.
- Development aid to agriculture was 4.3% in 2008, compared with 18% in 1979.
- Poor people spend between 50% and 80% of their income on food.

Globally, agriculture is moving away from cottage-type, traditional, labour-intensive practices, towards information-intensive models.[4] Access to ICTs therefore is increasingly becoming a necessity in order to integrate farmers in the ACP region into national, regional and international trade systems.

Ensuring that the value chains that exist in the agricultural sector are productive, well organised and sustainable is critical to securing the world's food supplies. Governments in ACP countries are increasingly recognising that the promotion of the agricultural sector is a core development issue which is in need of priority attention, in light of the unsurpassed ability of the sector to address concerns of poverty alleviation and to ensure future food availability for its populations.

The link between food and nutrition security and ICTs is most clear when looked at from an information perspective. ICT increases the quantity and quality of information available to the farmer and other stakeholders in the food ecosystem and promotes greater predictability in the production, sale and consumption of food. The availability of information facilitates greater investment into the agriculture/agri-food sector.

Information answers many questions that are common among the actors of agricultural value chains, such as: 'How do I find a buyer for my produce'; 'How do I locate producers who can deliver the

[2]Source: The World Technology Network. 2013. The WTN Global Challenges Program. Geography: Where is hunger?
Hunger Initiative http://www.wtn.net/hungerinitiative/Geography.php
[3]International Fund for Agricultural Development (IFAD) 2014. Food security facts and figures http://www.ifad.org/hfs/facts.htm
[4]Committee on Information and Communications Technology of the Economic and Social Commission for Asia and the Pacific (ESCAP) 2008.Information and communications technology for food security and sustainable agriculture in the knowledge economy. http://www.unescap.org/idd/events/cict-2008/CICT_INF1E.pdf

quantities that I need reliably and at a good price?'; 'Is it better to leave my cassava in the ground (store my produce) or reap it immediately for sale? 'and, 'How can I support (where do I buy produce which comes from) local farmers?'

The enhanced flow of information gives new insights, opens up new opportunities, supports the health of value chains, creates functioning markets and promotes the availability of nutritious food, while ensuring sustainable livelihoods for value chain stakeholders. ICTs can play an integral role in achieving much-needed improvements in agronomic practices, such as precision farming, crop scheduling; they support the traceability of products and inputs, facilitate the organisation of transport and distribution systems and are integral to other concerns of the agricultural community, such as agricultural research, weather forecasting and risk management (disaster loss reduction).

ICTs in the Caribbean

The Caribbean displays some of the highest mobile service penetration rates in the world. This situation has been demonstrated by the data that has been presented over the last decade by organisations such as the International Telecommunications Union (ITU) and others concerned with rating global productivity, technology usage. According to ITU data released in 2011, mobile phone subscription rates in some Caribbean states are close to 166%, compared to 128% in Europe, 104% in the United States of America and 76% in China. Information presented in the World Economic Forum's (WEF) Global Information Technology Report (GITR) 2013 suggests that mobile network coverage across the region averages between 95 and 100%.

The state of ICT capacity in the Caribbean (Table 1) must be considered when designing and implementing plans and strategies to support the advancement of regional agriculture. Such items to be considered include: the state of mobile voice and data services, broadband deployment, the availability of digital repositories of agricultural data and the human capacity of key actors in the agro-food space.

Table 1.Summary of indices of world economic forum global information technology report 2013.

Indices	Barbados	Trinidad and Tobago	Jamaica	Guyana	Average
Mobile network coverage, % pop	99	100	95	97	97.75
Mobile phone subscriptions/100 pop	127	135.6	108.1	69.9	110.15
Individuals using internet %	71.8	55.2	31.5	32	47.625
Households w/personal computer %	61.4	53.1	22.7	7.2	36.1
Households w/internet access %	51	18.6	14	6.1	22.425
Broadband internet subscriptions/100 pop	22.1	11.5	3.9	2.6	10.025
Mobile broadband subscriptions/100 pop	77.1	1.2	1.5	0	19.95
Use of virtual social networks	6.1	5.5	5.7	5.7	5.75
Business-to-business internet use	5.3	5	4.9	5.1	5.075

Business-to-customer internet use	4.7	4.1	3.9	4.5	4.3
Government online service index, 0-1 (best)	0.37	0.48	0.31	0.25	0.3525

Source: Bilbao-Osorio B., Dutta S. and Lanvin B. (Editors) 2013 **World Economic Forum (WEC) Global Information Technology Report 2013: growth and jobs in a hyperconnected world** <http://reports.weforum.org/global-information-technology-report-2013>

The state of the telecommunications market in Trinidad and Tobago: Pre vs. post Liberalisation

Statistic	*2004*	*2010*
Annual telecomm	*TT$3.3B*	*TT$4.4B*
Mobile subscription	*530,000*	*1,894,000*
Mobile penetration	*40.8%*	*143.8%*
Fixed voice subscription	*319,000*	*293,000*
Fixed voice penetration	*24.4%*	*22.3%*
Fixed internet subscriptions	*53,000*	*171,000*
Internet household penetration	*4.9%*	*49.9%*
Mobile internet subscriptions		*451,000*
Mobile Internet Penetration	*18.2% (2009)*	*23.5%*
Internet download speeds	*1Mbps (2005)*	*100Mbps*
Radio stations	*33 FM*	*37 FM*
TV stations	*3*	*8*

*Source: Presentation of Chairman of NICT Company Trinidad and Tobago, Mr Atiba Phillips at Regional ICT Ministerial Panel, CANTO Suriname 2011.*http://www.igovtt.tt/content/presentations

The current state of ICT proliferation especially as it relates to mobile services and broadband connectivity has been the result of State activity over the last 10 years by territorial governments in liberalising the telecommunications sector and granting concessions to service providers in an unprecedented way. Telecommunications liberalisation generally describes the process of ushering in competition into a telecommunications sector, which was formally dominated by a State monopoly provider. This process necessarily increases the competition in the sector and has been generally successful in the region, resulting in a proliferation of new telecommunication-based services being offered, significant increases in the marketing of services and devices, cheaper prices to the consumer, which resulted in greater user uptake. As an example, in the case of Trinidad and Tobago, the Telecommunications Act – the piece of legislation that governs the broadcasting and telecommunications sector – was amended in 2005 to facilitate new entrants into that sector which previously was dominated by the State telecommunications provider, Telecommunications Services of Trinidad and Tobago (TSTT). Since liberalisation, a ten-fold increase has been seen in internet household penetration, while mobile penetration has jumped from from 40.8% (2004) to 143.8% (2010). The number of radio and television stations have also seen increases.

The key challenge for regional governments is to accelerate the ***commercial uptake and usage*** of technologies, by SMEs in particular. The development of relevant government services and content seem to be a prerequisite for driving wider uptake of broadband and mobile data services, but the proliferation of e-Government in the region has been slow.

While Trinidad and Tobago was one of the first regional territories to liberalise its telecommunications sector, the experience of Trinidad and Tobago in this regard has been mirrored in many other Caribbean islands to-date.

Agriculture in the Caribbean[5]

Agriculture is an important sector for the 20 members and associate member States of the Caribbean Community (CARICOM), despite the economic diversification that has taken place over the last four decades, (particularly with the growth of service industries, notably tourism and financial services).

For the region as a whole, the share in world agricultural exports have declined from 2% in 1988 to 0.3% in 2004, whereas the share of its neighbours in Latin and Central America have increased from 6.9% to 9.6% and 2% to 2.6%, respectively.[6] At the same time, the region imports considerably more food than it exports. Concomitantly, CARICOM's agri-food sector imports had increased to approximately US$4.0 billion by 2011.[7] The product categories[8] that dominate the imports are: cereals, livestock products, preserved and prepared foods, beverages and fisheries products.

The rise in household incomes, increasing urbanisation, increasing women in the workplace, penetration of cars and modern appliances, travel and penetration of communication technologies has led to changes in consumer preferences for foods with increased levels of convenience and variety. This shift in consumer demand patterns has been reinforced by the consumption preferences of the quite sizeable numbers of tourists to the Caribbean.

The changes in consumer demand, together with increasing globalisation and liberalisation of the economies, have in turn impacted on the food distribution services industry and the structure of agri-food supply chains. The market share of the modern supermarket format has been increasing significantly compared to municipal fresh markets and there has been growing penetration of fast food chains, catering chains and regional food service (and hotel) operators. International food distribution chains and hotels have increased their market share and brought international best practices to the domestic industry. Likewise, the growing sophistication of distribution service operators is moving supply chains away from commodity wholesale markets to integrated chains and value chains where chain actors coordinate their operations more closely to meet consumer requirements and differentiate their products. Dependability of supply is especially important to intermediate purchasers in the food distribution services industry and hotels in particular often rely on importer/distributors to meet their buyer requirements.

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[5]Section contributed by Robert Best, Caribbean Agri-food expert

[6] Source: CARICOM Secretariat 2005. CARICOM Agribusiness Development Programme (EU funded) Concept Note. http://www.caricom.org/jsp/projects/agribusiness_dev/concept_note.pdf

[7] Source: CARICOM 2011. Food Security in CARICOM.*CARICOM View* July 2011. http://www.caricom.org/jsp/communications/caricom_online_pubs/caricom_view_jul_2011.pdf

[8]Source: Silva S., Tefft J., Smart M. and Best R. 2011. 'Reducing the CARICOM food import bill and the real cost of food: policy investment and options.' Report of a study conducted under the project 'Promoting CARICOM/CARIFORUM Food Security Phase II' Project of the Food and Agriculture Organization of the United Nations (FAO), funded by the Government of Italy. http://www.westindianprojects.com/uploads/2/0/9/0/20905888/fib_study.pdf

One important consequence of the changes in consumption from food consumed-at-home to food consumed away-from-home is that the share of farmers' contribution to consumer food expenditure has declined significantly. Agri-food service providers (e.g. based on global statistics; wholesalers/logistic providers: 20%, supermarkets: 25% and food service providers: 50%) now account for the largest share of the food bill of the modern consumer.

In addition to the domestic supply models above the market is supplied by importer/distributors that depend on international supply chains for products such as internationally branded products; preserved and prepared foods; and refrigerated foods.

The sector is experiencing a number of trends.

1. There is a continuous decline in the attractiveness of traditional export markets.

2. There is increasing competition from larger scale producers in both export and domestic markets.

3. Governments can no longer provide the same level of protection to the sector due to commitments made to international development financing bodies and multilateral and bilateral trade commitments.

4. High production costs such as factor costs (both domestic and imported) are common constraints. Financing costs vary considerably but are generally high. Operations costs such as energy, transportation and communications are in some cases prohibitive.

5. Labour availability is a constraint that is particularly large in countries with significant tourism and energy sectors. However, the human resources available to the sector are of a reasonably high quality; literacy levels are high by developing country standards and the ability to absorb new technology is also reasonably high.

6. Land is a scarce and increasingly expensive resource, not only in the smaller islands; water resources are scarce in some cases and water management capabilities are often deficient.

Intra-regional trade in primary commodity goods is limited by issues of: transportation, non-tariff restrictions and poor facilities for storage and handling, amongst other things. Cross-border investment is growing in the manufacturing industries (e.g. SM Jaleel [soft drinks], Bermudez [snacks], Angostura [alcohol], Grace [hot pepper products], Jamaica Broilers [poultry]) and service sectors (Goddard's Catering, Sandals Hotels, Rituals Cafés, Island Grill Restaurants, PriceSmart Supermarkets), which increasingly, is facilitating intra-regional trade in agro-food products.

The Region's agri-food sector policy[9] is based on a vision of it being a priority sector and entails a complete transformation towards a market-oriented, internationally competitive and environmentally sound system of agricultural production and services – one that provides improved food and nutrition security, especially for vulnerable groups. This vision has been outlined in a number of policy documents, such as the Community Agriculture Policy, the Regional Food and Nutrition Security Policy

[9]Source: CARICOM 2011. CARICOM Community Agricultural Policy.http://agricarib.org/regional-policies-programmes

and several supporting strategic policy frameworks, such as the CARICOM Agribusiness Development Programme. The regional trade policy also recognises that there are sensitive commodities that play an especially important role in food and nutrition security, and these have received special treatment in CARICOM external trade negotiations.

These changes in consumer demand and the transformation of the regional agro-food sector have been accompanied by a growing use of ICT technologies within the larger, more sophisticated, established, sectors (e.g. food distribution, food manufacturers, poultry) which have more coordinated supply chains. Some value chains in these industries utilise ICTs across the length of the chains. Other less developed chains such as those found in the fruit, vegetables, roots and small ruminant sub-sectors tend to be less coordinated and utilise simpler ICT technologies but the degree of integration and sophistication tends to be comparatively lower.

4. Summary of findings of the five focal countries

The study focused in particular on the discovery of the actors and ICT usage of the practitioners within the sheep and goat, and sweet potato and cassava value chains in each of the five focal countries (Jamaica, Barbados, St Kitts and Nevis, Trinidad and Tobago and Guyana). Due to the absence of the development of the milk value chain, the study concentrated on interaction and assessment of the actors within the meat value chain as it pertains to small ruminants.

The consultant team met with actors along these two value chains (Figure 5). The description of the value chains and ICT usage is based primarily on the returned questionnaires and in-depth interviews conducted with these stakeholders. The findings from the desk study (including voice calls to key actors not engaged during country visits) are also represented within the value chain descriptions.

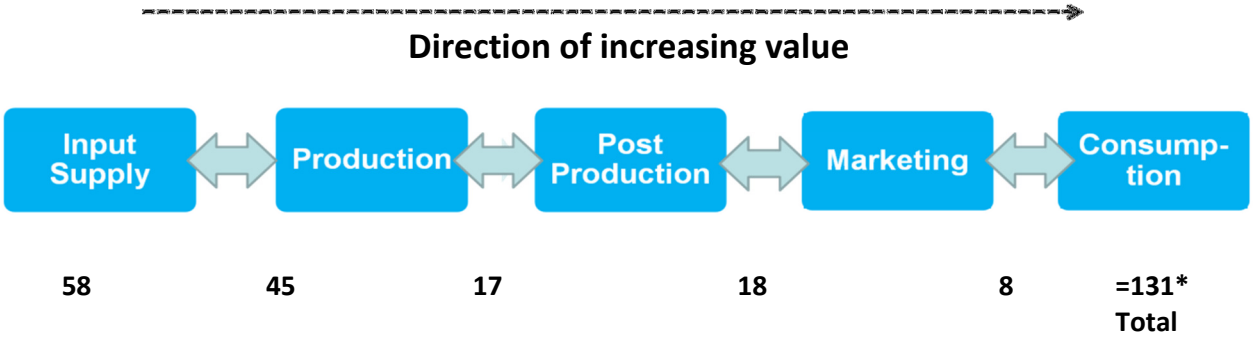
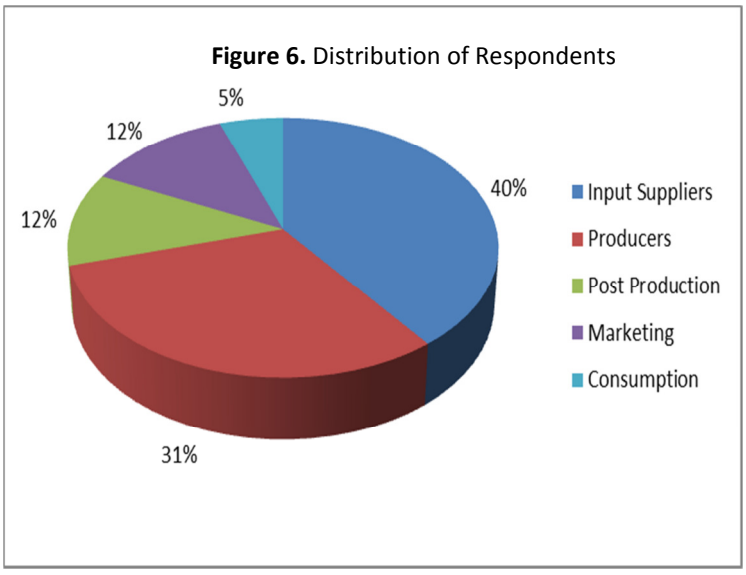


Figure 5. Representation of value chain respondents during in-country visits.

*Please note that the total number of respondents per country does not correlate with the total number of respondents from each node per country. This discrepancy is due to the fact that some respondents represented more than one node.

As can be seen in Figure 6, the persons who were available to engage with the study team during the days allocated to engage stakeholders in-country, were disproportionately representative of the early part of the chain i.e. input suppliers and producers (over 70%). Notwithstanding, in general, all nodes along the chain were represented. Representatives from the consumer node were drawn primarily from the tourism sector (i.e. restaurants and hotels) and in one case, a national school feeding programme.



A full list of the persons engaged in all five countries is given in Appendix 2.

For each of the five countries, a national study report was compiled. Each report documents the actors revealed on each of the nodes along the two value chains of focus and presents the main highlights of ICT usage at each node.

To facilitate the further analysis of the information gathered from the study countries, the Infocomm Technologies Ltd. e-Readiness framework was used. The framework assesses the current level of sophistication of ICT use within a sector, industry or organisation and assesses its preparedness to use ICTs to achieve operational effectiveness and efficiency gains, as well as to improve information management, dissemination and collaboration capacities.

For each focal country, in order to generate an overall picture of the current issues around ICT in the agricultural sector as a whole, the data collected via the two questionnaires and interviews with the value chain stakeholders was segmented into five core areas (or pillars) as follows:

1. business environment
2. governance
3. human resource capability
4. psychographics (culture and mindset)
5. ICT infrastructure

The categorised data was then analysed using the e-readiness framework to give insight into the current state of the studied sector in each pillar.

The sections below present a summary of the findings per county. For each country the following information will be given:

1. a brief overall description of the agricultural sector;
2. a representation of the actors, key highlights and ICT usage per node on the focal value chains;
3. a summary e-readiness profile, with key highlights in each e-readiness framework pillar.

Tables are inserted within the narrative of this section to provide a snapshot of the key highlights and ICT usage of each value chain under study; E-readiness country profiles are also presented in summarised tabular formats. (See Tables No. 2–17)

Case studies are also interspersed within the narrative to highlight stand-out and/or innovative applications of ICTs that were reported in the Caribbean value chains under study (See Case studies 1–16, 22 and 23).

St Kitts and Nevis

Overview of the agricultural sector

The twin-island Federation of St Kitts and Nevis is situated among the Leeward Islands in the Caribbean and has a total land area of 269 km² (104 mi²). St Kitts is the bigger of the two islands with a total of 176 km² (68 mi²). The total land area for Nevis is 93 km² (36 mi²). Before 2004, approximately 32% of the total of St Kitts and Nevis land area was categorised as agricultural land. By 2005 this figure fell to less than 20% but started to show a gradual increase again in 2008. The total agricultural land increased to 23% by 2011.[10]

According to the World Bank, St Kitts and Nevis had a total population of 53,580 and a GDP of US$748.5million in 2012. Measured by its sub-sectoral composition of crops, livestock, fisheries and forestry, agriculture contributes 4% or less to the gross domestic product (GDP).[11]

Similar to its other Caribbean counterparts, St Kitts and Nevis has been a major importer of food products over the years, with food imports accounting for over 60% of St Kitts and Nevis' food supplies. This makes the country vulnerable to global food price instability. The country imports around US$50 million worth of agricultural and food products annually, which constitutes 17% of total merchandise imports.[12]

For many years the production of sugarcane was the traditional mainstay of the economy of St Kitts and Nevis. However, being faced with an increasingly unprofitable sugar industry, the government officially closed sugar operations in 2005 and implemented a programme to diversify the agricultural sector and stimulate the development of other sectors within their economy. The diversification programme emphasizes crops and livestock such as: hot pepper, roots and tubers (white and sweet potato), vegetables, dairy, beef, mutton, pork and poultry.

Based on the International Trade Centre data, the country recorded an average annual import of 4 tonnes of cassava and over 30 tonnes of sweet potatoes between 2007 and2011.During the same period, the country imported an average of 118 tonnes of small ruminant meat.[13]

The current farming population comprises a large number of small and semi-commercial food producers and local production of roots and tubers was estimated at 482 tonnes in 2011.[14] Sheep and goat meat production stood at 11,700kg in 2009.[15] Another notable small group encompasses small-to-medium-sized food processors that depend largely on domestically produced raw materials.

Value-adding and agro-processing activities in St Kitts and Nevis are built around a relatively large range of local crops such as: guava, cassava, tamarind, gooseberry, hot peppers, coconut, *kakanga* root, *mauby* bark, ginger, sweet potato and several other fruits and livestock meats.
The major agro-processing products include cassava products (meal, plain tarts, cookies), jams and jellies, coconut oils, fruit wines and drinks, fermented drinks (sarsaparilla), hot sauce, cakes, pastries, chips, candies, (guava-cheese, and fudge), condiments, dried fruit, vinegar and sweet potato products

[10]Source: World Bank. 2011. Country Survey. St Kitts and Nevis. http://data.worldbank.org/country/st-kitts-and-nevis
[11]Source: St Kitts. 2013–2016. Agriculture Development Strategy (ADS)
[12]Source: ibid
[13]Source: International Trade Centre. Trade Statistics. http://www.intracen.org/trade-support/trade-statistics/
[14]Source: FAOSTAT. http://faostat.fao.org/DesktopDefault.aspx?PageID=339&lang=en&country=188
[15]Source: St Kitts. 2013–2016. Agriculture Development Strategy (ADS)

(*conkie)*[16].These activities are dominated by small and cottage-type operations supplying local consumers.

The roots and tubers value chain and ICT usage – St Kitts and Nevis

The Government of St Kitts and Nevis has identified the production of sweet potato and cassava as strategic to the diversification of the agricultural sector. As such, development of these subsectors is being facilitated by the government through the production unit, marketing division and extension department of the Department of Agriculture (DoA) in collaboration with several allied agencies. There has also been deliberate effort to revitalize the agro-processing sector through targeted training and institutional strengthening, especially of the St Kitts Farmers' Cooperative Society (SKFCS).

Table 2 presents a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed in the sweet potato and cassava value chain in St Kitts and Nevis.

[16]Conkie – a sweet boiled desert that is made with cornmeal to which coconut, sweet potato, pumpkin and spices are commonly added. Traditionally, the mixture is boiled in banana leaves

Table 2. Snapshot of the sweet potato and cassava value chain: Key highlights and ICT usage – St Kitts and Nevis.

INPUT SUPPLY	
Key highlights	**ICT usage**
- Farmers supply cuttings, labour - Large suppliers coordinate imports and sublet through various small outlets (hardware and small farm stores) - SKFCS provides/facilitates insurance, markets, storage, targeted training and technical support - Allied agencies collaborate with government and engage in ongoing targeted research - Government offers support through various departments (production units, outreach centres, research, marketing, quarantine and communication) - Financial and other support offered through local development banks, regional and international organisations	- Mobile voice and SMS –for communication with producers and maintaining relationships with them. - Computers and internet – for data entry, gathering information and research. Also for administrative tasks record keeping and communication with stakeholders via e-mail. - TV and radio –used by large chemical companies and the DoA to disseminate information to stakeholders. These programmes are mainly targeted to actors on the production node. - Social media (Facebook, blogs, etc.) –organisations (mainly in the State sector) use these technologies to disseminate information to stakeholders and to gathering feedback from them. Major players in this node include: - farmers commodity associations: SKFCS, Agro-Processors Association - farm stores (Trade and Development Company(TDC), Horsford, Caribbean Chemicals and DOA) - government/allied agencies: CARDI ,Inter-American Institute for Cooperation on Agriculture(IICA), FAO, European Union (EU) - financiers: Caribbean Development Bank (CDB), CARICOM, EU, Inter-American Development Bank(IDB), FAO, United States Agency for International Development(USAID)
PRODUCTION	
Key highlights	**ICT usage**
- Mainly farmers with less than 1 ha of land - Mainly 'farm saved 'planting materials (or cuttings from previously grown crop) - Few medium and large farmers - Emergence of improved	- Mobile voice and SMS- Used to communicate and maintain relationships with extension officers, buyers, processors and other producers. - Computers and internet- Used mainly for individual information gathering and research pertaining to agronomic practices/techniques.

agronomic practices	- TV and radio- The 'Agriculture in Context' is a popular programme is used to get information on the local development in the sector. - Social media- Used to communicate with peers and share information. Major players in this node include: - small farmers
POST PRODUCTION: Harvesting, Post-harvest handing, Value added	
Key highlights	**ICT usage**
- Random markets - Manual labour (family and shared labour with other farmers) - Produce taken to the markets or processing facility - SKFCS provides some farmers with improved storage and packaging facilities - Washing is done where the produce is intended for export, supermarkets or hotels - Several small processors produce puddings, chips and flour - Efforts to formalise the agro-processing sector - Agro-processors group offers coordinated relationships to streamline *ad hoc* value-added processing	- Mobile voice and SMS –to communicate and maintain relationships with producers/suppliers buyers, to get information on availability of produce and on demand for commodity/value-added products. - Computers and internet – for e-mail communication with producers/suppliers and other stakeholders and for administrative tasks (word processing accounting), as well as research. Major players in this node include: - farmers and traders - a few small processors - Taiwanese processing unit - households
- **MARKETS/MARKETING**	
Key highlights	**ICT usage**

- Commodities marketed mainly in unprocessed forms as fresh produce - Further packaging and grading may be done for sweet potato for export - Sweet potatoes are exported to the British Virgin Islands (BVI) (Tortola, St Martin and Anguilla) and the Dutch Islands	- Mobile voice and SMS –for communicating and maintaining relationships with producers/suppliers buyers, getting information on availability of produce and demand for the commodity/value added products. - Accounting/Inventory management systems – used to effect business administration and managing stock of goods available. Major players in this node include: - municipal markets - greengrocers - supermarkets - processors - exporters
CONSUMPTION	
Key highlights	**ICT usage**
- Commodities eaten mainly as fresh produce - Consumed boiled, baked, fried, crushed, as salads or in soups - Commodities constitute a major part of the local staples for local people	- Computers and internet – for e-mail communication with producers/suppliers and other stakeholders. Also used for research and administrative tasks (incl. word processing and accounting). - Sophisticated inventory, purchasing and forecasting systems at hotels – many of the larger hotels use these systems for managing information about their stock of food supplies. These systems produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions to provide a satisfactory service to their guests. Major players in this node include: - households - hotels - nutritional programmes - restaurants

CASE STUDY 1

MINISTRY OF AGRICULTURE AND MARINE RESOURCES WEBSITE

http://agriculture.gov.kn/

***Administrator**: Department of Agriculture, Government of St Christopher (St Kitts) and Nevis*

***Description**: This website is intended to serve the needs of all agro-food sector stakeholders in St Kitts and Nevis. It provides visitors with extensive information about the sector and includes information about:*

- *products and services – lists of the prices of production input supplies, equipment and services offered by the agriculture department and relevant contact information*
- *forms – downloadable PDF forms that must be submitted to the state for export permits, import permits, animal slaughter certificates, vet permits, laboratory reports, etc.*
- *economic and market information –*
  - *availability of selected commodities on the domestic market*
  - *lists of farmers with commodities under production or for sale*
  - *guidance on marketing, exporting, forecasting market trends, assessing market opportunities and supplying the hospitality sector*
- *farmers' directory – downloadable documents containing the contact information of the registered farmers and the commodities that they produce*
- *publications – downloadable annual report documents.*

The service presents content on agronomic and husbandry best practices, news bulletins, weather forecasts and links to the "Agri-Scope" and "Agriculture in Context" weekly radio and TV programmes.

This service is intended to be the one-stop shop for all of St Kitts and Nevis agri-sector content and to provide links to other regional resources and government content.

***Challenges met in deploying the service:** Since the deployment of the service, the key challenge has been to keep the content on the website up to date. The agriculture department has only one person updating the site's content. This staff member's core function in the organisation is not related to maintenance and management of the web service, but the individual has been assigned the task of compiling and updating the site as an additional duty. For this reason, content updates are not regular.*

CASE STUDY 1 (CONTINUED)

Financial aspects: *The platform's development and continued administration is funded by the St Kitts and Nevis Department of Agriculture.*

Results and impacts achieved*: The website is a comprehensive online offering for St Kitts and Nevis value chain stakeholders, but it is still not clear what the impact or usage of the service has been. Many producers are unaware that the service exists. Also, several marketers and buyers of produce did not indicate that they regularly used the service.*

Perspectives on the deployment*: This website is potentially a useful service, for the domestic value chains and for regional importers and exporters of agro-food products. However, the current human resource limitations within the agriculture department affect the quality and timeliness of the content that is presented.*

There is also a need to promote the website to all value chain stakeholders as a resource that they should use for accessing information and communicating with the agriculture department. The website's user interface (UI) could also be improved to better facilitate stakeholders.

As far as the development of further services, it was found that a key value addition would be the development of the capability for producers to directly access opportunities from locally based supermarkets, hotels and restaurants. In this way, the development and promotion of this website can be used to enhance sector relationships.

The small ruminants value chain and ICT usage – St Kitts and Nevis

Slow growth rates and low carcass weights are typical for animals in the St Kitts and Nevis small ruminant subsector. Consequently, the government, through several allied agencies, has undertaken programmes to organize small ruminants operations so as to improve production quality and quantities. These government initiatives include allocation of land for pasture establishment, provision of subsidies and waiving of slaughtering fees. In this section, sheep and goats are the small ruminants of interest.

A snapshot of the key highlights and ICT usage of each node of the sheep and goat value chains is presented in Table 3 below.

Table 3. Snapshot of the sheep and goat value chains: Key highlights and ICT usage -St Kitts and Nevis.

INPUT SUPPLY	
Key highlights	**ICT usage**
- Government supplies breeding stock and helps farmers organise their operations - Some farmers retain animals for breeding and sell to other farmers - Government collaborates with allied agencies to improve the quality of livestock and husbandry practices - Farmers maintain generally low-cost operations and may use some feed supplements - Veterinary services are available usually at market rates	- Mobile voice and SMS– The main usage for extension officers and suppliers of chemicals and feed is in communication with producers and maintaining relationships with them. - Computers and internet – State sector organisations and other actors use these technologies for conducting desk research, administrative tasks and record-keeping as well as for e-mail communication with stakeholders across the value chain. - TV and radio- Used to disseminate information to stakeholders. Programs are mostly targeted to actors on the producer node. - Websites, Social media (Facebook, blogs, etc.) – Organisations mainly in the State sector, use these technologies to disseminate information to and to gather feedback from stakeholders. Major players in this node include: - farmers - farm stores (TDC, DOA, Horsford and Caribbean chemicals) - equipment providers - government: Bourkes Breeding Unit - allied agencies: CARDI, FAO, IICA, United States Department of Agriculture (USDA) - veterinary services
PRODUCTION	
Key highlights	ICT usage
- Animals mainly graze freely	- Mobile voice and SMS – for communicating and maintaining

- Limited chemicals and fertiliser inputs - Animals produced mainly for fresh meat - Limited milk production - Initiatives in train by allied agencies to organise production	relationships with extension officers, buyers, processors and fellow producers. - Computers and internet – for individual information gathering and research pertaining to husbandry practices/techniques. - TV and radio–*Agriculture in Context* is a popular programme tuned into by production actors to get information on local developments in the sector. - Social media – to communicate with peers and share information. Major players in this node include: - individual farmers
POST PRODUCTION: Harvest, Post-harvest handling and Value added	
Key highlights	**ICT usage**
- Random selection of marketable animals - Praedial larceny (theft of agricultural produce) - Dog attacks common - Abattoir facility available - Live animals transported inappropriately to abattoir - Limited cold storage facilities - No traceability - Little or no value added	- Mobile voice and SMS –for communicating and maintaining relationships with producers/suppliers and for getting information on availability of produce and demand for commodity/value-added products. Major players in this node include: - farmers - butchers - traders - supermarkets
MARKETS/MARKETING	
Key highlights	**ICT usage**
- Limited cold storage but for imported products - Meat is undifferentiated on the fresh market - Unknown demand for small ruminant milk and milk products - Large quantity of imports	- Mobile voice and SMS – for communicating and maintaining relationships with producers/suppliers buyers getting information on availability of produce and on the demand for the commodity/value added products. - Computers and internet –for e-mail communication with both domestic and international producers/suppliers and other stakeholders. Also for administrative tasks (word processing accounting (Quickbooks), and research. - Accounting/Inventory management systems –_ to facilitate business administration and managing stock levels of goods available for sale. Major players in this node include: - supermarkets

	- municipal markets - meat shops
CONSUMPTION	
Key highlights	**ICT usage**
- Preference for local fresh meats - Purchase of whole animals for weddings, parties and other special occasions - Minimal use of small ruminant milk at the household level	- Computers and internet –e-mail communication with producers/suppliers and other stakeholders, and administrative tasks (word processing accounting (Quickbooks) and research. - Sophisticated inventory, purchasing and forecasting systems at hotels – many of the larger hotels use these systems for managing information about their stock of food supplies. These systems produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions in an attempt to ensure maximum satisfaction of their customers. Major players in this node include: - households - restaurants

CASE STUDY 2 (ST KITTS AND NEVIS)

PROCUREMENT MANAGEMENT SYSTEMS FOR THE HOSPITALITY INDUSTRY

***Platform users**: hospitality industry, restaurants.*

***Platform description**: Procurement software systems help to automate the purchasing function of organisations. These systems allow the following to be done electronically:*

- *raising and approving purchase orders;*
- *selecting and ordering the product or service;*
- *receiving and matching the invoices and orders;*
- *paying bills.*

Using these systems, the procurement department can see all orders and ensure that nothing is ordered without the correct approvals. The software allows procurement departments to get the best value by combining several orders for the same type of good or by getting suppliers to bid for the business.

There are a multitude of procurement software solutions on the market that come in industry specific flavours including ones tailored for the hospitality industry. Multinationals or otherwise large organisations tend to use a shared procurement system (i.e. one that can be leveraged by multiple hotel procurement units) to take advantage of economies of scale and drive down the unit cost of purchases. Instead of each hotel in a chain deploying its own system, all the hotels of a chain are given access to a centralised platform through an internet connection that allows them to use the "cloud" service. The key strength of these systems lies in the ability to standardise the procurement of commodities, but some services are also available for purchase through automated systems.

Common features of procurement software systems are as follows:

- ***requisitions -**creation of a purchase order with line items to be fulfilled by a vendor; automated sending via fax or e-mail*
- ***vendor follow up** - automated, or reminders to follow up with vendors to confirm purchase orders*
- ***receiving of goods or services** - maintaining a physical inventory of goods*
- ***financial settlement** - creation of financial and/or inventory related transactions as goods are physically received.*
- ***customised report and analytics generation**.*

(For more information see: http://en.wikipedia.org/wiki/Procurement_software)

***Results and impacts achieved:** Many of the multinational hotel chains that operate in the Caribbean use procurement systems that are shared by all the hotels in the chain. These systems are invaluable for effective hotel management and administration, and in many cases they seamlessly integrate with accounting, inventory management, reservations, customer relationship management (CRM) and labour scheduling systems.*

CASE STUDY 2 (CONTINUED)

The key benefit for organisations using procurement software include, ease of administration and potential long-term cost savings. Having a single interface for procurement related management information cuts down the time and effort required for monitoring of organisational spending. The use of such software allows procurement managers to control the vendors used by the wider organisation so all employees take advantage of negotiated rates and other terms of service.

Financial aspects: *System deployments such as Adaco.NET usually involve considerable customisation to the specific needs and realities of the client hotel. Deployment costs vary widely from deployment to deployment. While the costs of deployment for a hotel are not definitely known, it is clear that the decision to purchase such system is much easier to justify for larger hoteliers than the smaller establishments, even though many of the systems are now available as cloud services – thus reducing the need for capital investments thereby reducing the total (financial) cost of ownership.*

Perspectives on the deployment: *It is difficult for a medium to large hospitality sector establishment to function efficiently and control their costs without using a procurement system that integrates with accounting, inventory management and other functions. These are already becoming standard offerings in the Caribbean hotel and tourism sector. Local producers who integrate their operations with the requirements of these systems stand to gain a great competitive advantage over those producers who continue to ignore this market.*

e-Readiness country profile – St Kitts and Nevis

Table 4 gives a summary of the key issues that affect the level of sophistication of ICT use within the St Kitts and Nevis agricultural sector. The analysis also gives an indication of the preparedness of the nation to achieve operational effectiveness and efficiency gains within the sector through additional investment in ICTs.

Table 4.e-Readiness country profile – St Kitts and Nevis.

Pillar	Country characteristics	Element rating
Business environment	ICT capacity at consumer and marketing nodes is high (esp. restaurants, hotels)	High
	ICT knowledge in Taiwanese processing facility is above average; Government owns a 'high tech'abattoir; ICT knowledge in cottage processing is low	Medium
	Producer ICT knowledge is low	Low
	Pool of digitised baseline data exists	High
	Inadequate information sharing generally, but some collaboration exists within the input supply node	Medium
	Information products exist along value chain	High
	Final product is physical and perishable	Low
	Currently not satisfying domestic demand	High
Governance	Defined, current national agriculture guidelines exist	High
	Dedicated department for implementation of national ICT strategy and e-government	High
	Formalised arrangements with St Kitts Farmers' Cooperative Society (SKFCS)and Marriott Hotel	High
	Conflicting policy implementations across islands	Low
	National ICT plan is outdated and does not address ICT strategy for agriculture	Low
	The agriculture strategy does not elaborate on the inclusion of ICTs	Medium
	Partially defined sector operational guidelines	Medium
	Formation of an agro-processors group to streamline agro-processing	High
HR capacity	State actors at input supplier node have basic ICT capacity	Medium
	No dedicated IT department at DoA	Low
	Insufficient strategic ICT capacity in the State sector	Low
	Good ICT capacity at marketing and consumer nodes (hotels, supermarkets, retail food chains etc.)	High
	ICT capacity at production node and at cottage processing low	Low
Psychographics	Policy commitments to agriculture	High
	Government demonstrates understanding of the role of ICTs for development	High
	National ICT strategy has not been revised for past 9 years	Low
	No website available for the department responsible for e-government	Low
	No recent sector innovations which leverage ICTs	Low

	Production node not generally inclined to ICTs	Low
Infrastructure	Online services available (weather forecasts, farmer registration, marketing info etc.)	Medium
	Population mobile subscription rate > 100%	High
	Population internet usage approx. 80%	High
	Population fixed broadband subscriptions <30%	Low

Key:
High – indicates that the factor being considered is such that it lends itself to the host country benefiting greatly from additional investment in ICTs along the value chain.

Medium– indicates that the factor being considered is such that it lends itself to the host country receiving only a nominal benefit from additional investment in ICTs along the value chain.

Low– indicates that the factor being considered is such that it does not lend itself to the host country benefiting proportionately from additional investment in ICTs along the value chain. It indicates that this or other critical factors need to be addressed first before ICT investments will return maximum value.

CASE STUDY 3 (ST KITTS AND NEVIS)
INVENTORY MANAGEMENT SOFTWARE

***System users**: wholesalers, retailers, supermarkets, hotels, restaurants.*

***Platform description**:*

These are a class of software systems used to track inventory levels, orders, sales and deliveries. Organisations that manage, move or trade large inventories of goods use these systems to avoid product overstock and outages. These systems are used to organise inventory data that was historically stored in hard-copy books or in spreadsheets.
Inventory management software packages usually integrate a number of features.

- ***Service management**– Companies that are primarily service-oriented rather than product-oriented can use inventory management software to track the cost of the materials they use to provide services, such as catering. In this way they can attach prices to their services that reflect the total cost of providing them.*
- ***Product identification**– Products are often tracked via tracking criteria, such as serial number, lot number or revision number. These numbers are used to link to information about the product on the system.*
- ***Order management**– a company's inventory management system can be programmed to tell managers when and how much to reorder of a product when a predetermined stock threshold is reached. This helps companies avoid running out of products or tying up too much capital in stock.*
- ***Asset tracking** –many of these systems integrate with barcode readers, radio (radiofrequency identification (RFID)) and/or wireless tracking technology through which product can be tracked in-transit or in a warehouse or store.*

***Results and impacts achieved:** The value of inventory management software to wholesalers, supermarkets and businesses in the hospitality sector is well-known and understood. The business efficiency and productivity gains that medium and large business receive from using these systems have made these ICT systems one of the most widely used in the Caribbean by medium and large businesses that are part of agro-food value chains. The effective use of these systems help to reduce the cost of managing inventories, the efficiency with which inventory information is stored/accessed and the ability to use inventory data to discover purchasing and customer trends that can be used to forecast future purchasing requirements. Key advantages include:*

- ***Cost savings –** Helps organisations minimise the amount of items they have in storage. Through the use of these systems, organisations get a better sense of what is needed and when, and can then optimise their purchasing schedules to minimise spoilage and storage space requirements. This is particularly important for hotels, restaurants and supermarkets that have inventories of perishable food items.*
- ***Increased efficiency –** Allows for automation of many inventory-related tasks that increase business productivity, such as automatic data collection, calculations and generation of reports.*
- ***Updated data –**Availability of up-to-date, real-time data on inventory conditions that allow managers to make informed purchasing and tactical decisions.*

CASE STUDY 3 (CONTINUED)

- ***Data security***– *Inventory managers can allow many employees to assist in inventory management by separating accountability and granting employees specific access rights to receive products, make orders, transfer products, etc. in a manner that promotes company security. This represents another business productivity gain.*
- ***Insight into trends –*** *These systems can generate reports and analyses based on the repositories of data that these systems manage. Organisations can use their purchasing and inventory data to generate useful insights into the quantities purchased, their schedules, seasonality and other factors that can help their organisation generate knowledge that can benefit their operations.*

Financial aspects:

- ***Expense –****Many large companies use inventory management software, but small organisation can find the cost of implementing these systems prohibitive. .*
- ***Complexity –*** *Initial deployments of inventory management systems usually require that the beneficiary organisation invests a certain amount of time to learning the effectively use the platform – both the hardware and the software.*

Perspectives on deployment: *In many cases, inventory management systems are not stand-alone systems. Many of these systems are modules or components of bigger software packages that integrate company accounting, procurement management, customer relations management (CRM), labour scheduling, reservation systems etc. There are however a wide range of platforms on the market to choose from.*

In the case of global/international hotel chains such as the Hilton, Marriot, the parent organisations usually run their own systems that are integrated with procurement management, accounting and other software. These systems are specifically developed for the chain and in many cases are not available for use by other organisations.

Trinidad and Tobago

Overview of the agricultural sector

Trinidad and Tobago (T and T) are the two southern-most islands of the Lesser Antilles. Trinidad is 30 km (19 mi) from Tobago. The total land area is 5,128 km² (1,980 mi²). Trinidad covers 4,828 km² (1,864 mi²) while Tobago covers 300 km² (117 mi²). The dry season generally runs from January to May with a wet season from June to December. The annual rainfall is 1,869 mm (73.6 in).[17]

Trinidad and Tobago is the leading Caribbean producer of crude oil and natural gas. During the first seven months of fiscal 2012/2013, Trinidad and Tobago exported 435.2 trillion British thermal units (BTU) of liquefied natural gas (LNG), marking a 6.9% increase over 2011.[18]

The government has embarked on economic diversification efforts that include agriculture, manufacturing and tourism. However the economy continues to show dependency on the petroleum sector while the contribution of the agricultural sector continues to decline, contracting by 0.1% and 4.9% in 2011 and 2012, respectively.[19]

Before 2000, sugar was the major contributor to agricultural GDP. However, the advent of structural adjustments of global markets saw total removal of preferential treatments, leading to the closure of the state-owned sugar company Caroni (1975) and a subsequent halt in sugar production in the country by 2008.[20]The loss/decline of the sugar industry, has led to renewed interest in the diversification of the Trinidad and Tobago agricultural sector and in root and tubers/small ruminant production.

In a recent Trinidad and Tobago country profile for roots and tubers, CARDI reported that the Common Fund for Commodities (CFC) has been providing support to the county's production of sweet potato and cassava in a bid to increase demand for root and tubers. The report also stated that through this project, the CFC has partnered with the Trinidad and Tobago Agri-Business Association (TTABA) to upgrade and expand the physical infrastructure associated with the processing and distribution of sweet potato and cassava.

Sheep and goats can be found throughout Trinidad and Tobago. Higher concentrations are found in Tobago, Wallerfield, Carlsen Field and Princes Town. An estimated 87% of farmers are located on owned or leased lands and about 13% are based on landless systems. Production technology ranges from free range to intensive, under 'land and landless' systems. Over 85% of the sheep and goat meat consumed in Trinidad and Tobago is imported.[21]

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[17]Source: CARDI. Trinidad and Tobago. Country profile. http://www.cardi.org/country-offices/trinidad-tobago

[18]Source: Gov. of the Republic of Trinidad and Tobago Ministry of Finance and the Economy. Review of the Economy 2013 http://www.finance.gov.tt/content/Review-of-the-Economy-2013.pdf

[19]Source: Gov. of the Republic of Trinidad and Tobago. Ministry of Finance and the Economy. Review of the Economy 2013 http://www.finance.gov.tt/content/Review-of-the-Economy-2013.pdf

[20]Source: European Commission 2010. Restructuring the sugar industry of Trinidad and Tobago .EuropeAid. http://ec.europa.eu/europeaid/documents/case-studies/trinidad-and-tobago_agriculture_sugar-industry_en.pdf

[21]*Trinidad Guardian* 2013 Trinidad and Tobago imports 85% of goat and sheep meat (Central Statistical Office) http://guardian.co.tt/news/2013-02-28/tt-imports-85-goat-and-sheep-meat

The roots and tubers value chain and ICT usage – Trinidad and Tobago

In this section, sweet potato and cassava are represented as the roots and tubers of interest. Table 5 presents a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed in the sweet potato and cassava value chain.

Table 5. Snapshot of the sweet potato and cassava value chains: Key highlights and ICT usage – Trinidad and Tobago

INPUT SUPPLY	
Key highlights	**ICT usage**
- Farmers use 'farm saved 'cuttings, (or cuttings from previously grown crop) and provide labour and finance - 4 large farm stores coordinate imports and sub-let through various smaller outlets - Commodity organisations facilitate production and marketing - Ministry of Agriculture (MOA) offers subsidies and technical support through its several units - Allied agencies collaborate with government and engage in ongoing targeted research - Financial and other support offered through local development banks, regional and international organisations - CARDI provides clean planting materials	- Mobile voice and SMS – Extension staff use these technologies to communicate and maintain relationships with their clients. SMS is also used to access produce prices through the National Agricultural Market Information System for Trinidad and Tobago (NAMISTT) SMS service. - Computers and internet – State and private-sector organisations use these technologies for conducting desk research, administrative tasks and record keeping and for maintaining e-mail communication with stakeholders across the value chain. - Researcher virtual communities of closed user groups (D groups) – These are used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - Organisational websites and e-services – The Ministry of Food Production and other input suppliers use their websites to provide sector relevant information to their stakeholders including current developments, production manuals, information for accessing services, etc. e-Services such as NAMISTT provide stakeholders with domestic produce price information, market intelligences, market forums for doing business, etc. - Social media (Blogs, YouTube, Facebook) –Social media services are used by input suppliers, both State and private sector, to push information to value chain stakeholders and elicit responses and comments on the content that they push out. - Web 2.0 Tools: Cloud storage – Many input suppliers use the available cloud storage tools available online such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low-cost alternative to implementing their own storage solutions and intranets. - CDs/DVDs – These media are used to disseminate training materials for producers in video presentations and other forms. These are distributed to producers and producer groups who can play the material on DVD players and computers in public centres or in homes.

	Major players in this node include: - farmers (small and large) - commodity organisations (TT Roots and Tubers Association; TT Agro-Processors Association) - large farm stores (Caribbean Chemicals, Marketing and Distribution, Carlsen Chemicals, Marketing Arm) - several small farm store outlets - government: MOA, TTABA, National Marketing and Development Corporation (NAMDEVCO) - allied agencies (CARDI, IICA, FAO, EU) - financiers (Agri Dev. Bank, Commercial Banks, CDB, IDB)
PRODUCTION	
Key highlights	**ICT usage**
- Many small farmers, with less than 1 ha - Few large operators with over 15 ha - Large farmers use some mechanisation - Use of 'farm saved 'planting materials - Limited use of chemical and fertiliser inputs	- Mobile voice and SMS– to communicate and maintain relationships with suppliers, buyers and peers. SMS is also used to access produce prices through the NAMISTT SMS service. - Computers and internet – fore-mail communication with input suppliers, buyers and peers. Use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records; it is also used for internet research on inputs, buyers and agronomic techniques. Major players in this node include: - small and commercial farmers
POST PRODUCTION: Harvest; Post-harvest; Value added	
Key highlights	**ICT usage**
- Mainly use family and hired labour - Some large operators harvest mechanically - Use of recycled containers for packing - Some large farmers use special crates and boxes - Some washing and storage especially for supermarket and processors - Cassava flour, frozen cassava, *farine, kumar*, ice cream, *pone*, wines and chips - Cassava shop in Tobago - TTABA offers agro-	- Computers and internet – for e-mail communication with suppliers and buyers. Use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records as well as Internet research on inputs, buyers and agronomic techniques. - Social media (Blogs, YouTube, Facebook) –Social media services are used by stakeholders in this node to push information to suppliers, buyers and markets. Major players in this node include: - farmers - traders - Roots and Tubers Producers Association - TTABA - a few small processors (e.g. cassava shop) - households

processing facility and sustains coordinated support with farmers	
MARKETS/MARKETING	
Key highlights	**ICT usage**
- Commodities predominantly sold in unprocessed forms - TTABA and NAMDEVCO facilitate markets, storage, provide targeted training and technical support	- Digital display boards- NAMDEVCO uses digital display boards at the major municipal markets across the country to push daily wholesale and retail prices to farmers, wholesalers, retailers and buyers. - Point of sale and inventory systems- Many retailers, especially supermarkets use point of sale hardware and software systems that include cash registers, barcode scanners, etc. these systems integrate with the businesses' inventory management systems. - Social media (Facebook, etc.)- A few of the major supermarket chain use social media pages to promote their brands and advertise their offerings. TTABA also uses its Facebook presence to communicate supply opportunities for its members. - Computers and internet –Used for e-mail communication with producers/suppliers and buyers/consumers and for administrative tasks through productivity software (MS word, Excel, Access, Quickbooks, PeachTree, etc.). Research and access to market prices and intelligence through NAMISTT, Ministry of Food Production websites and others is also facilitated. Further other government e-services are accessed such as TTBizLink, a service that allows users to access forms for access to import/export licenses and other business services. - Mobile voice and SMS- Used for communication and maintenance of relationships with suppliers/producers and buyers/customers as well as for access of current produce prices through the NAMISTT SMS service. Major players in this node include: - municipal markets - greengrocers - government: TTABA - supermarkets

CONSUMPTION	
Key highlights	**ICT usage**
- Preference for fresh cooked local products - Processed products are also consumed	- Computers and internet – for e-mail communication with producers/suppliers/retailers and consumers and administrative tasks through productivity software (MS word, Excel, Access, Quickbooks, PeachTree, etc.). It is also used to find wholesale and retail prices of produce through the NAMISTT service. - Sophisticated inventory, purchasing and forecasting systems – many of the larger hotels use these systems for managing information about their stock of food supplies. These systems can produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions in order to satisfy the demands of hotel guests. - Mobile voice and SMS – for communication and maintenance of relationships with suppliers/producers and buyers/customers and accessing produce prices through NAMDEVCO's SMS platform. Major players in this node include: - household - restaurants - hotels - nutrition programmes (schools)

CASE STUDY 4

TEXT MESSAGING SYSTEM FOR WHOLESALE PRICES (TRINIDAD AND TOBAGO)

http://www.namdevco.com/services/latest-technologies/

***Platform owner/Administrator**: The National Marketing and Development Corporation (NAMDEVCO)*

***Platform description**: In an effort to improve information accessibility for stakeholders, this text messaging service (SMS) was developed to provide wholesale prices for fresh produce and seafood.*

This service works on both mobile networks in country. Users send a text message to 46PRICE or 467-7423 with the keywords 'Get<your commodity name goes here>'. For instance 'Get carrot'. The platform will automatically send the latest updated wholesale price for the commodity requested. This feature costs the same as an ordinary text message. The development of NAMDEVCO's SMS system was carried out by the Corporation's information technology team.

Challenges met in deploying the service:

1) *Users, especially the smaller farmers believe that the service should be a 'free' offering*
2) *NAMDEVCO's negotiations with the telecoms partners to offer the service as a public good have not yet yielded any fruit.*

Financial aspects:

1) *This system was developed by NAMDEVCO's in-house development team. The Information Technology Department's annual budget was used to finance system development and deployment.*
2) *Half of the cost of the service is deducted from the user's mobile credit per SMS received while the other half is paid by NAMDEVCO.*

Results and impacts achieved:

1) *The service currently has approximately 2000 users whose feedback to date has been positive. The users of this service include:*
    - *farmers*
    - *exporters*
    - *supermarkets*
    - *importers*
    - *agro-processors*
    - *hotels*
    - *restaurants*
    - *caterers*

2) *The service provides users (particularly farmers) with information that allows them to better negotiate buying and selling terms.*

CASE STUDY 4 (CONTINUED)

Perspectives on the deployment: *Since the majority of the T and T population have access to at least one mobile phone, SMS is an important information dissemination technology to leverage.*

Through this service, information is disseminated to farmers and stakeholders who live in remote areas without access to computers or adequate internet connectivity. Fishermen who are out at sea also benefit from this pricing system before entering local markets.

What particularly stands out is the reluctance of farmers to pay the full cost of the service and the reluctance of the mobile service providers to offer the service as a public good, or to make concessions that will reduce the user access costs.

These challenges are seen in the Trinidad and Tobago landscape, and in Guyana where a similar SMS system has been installed. This drives home the point that ICT services have an ongoing operational cost that some Caribbean stakeholders are not willing to pay.

Either stakeholders believe that the information provided is not valuable enough, or they are unable to pay the cost of accessing the information. This is an area in which State intervention can make a difference.

As far as making arrangements with mobile service providers are concerned, the option is for the State to underwrite the cost of the public good, or for telecom regulators to make provisions for such public goods/services in granting concessions and licenses to service providers. The current solution wherein NAMDEVCO bears of the portion of the cost per SMS is notable and may be replicated in other territories.

CASE STUDY 5

DIGITAL DISPLAY BOARDS (TRINIDAD AND TOBAGO)

***Platform owner/Administrator**: The National Marketing and Development Corporation (NAMDEVCO)*

***Platform description**: Since 2007, NAMDEVCO has used digital display boards at the major municipal markets (Macoya Market, Central Port of Spain Market) to display the wholesale and retail prices of the major commodities sold. This service was intended to benefit producers/farmers who come to these markets to sell their produce to middlemen and retailers.*

Between 2006 and 2008, Trinidad and Tobago experienced a high food price inflation rate which was mostly driven by the dramatic increases in the prices of locally produced fruits and vegetables. There were accusations among different value chain nodes that were perceived to be the major contributors to the situation.

Producers insisted that they were not at fault because the prices they received from middlemen and retailers was low and did not substantially change during the period of high price inflation. It was discovered that the middlemen at these major municipal markets had organised themselves into a cartel-like structure and were imposing low buying prices from producers and substantially high selling prices to retailers and consumers.

The digital display boards initiative arose from the need to democratise market price information and thereby contribute toward curbing food price inflation.

Challenges met in deploying the service:

1) *After initial procurement and installation, NAMDEVCO experienced problems funding the maintenance of the system with its own budget. Eventually a directive was given to seek maintenance funding from other State institutions.*

Financial aspects:

1) *NAMDEVCO received seed funding from the government to procure, install and run the service for an initial period of time.*
2) *Currently the service and maintenance costs are covered by NAMDEVCO's budget, but this was not the case for the first few years post-implementation.*

***Results and impacts achieved:** The service successfully contributed to creating a more levelled playing field regarding price information for entities doing business at the markets (producers, wholesales, middlemen, retailers, consumers). The initiative has helped mitigate food price inflation during the period and has given farmers information that will help them better negotiate with middlemen and retailers.*

CASE STUDY 5 (CONTINUED)

Perspectives on the deployment: *This initiative has been considered a success. It provides relevant and accurate information to persons most needing it at the time that they needed it – when conducting business. For many stakeholders who are not inclined to use a mobile phone or a computer to access the internet, this solution is optimal.*

Noting the financial challenges involved, this case highlights that ICT services have an ongoing operational cost that some Caribbean stakeholders (even government) are not willing to pay. The benefits of these services must be better articulated so as to gain greater support for ongoing deployment and expansion.

Source: NAMDEVCO

The small ruminants value chain and ICT usage – Trinidad and Tobago

In Trinidad and Tobago, small ruminants are reared primarily for meat, although some milk is also produced. Table 6 therefore offers a representation of the small ruminant meat value chain, with a specific focus on sheep and goats, giving a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed.

Table 6: Snapshot of the small ruminant value chains: Key highlights and ICT uses – Trinidad and Tobago.

INPUT SUPPLY	
Key highlights	**ICT usage**
- Government is the major supplier of breeding stock - Farmers retain special animals for breeding stock and will sell to other farmers - Farmers rely on personal funds or borrow mainly from credit unions - Farmers maintain low-cost operations - Other major inputs include vet services and feed supplements - Government collaborates with allied agencies to provide improved farming systems and breeding stocks - Trinidad and Tobago Sheep and Goat Farmers' Association (TTSGFA) provides technical advice and improved market access for small ruminant meat and milk products.	- Mobile voice and SMS– Extension staff uses these technologies to communicate and maintain relationships with their clients. Major players are: farm stores: Caribbean Chemicals, Marketing and Distribution, Carlsen Chemicals, Marketing Arm - Research centres: Sugarcane feed centre - Computers and internet– State and private sector organisations use these technologies for conducting desk research, administrative tasks and record keeping and for e-mail communication with stakeholders across the value chain. - Researcher virtual communities of closed user groups (D groups) – These are used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - Organisational websites – The Ministry of Food production and other input suppliers use their websites to provide sector relevant information to their stakeholders including, current developments, husbandry manuals, information for accessing services, etc. - Social media (Blogs, YouTube, Facebook) –Social media services are used by input suppliers, both State and private sector, to push information to value chain stakeholders and elicit responses and comments on the content that they push out. - Web 2.0 Tools: Cloud storage – Many input suppliers use the available cloud storage tools available online such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low-cost alternative to implementing their own storage solutions and intranets.

	- CDs/DVDs – These media are used to disseminate training materials for producers in video presentations and other forms. These are distributed to producers and producer groups who can play the material on DVD players and computers in public centres or at homes. - Geographical information system (GIS): State Agricultural Land Information System(SALIS) – Ministry of Food Production, Land and Marine Affairs uses a GIS-based system for managing an inventory of all state agricultural lands. - Closed-circuit television (CCTV) surveillance cameras-The Sugar Cane Feed Centre uses CCTV cameras to mitigate theft incidents on its premises. These cameras have placed at strategic locations on the estate to monitor the activities in the compound. Major players in this node include: - farmers - government: Centeno Livestock Station, Trinidad Blenheim and Hope farms in Tobago - allied agencies: CARDI, IICA, FAO - commodity organisations: TTSGFA
PRODUCTION	
Key highlights	**ICT usage**
- Farming systems includes a mix of traditional methods 50% housing (slotted floor), paddocks (30%) and tethering (20%) - Animals reared mainly for fresh meat - Limited use of chemical/fertiliser inputs	- Mobile voice and SMS – Mainly used to communicate and maintain relationships with input suppliers, buyers and peers. - Computers and internet – Used fore-mail communication with suppliers and buyers and internet research on inputs, buyers and husbandry practices. Also, use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records. Major players in this node include: - Small and large farmers
POST PRODUCTION: Harvesting; Post-harvest; Value added	
Key highlights	**ICT usage**
- Harvesting process is unstructured with traders exerting market power over small producers - Farmers cull unproductive animals for sale - Purchased animals are transported in vehicles that	- Computers and internet – Used for e-mail communication with suppliers and buyers and internet research on inputs, buyers and husbandry practices. Also, use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records. - Social media (Blogs, YouTube, Facebook) –Social media services are used by stakeholders in this node to push information to suppliers,

are not well suited for live animal transport - Animals are transported on boats from Tobago to Trinidad - Little cold storage for fresh meats - Some supermarkets differentiate into special cuts	buyers and markets. - Mobile voice and SMS– Mainly used to communicate and maintain relationships with suppliers, buyers and peers. Major players in this node include: - farmers - butchers - individuals - traders - supermarkets
MARKETS/MARKETING	
Key highlights	**ICT usage**
- Meat shops and municipal markets have limited cold storage - Most meat is sold undifferentiated on the fresh market - Large portion of imported goat meat are sold mainly in supermarkets - Some supermarkets carry imported small ruminants' milk and milk products.	- Point of sale and inventory systems– Many retailers, especially supermarkets use point of sale hardware and software systems that include cash registers, barcode scanners, etc. these systems integrate with the businesses' inventory management systems. - Social media (Facebook, etc.) – a few of the major supermarket chain use social media pages to promote their brands and advertise their offerings. TTABA also uses its Facebook presence to communicate supply opportunities for its members. - Computers and internet – for e-mail communication with producers/suppliers and buyers/consumers. Administrative tasks through productivity software (MS word, Excel, Access, Quickbooks, PeachTree, etc.). Research and access to market prices and intelligence through NAMISTT, Ministry of Food Production websites and others. Further other government e-services are accessed such as TTBiz Link, a service that allows users to access forms for access to import/export licenses and other business services. - Mobile voice and SMS– for communication and maintenance of relationships with suppliers/producers and buyers/customers and to access current produce prices through the NAMISTT SMS service. Major players in this node include: - meat shops - individuals - supermarkets - municipal markets
CONSUMPTION	
Key highlights	**ICT usage**

- Popular cultural dishes – 'goat roti', curry and brown stews. - The Muslim community is the main market for live animals - Individuals purchase whole animals for special occasions (religious, weddings and parties)	Computers and internet – Used for e-mail communication with suppliers and buyers and Internet research on inputs, buyers and husbandry practices. Also, use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records. - Sophisticated inventory, purchasing and forecasting systems – Many of the larger hotels use these systems for managing information about their stock of food supplies. These systems are able to produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions in order to best satisfy demands of guests. - Mobile voice and SMS–Used for communication and maintenance of relationship with suppliers/producers and buyers/customers. Major players in this node include: - individuals - households - restaurants

CASE STUDY 6

NATIONAL AGRICULTURAL MARKET INFORMATION SYSTEM (NAMISTT); TRINIDAD AND TOBAGO

***Platform owner/Administrator**: National Marketing and Development Corporation (NAMDEVCO)*

***Platform description**: This web service was developed in 2005 to provide timely information on the agri-food sector, so as to promote investment and sound strategic, management and policy decisions by all stakeholders.*

The information repositories that NAMISTT provides are categorised as follows:

- *market information system*
- *pesticide information system*
- *fertiliser information system*
- *document repository*
- *contacts database*

The web service provides the following services among others:

- *commodity wholesale prices for various farmers' markets.*
- *market reports and analyses*
- *market intelligence reports*
- *data and report archives*
- *e-market forum*
- *database of domestic regional and international traders and exporters*

The market information system is the prime driver of NAMISTT. This module comprises of supply and demand data for agricultural produce. Data is fed into the NAMISTT by NAMDEVCO's field officers and research assistants.

The production data contains farmer's information, farmland information, farm certification and monitoring. Each field officer is assigned a zone with farmers to visit and record information such as the date produce is planted, expected date of harvest, expected harvest volume, state of field, pest and disease incidences, etc.

NAMISTT contains historic prices between 2001 and present for over 40 commodities commonly traded at the market place. Volumes traded at the wholesale market are available from 2006.

CASE STUDY 6 (CONTINUED)

Financial aspects: *This system was developed by NAMDEVCO's in-house development team. The Information Technology (I.T) Department's annual budget was used to finance system development and deployment.*

Results and impacts achieved: *This information service has been one of the more successful examples of web services not only for Trinidad and Tobago value chain stakeholders, but also for importers and exporters from the Caribbean region and further afield.*

This service is viewed as a regional best practice as far as its implementation, management and service offerings are concerned. However NAMDEVCO is reported to be considering handing over control of the service to the Ministry of Food Production, Land and Marine Affairs.

Perspectives on the deployment: *NAMDEVCO has demonstrated the institutional capacity to build and operate ICT infrastructures geared towards servicing the agricultural sector. Institutional arrangements within the company however, seem to constrict its ability to continue ongoing maintenance and management of this infrastructure.*

NAMDEVCO's role in terms of governance of the IT infrastructure must be rationalized with regard to the agriculture roles of other organisations that feed these platforms with agriculture information. As such, overall policy guidance will be required to ensure optimal collaboration and coordination among agencies for the benefit of the sector as a whole.

Additionally, it will be important that the platform continues to evolve to meet the on-going needs of stakeholders. The continued improvement of the platform's layout, usability and user-friendliness to users with basic navigation skills will be important. Furthermore, the development of advanced features that facilitate the matching of buying and selling opportunities would be valuable additions

Source: NAMDEVCO

e-Readiness country profile – Trinidad and Tobago

Table 7 gives a summary of the key issues that affect the level of sophistication of ICT use within the Trinidad and Tobago agricultural sector. The analysis also gives an indication of the preparedness of the nation to achieve operational effectiveness and efficiency gains within the sector through additional investment in ICTs.

Table 7. e-Readinesscountry profile – Trinidad and Tobago.

Pillar	Country characteristics	Element rating
Business environment	ICT knowledge at marketing and consumer nodes high	High
	A ready pool of digitised data exists	High
	Evidence of collaboration between government and organisations at input supply node	Medium
	Information sharing among nodes inadequate	Low
	Intra-nodal mistrust exists	Low
	Current domestic demand is not satisfied	High
	Information products exist	High
	Strength in the production of processed goods	Medium
Governance	No official policy for the agricultural sector	Low
	No official ICT plans since 2008	Low
	There is a dedicated ICT institution	High
	Frequent changes in leadership and governance arrangements (ICT and agriculture)	Low
	A number of operational guidelines and mechanisms exist	High
	No measurement and evaluation frameworks in place	Low
	A number and farmer and agri-business associations exist	High
HR capacity	State sector employees possess good functional skill in the end-user use of ICTs	Medium
	NAMDEVCO demonstrates high ICT capacity	High
	No clear strategic ICT experts available within the ministry	Low
	Inadequate availability of ICT capable staff in the state sector	Low
	At production node, farmers have at least secondary level education	Medium
	At the consumer and marketing nodes, HR capacity satisfactory	High
Psychographics	Government commitment to ICTs and agriculture inconsistent	Low
	Delays in passing national ICT plans in parliament	Low
	Several national ICT initiatives have been pursued	High
	Declining budget allocation toward agriculture	Low
	No visible ICT champs at the State level	Low
	Agriculture ministry operational leadership not inclined to ICTs	Low
	Innovative initiatives recently deployed	High
	Average age of farmers over 45 years old	High
	Farmers resistant to training and to change	Low
Infrastructure	An array of ICT initiatives currently implemented at the State level	High
	Some state sector workers do not have access to the necessary	Medium

	hardware and software to perform tasks	
	Mobile subscription rates > 100%	High
	Fixed broadband subscription rates 11.5%	Low
	Mobile broadband subscription rates 1.2%	Low
	Total internet users 55%	High
	Mobile internet users increasing	High
	Easy access to broadband (WiFi hot spots, libraries, schools)	High

Key:

High – indicates that the factor being considered is such that it lends itself to the host country benefiting greatly from additional investment in ICTs along the value chain.

Medium– indicates that the factor being considered is such that it lends itself to the host country receiving only a nominal benefit from additional investment in ICTs along the value chain.

Low– indicates that the factor being considered is such that it does not lend itself to the host country benefiting proportionately from additional investment in ICTs along the value chain. It indicates that this or other critical factors need to be addressed first before ICT investments will return maximum value.

Guyana

Overview of the agricultural sector

Guyana is the only English-speaking country in South America. It is also the continent's third smallest country with an area of 83,000 m^2 or 215,000 km^2. It is bounded on the north by the Atlantic Ocean, on the east by Suriname, on the south and south-west by Brazil and on the west and north-west by Venezuela. The country's GDP grew by 4.8% in 2012, the seventh consecutive year of positive growth. Agriculture contributed 21% to GDP in 2012,[22]down from 30% in 2006.[23]

Approximately 80% of the country is covered by forest, which is divided into a white sand belt and interior highlands consisting of mountains, plateaus and savannah. Based on a CARDI report,[24] only about 5% of the country's land area is suitable for the cultivation of crops. This land area lies significantly on the coastal regions, 1 m below the high-tide level of the sea and is protected by a system of dikes and dams. Because about 90% of the country's population lives in the coastal zone that comprises only about 7.5% of its total land area, agricultural expansion in this area is costly.

Agriculture is among the leading productive sectors contributing over 30% of employment and 40% of export earnings.[25] In fact, Guyana is self-sufficient in most of its food produce (both crops and livestock) and domestic crop farmers reported that at 40% of their production capacity, they are saturating local demand.

The main agricultural livestock produced include cattle (dairy and beef), chicken, swine, rabbits and small ruminants (sheep and goats). Guyana has largely continued to produce traditional agriculture products such as rice and sugar. However, in its current diversification efforts, several non-traditional commodities such as sweet potatoes and small ruminants are considered among the major commodities of interest.

According to the National Agriculture Research and Extension Institute (NAREI), Guyana grows in excess of 70 cassava varieties. The major varieties reported are: Four Month, Butter-stick, Uncle Mack and Bad Woman. Cassava is the most important root crop grown in Guyana and is the staple food of hinterland communities especially for the Amerindians. Sweet potato is also a popular tuber that is cultivated in Guyana. Several varieties of sweet potatoes are grown in the country but the most popular ones are the Black Rock, Strong Man and Viola.

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[22]Source: Presentation, Guyana Minister of Agriculture, July 2012 – **Hunger Free LAC Initiative**<http://www.rlc.fao.org/fileadmin/templates/iniciativa/content/pdf/gt2025/2012/presentaciones/guyana.pdf>

[23]Source: Ministry of Agriculture and Fisheries 2006 **National Medium Term Priority Framework for FAO Assistance** – Draft document, 2006

[24]Source: CARDI <http://www.cardi.org/country-offices/guyana/>

[25] Source: CARICOM Secretariat Agriculture Development Profile -Guyana <http://www.caricom.org/jsp/community/donor_conference_agriculture/agri_profile_guyana.jsp >

CASE STUDY 7

NAREI- BLACKBERRY SMARTPHONE USAGE (GUYANA)

Subject Organisation: *Guyana's National Agriculture Research and Extension Institute (NAREI)*

Platform Description: *Most NAREI extension officers use the BlackBerry smartphone e for their work and personal voice and SMS communications. These extension officers have taken the initiative to use several key features of the BlackBerry devices to improve their productivity as crop extension officers. The following two features stand out:*

1. ***Smartphone camera –*** *Cameras on the BlackBerry devices are used to take pictures of plant pests, diseases and other problems that officers encounter in the field. These images are brought back to the main office for analysis by experts and experienced extension staff, so that problems can be diagnosed and solutions relayed to producers. Pictures can communicate much more information with less effort, especially when trying to bridge the gap between producers and experts/researchers.*

2. ***BlackBerry Messenger (BBM) –*** *Extension officers use the (free) BBM capabilities of these devices to communicate with each other. These interactions between extension staff range from coordinating activities to communicating problems and challenges encountered in the field. BBM provides another cost-effective real-time communication tool for extension officers.*

   Above the basic use of BBM, extension staff members have also created a private BBM forum where they can communicate with each other and log their work related BBM messages for forum members to view and contribute to conversations. As time passes, this forum can become a valuable information resource for extension officers, as past conversations are available for reference.

Challenges met in deploying the service: *No challenges reported.*

Financial aspects: *Staff members have taken the initiative to use their device's standard tools and functions. As such, no special development efforts or skills were required for deployment. Also no incremental maintenance costs are incurred by NAREI.*

Results and impacts achieved: *NAREI extension officers have been able to cost effectively increase their productivity by using devices and applications that are familiar to most, at no additional cost to them or to the organisation.*

CASE STUDY 7

Perspectives on the deployment: *NAREI extension officers have demonstrated the ability to take the initiative and use the technologies available to them to increase their productivity.*

This case highlights that sometimes the most effective ICT initiatives are not necessarily driven by top-down directives. The challenge is for the State sector to find mechanisms to allow staff to innovate their own solutions, which may leverage technologies that they already have at their disposal, to improve productivity. While public sector rules and governance structures are important for effective organisational function, innovation must be encouraged.

At the same time however, these initiatives must be evaluated on a case-by-case basis as the security of the information of value chain stakeholders' must also be considered.

In this section, sweet potato and cassava are represented as the roots and tubers of interest. Table 8 presents a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed in the sweet potato and cassava value chain.

Table 8. Snapshot of the sweet potato and cassava value chains: Key highlights and ICT usage - Guyana

INPUT SUPPLY	
Key highlights	**ICT usage**
– **Farmers supply 'farm saved 'planting materials and share labour** – **Government provides support services (extension** and **marketing)** – **Allied agencies collaborate with government to provide research, improved technology and other resources** – **Financiers provide support though grants and credit mainly for research and agro-processing**	– Mobile voice and SMS – The extension services of many the Input Suppliers (NAREI, Guyana Livestock Development Agency (GLDA), etc.) use mobile handset technologies to communicate with and disseminate information to producers and other value chain stakeholders through voice and SMS. – BlackBerry Messenger (BBM) – Most NAREI Extension officers use some form of the BlackBerry Smartphone device and thus use the BBM capabilities of these devices to communicate with each other. The communications range from coordinating extension activities to communicating problems and challenges encountered in the field and seeking advice from colleagues. – NAREI extension officer BBM group – Extension staff members have created a private BBM forum where they can communicate with each other and log their work-related BBM messages for forum members to view and contribute to conversations. This forum is a valuable information resource for extension officers, as past conversations and posts are archived for reference. – Mobile phone cameras – NAREI extension officers use their mobile phone cameras to take pictures of plant pests, diseases and other problems that they and their clients encounter in the field. These images are brought back to the main office for analysis and diagnosis by experts and researchers so that the most optimal solutions can be found and relayed back to the producers. This use of mobile phone cameras is particularly useful for extension officers; they use the images to better communicate problems with experts and colleagues and determine the best solutions for the problems, since no individual extension officer is experienced in all matters. – Productivity software (Word, Excel, Access etc.) – Laptop and desktop PCs with productivity software

	(Microsoft Word, Excel, Access, etc.) are used by NAREI, GLDA and other input suppliers for performing administrative tasks and record-keeping and for e-mail communications with colleagues, researchers and other stakeholders. – Internet for research– Input supplier personnel use the internet as an invaluable tool for desk research especially for personnel involved in research and providing extension services. The ability to access the multitude of resources available online is a basic requirement for input suppliers. – Village PA systems – Organisations that provide information and extension services to crop farmers such as NAREI occasionally use these local systems to announce and promote events and gatherings organised by State agencies in farming communities throughout Guyana. These village PA systems are usually microphone, amplifier and speaker systems mounted on vans or cars that drive slowly through villages while they make announcements or presentations. Major players in this node include: – farmers – farm stores (Farm Supplies Ltd.) – government(Ministry of Fisheries, Crops and Livestock (MFCL), NAREI, the National Drainage and Irrigation Board (NDIB), Guyana School of Agriculture (GSA)and Land Survey Commission (LSC)) – allied agencies (CARDI, FAO, IICA, CARICOM) – financiers (local banks, CDB, EU)
PRODUCTION	
Key highlights	**ICT usage**
– **Use of 'farm saved' cuttings, hired and family labour** – **Cassava popularly grown by Amerindians for centuries** – **Use of traditional means for cultivation e.g. slash and burn for land preparation** – **Minimal use of fertilizer and other chemicals**	– Mobile voice and SMS-The mobile handset is the most used technology device by Guyanese farmers. Producers use this technology as the primary communication tool for connecting with their peers, extension officers, input suppliers, buyers and markets by mostly applying the voice and SMS services. A few have applied the platform for accessing commodity market prices through the New Guyana Marketing Company GMC's (New GMC's) AMIS service. This service allows users to make requests of commodity prices by making SMS queries to the AMIS. AMIS answers the query with an SMS message that contains the current price of the commodity. – Mobile phone cameras – Farmers who are familiar with ICTs use their mobile phone cameras to take

	pictures of pest and disease incidents that they experience on their farms. These images are then shown to the extension officers when they visit the farms. – Social networking platforms – Producers who have access to internet connectivity and are users of the social networking services available such as Facebook, Twitter, etc.) use the same social networking applications to communicate and share information with their colleagues. A few of the larger crop producers have their own Facebook pages that they use to market their products and build public awareness of their activities. Harmony Products is an example of one such farm.[26] – Computers and internet – Used for basic e-mail communications with colleagues, buyers and input suppliers. The internet is also an invaluable tool for desk research on agronomic practices, buyers and prices for both local websites (new GMC website) and foreign websites such as NAMIS. Major players in this node include: – small farmers
POST PRODUCTION: Harvest; Post-Harvest Handling; Value Added	
Key highlights	**ICT usage**
– **Manual harvesting** – **The main cassava products are**: **flour (tapioca), bread, *farine*[27], beverages, chips and *pone*[28]** – **Cassava juice is processed into *casareep*[29]** – **Majority of processing done manually. Some of the produce is processed at the two local processing plants**	– Mobile voice and SMS – Wholesalers and retailers use voice and SMS to communicate with producers and negotiate terms and prices for produce. – Productivity software – Used for business' administrative tasks (word processing, record keeping and accounting). – Computers and internet – Used for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms.

[26] Source: http://www.facebook.com/harmonyproductsgy/info

[27]Farine – grated cassava which is dried and milled to a mealy texture

[28] Pone - A sweet pudding-like cake traditionally made with cassava and coconut as key ingredients

[29]Casareep - a sweet brown thick liquid is traditionally made from bitter cassava and used as a flavouring; it is claimed to have preservative properties. Pepperpot, (the national dish of Guyana) is a mixture of meats stewed in casareep and various spices.

	Major players in this node include: – farmers – traders – household processors – agro-processors (Takakuma and Surama)
MARKETS/MARKETING	
Key highlights	**ICT usage**
– **Commodity associations coordinate agro-processing and provide useful links between farmers and service providers** – **Most sweet potatoes are sold as fresh produce in municipal markets and by greengrocers** – **Cassava processing is mainly done by households and small processors** – **Fresh cassava is sold at municipal markets and greengrocers** – **Only small amounts are exported**	– Mobile voice and SMS – These groups of stakeholders use voice and text messaging on mobile cellular devices to communicate with producers and wholesalers for negotiate terms and prices. Major players in this node include: – commodity associations (The New Guyana Marketing Corporation (NGMC), Guyana Agricultural Producers Association(GAPA), other farmers associations) – municipal markets – greengrocers – supermarkets
CONSUMPTION	
Key highlights	**ICT usage**
– **Both cassava and sweet potatoes are consumed boiled, baked or fried** – **Cassava products are commonly consumed among locals in the form of flour (tapioca), bread, *farine*, beverages, chips and pone** – ***Casareep* is used mainly for flavouring in foods.**	– Computers and internet – Used for e-mail communications with producers/suppliers and other stakeholders specifically for gathering price information and negotiating terms, administrative tasks (word processing, record keeping, accounting) and conducting research. Major players in this node include: – households – restaurants and hotels

CASE STUDY 8

MARKET AND ENTERPRISE INFORMATION SYSTEM (GUYANA)

http://www.newgmc.com/

Platform owner/Administrator: *This platform is administered by the Guyana Marketing Corporation (GMC), a State corporation established under section 46 of the Public Corporations Act, Chap 19:05 of the Laws of Guyana. This Corporation which is also referred to as the 'New GMC' is tasked with developing the non-traditional agricultural sector and promoting the cultivation and export of Guyana's non-traditional agricultural crops to regional and extra-regional markets.*

In this regard, New GMC provides marketing services and advice, assistance for sourcing supplies for harvesting, cleaning and packaging and facilitation of logistical arrangements for exports.

Platform description*: This is a website that provides stakeholders of the non-traditional agricultural sector value chains and exporters with information about the services that the New GMC provides. The website has now developed into a resource for market/price information, proper post-harvest handling techniques, packaging and marketing practices for farmers, agro-processors, exporters and local and international buyers. Specifically this website provides:*

- *quarterly, monthly and weekly market analyses and price movement reports*
- *famer manuals and training material (documents, videos)*
- *library of past newsletters*
- *agricultural news articles*
- *monthly commodity retail prices*
- *application forms for permits, licenses, etc.*
- *market entry requirements (Caribbean markets, USA, UK, etc.)*
- *information on the various services and facilities that are available (packaging, cold storage, etc.)*

Results and impacts achieved: *The new GMC website has:*

- *provided critical market information to stakeholders of the non-traditional agricultural sector*
- *helped increase the usage of the*
- *internet and other ICTs among value chain stakeholders*
- *provided Guyana-based agro-processors with an additional medium for marketing their products.*

Perspectives on the deployment: *The website is a valuable resource for any exporter, producer or buyer of Guyanese non-traditional agricultural commodities and value-added products. The service in its current format will remain relevant to the Guyana's agro-business sector so long as the content remains relevant and up to date.*

One key service that will bring added value to this offering is a facility that can list opportunities in real time and match buyers and sellers as opportunities arise.

The small ruminants value chain and ICT usage – Guyana

In Guyana, the small ruminant sub-sector is characterised mainly by fairly large herders with more than 300 animals reared under either an extensive or semi-intensive farming system. While the extensive system permits the animals to graze on free range all year round, the semi-intensive system is characterised by partial confinement mainly at nights and the animals are released onfree range during the day. According to the *FAO Draft Country Report*, the major challenges that are associated with the rearing of small ruminants in Guyana are drought, disease, flooding and theft.

The small ruminant population consists of both sheep and goats, with sheep being the larger group. The main sheep breeds include the: Barbados Black Belly, Virgin Island White, Wiltshire Horn and Creole. The popular goat breeds are Creole, Nubian and Boer.

In Guyana, small ruminants are reared primarily for meat. Table 9 offers a representation of the small ruminant meat value chain, with specific focus on sheep and goats, giving a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed.

Table 9 Snapshot of the sheep and goat value chains: Key highlights and ICT uses – Guyana.

INPUT SUPPLY	
Key highlights	**ICT usage**
– Through GLDA, the government supplies breeding stock and technical advice – Farmers retain special animals for breeding and will sell to other farmers – Other major inputs include vet services, animal security and feed supplements – Guyana Goat Breeders Association(GGBA) provides technical advice and improved market access for small ruminant meat.	– Mobile voice and SMS – The extension services of many of the input suppliers (GLDA, etc.) use mobile handset technologies to communicate with and disseminate information to producers and other value chain stakeholders through voice and SMS. – Voice over internet Protocol(VoIP), Teleconferencing –researchers use VoIP and teleconferencing applications to communicate with students and fellow researchers and experts around the region and further abroad. – Computers and internet – for e-mail communications with colleagues, researchers and other stakeholders. The internet is also an invaluable tool for desk research especially for personnel involved in research and providing extension services. The ability to access the multitude of resources available online is a basic requirement for input suppliers. – Productivity software – Microsoft Word, Excel, Access etc. are used by GLDA and other input suppliers for performing administrative tasks and record-keeping. Major players in this node include: – farmers – farm stores (Farm Supplies Ltd.) – government (MFCL, GLDA, NDIB, sugar factories) – allied agencies (CARDI, FAO, IICA, CARICOM) – commodity associations(NGMC – financiers (CDB, EU) – Guyana Goat Breeders Association (GGBA)

PRODUCTION	
Key highlights	**ICT usage**
– Extensive or semi-extensive farming systems – Animal reared mainly for meat. Milk production is minimal – Main sheep breed: Barbados Black Belly	– Mobile voice and SMS– Producers use this technology as the primary communication to connect with their peers, extension officers, input suppliers, buyers and markets by mostly applying the voice and SMS services. A few have applied the platform for accessing commodity market prices through New GMC's AMIS service. This service allows users to make requests of commodity prices by making SMS queries to the AMIS. AMIS answers the query with an SMS message that contains the current price of the commodity. – Social media –Producers who have access to internet connectivity and are users of the social networking services available such as Facebook, twitter, etc.) use the same social networking applications to communicate and share information with their colleagues. Several farmer groups/associations use these platforms to disseminate information to their members. For example the *West Berbice Sheep and Goats Farmers Association*[30]administers an open Facebook group through which they promote their activities and interface with their members and the public. – Computers and internet – Used for basic e-mail communications with colleagues, buyers and input suppliers. The internet is used for conducting research on agronomic practices, buyers and prices for both local websites (New GMC website) and foreign websites like NAMIS. Major players in this node include: – small and large farmers
POST PRODUCTION: Harvest; Postharvest Handling; Value Added	
Key highlights	**ICT usage**
– Traders (usually butchers) select choice animals for purchase – Uncontrolled slaughtering despite municipal abattoir in George Town – Little or no cold storage – No traceability – Sorting, pricing, packaging and storage – Product differentiation	– Mobile voice and SMS – Used to communicate with producers and negotiate terms and prices for produce. – Computer and internet – Used for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms. – Productivity and accounting software– Used for business administrative tasks (incl. word processing, record keeping, accounting). Major players in this node include: – farmers – traders – butchers (Rossignol and Rising Suns Farms)

[30] Web Site: https://www.facebook.com/groups/116942875011189/

	– supermarkets
MARKETS/MARKETING	
Key highlights	ICT usage
– Little cold storage at municipal market – Most meat is sold undifferentiated on the fresh market – Little or no imports of small ruminant meats	– Mobile voice and SMS – to communicate with producers and negotiate terms and prices for produce. – Computer and internet– for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms. – Productivity and accounting software– for administrative tasks (word processing, recordkeeping, accounting). – Fax –for sending invoices and other printed communications to domestic and international suppliers and other stakeholders. Major players in this node include: – meat shops – municipal markets
CONSUMPTION	
Key highlights	ICT usage
– Preference for local fresh meat – 'goat curry'and 'goat water' is a popular dish made from small ruminant meat – Strong cultural and religious influences on domestic consumption	– Mobile voice and SMS – to communicate with wholesalers, retailers and producers to negotiate terms and prices. – Computer and internet – for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms. – Productivity and accounting software– for administrative tasks (incl. word processing, record keeping and accounting). – Telephone –to communicate with wholesalers, retailers and producers to negotiate terms and prices. – Fax –to send invoices and other printed communications to domestic and international suppliers and other stakeholders. Major players in this node include: – individuals – households – restaurants and hotels

CASE STUDY 9

AGRICULTURE MARKETING INFORMATION SYSTEM (AMIS) TEXT MESSAGING SERVICE (GUYANA)

Platform owner/Administrator*: This platform is owned by the New Guyana Marketing Corporation (New GMC) and was developed in partnership with Digicel Guyana who administers the platform.*

Platform description*: This service was designed to keep farmers, the consuming public and other key stakeholders up to date with the latest market prices for agricultural commodities, along with other vital information, via the mobile handset through SMS technology.*

Result and impact: *The service is accessed by users by typing the name of a particular agriculture commodity, 1010 and pressing the send key on any mobile handset device subscribed with Digicel's network. Almost instantaneously, the wholesale and retail prices at the Bourda and Stabroek Markets in Guyana, together with the prices in Trinidad and Tobago and Barbados, are sent to the user's mobile device as a response.*

Financial aspects

1) *Farmers, especially the smaller farmers, were not willing to pay for the full service*
2) *Because farmers are less inclined to pay the full service charges, New GMC has attempted to negotiate an arrangement with Digicel (the telecoms partner), to offer the service as a public good. These negotiations have not yielded any fruit. Because of this non-resolution between the partners, the platform is not well promoted and uptake is lower than it otherwise might have been.*

Challenges met in deploying the service: *What particularly stands out is the reluctance of farmers to pay the full cost of the service and the reluctance of the mobile service provider to offer the service as a public good. These challenges are not only seen in the Guyana landscape, but also in Trinidad and Tobago where a similar SMS system has been deployed.*

Perspectives on the deployment: *This highlights that ICT information services have an ongoing operational cost that many Caribbean stakeholders are not willing to pay for. Stakeholders believe that the information provided is not valuable enough, or they are unable to pay the cost of accessing the information. This is an area in which State intervention can make a difference. As far as making arrangements with mobile service providers are concerned, there are options for the State to underwrite the cost of the public good or for regulators to make provisions for such public goods/services in the context of granting concessions and licenses to telecoms service providers.*

Guyana Chronicle Online, GMC-Digicel launch AMIS to assist farmers, exporters; Web Site: http://www.guyanachronicle.com/site/index.php?option=com_contentandview=articleandid=2960%3Agmc%2C-digicel-launch-amis-to-assist-farmers%2C-exportersandItemid=12, Last Updated July 2, 2009; Last Accessed Sept 9, 2013.

e-Readiness country profile – Guyana

Table 10 gives a summary of the key issues that affect the level of sophistication of ICT use within the Guyana agricultural sector. The analysis also gives an indication of the preparedness of the nation to achieve operational effectiveness and efficiency gains within the sector through additional investment in ICTs.

Table 10.e-Readiness country profile – Guyana.

Pillar	Country characteristics	Element rating
Business environment	Consumer node: Hotels/restaurants not plugged into international chains; Population ICT knowledge is satisfactory	Medium
	Inadequate digitized records	Low
	Value chain communication is a challenge	Low
	Information silos exist	Low
	Information products exist along the value chain	High
	Environmental factors (security, infrastructure, etc.)	Low
Governance	National policies defined	High
	National ICT strategy in draft since 2006	Medium
	Dedicated department for creating and implementing ICT strategy	High
	Weak/informal institutional arrangements	Low
	Weak operational value chain guidelines	Low
HR capacity	State sector trained and skilled in the end-user use of ICT	Medium
	Advanced back-end configurations	High
	No dedicated ICT staff or dept at some agencies	Low
	Unavailability of skilled ICT staff cited as a challenge	Low
	Consumer, marketing nodes: ICT skill only satisfactory	Medium
	Production node: Comfortable with mobile, but not comfortable with computers and internet	Low
Psychographics	Government displays an understanding of the role of ICTs in development e.g. One Laptop Per Family (OLPF) initiative	High
	Recent sector innovations	High
	Indication of farmer willingness to receive ICT training	High
	No desire to optimize ICTs at the post production and marketing nodes	Low
Infrastructure	Government OLPF initiative	High
	Few national platforms (AMIS, New GMC website)	Medium
	Mobile subscription below regional average	Low
	Uptake of network and internet below regional average	Low
	Fastest mobile growth rates	High

Key:

High – indicates that the factor being considered is such that it lends itself to the host country benefiting greatly from additional investment in ICTs along the value chain.

Medium– indicates that the factor being considered is such that it lends itself to the host country receiving only a nominal benefit from additional investment in ICTs along the value chain.

w– indicates that the factor being considered is such that it does not lend itself to the host country benefiting proportionately from additional investment in ICTs along the value chain. It indicates that this or other critical factors need to be addressed first before ICT investments will return maximum value.

Barbados

Overview of the agricultural sector

Barbados is the most easterly of the Leeward Islands chain in the Caribbean and is located at latitude 13° 10' North and longitude 59° 35' West. The country covers a land area of 430 km^2 (166 mi^2) of which 37.2% or 16,000 ha(40,000 ac) is considered to be arable land[31].

In 2012, Barbados' total population was 287,733 and agriculture employed 10% of the total labour force.[32] According to a Ministry of Agriculture case study report, Barbados possesses many of the typical characteristics of Small Island Developing States (SIDS), including vulnerability to natural disasters such as hurricanes, droughts and floods, a high level of dependence on imports, reliance on a mono-crop (sugar) within the agricultural sector as the major source of foreign exchange and the existence of production systems which are relatively high cost and uncompetitive.[33] The Barbados food import bill increased from BB$196 million in 1990 to approx. BB$653.78 million in 2011 to BB$730 million in 2013.

In response to these challenges, the government has increased its call for greater domestic food production through new and improved methods of farming. A recent National Consultation on an Agriculture draft report,[34] outlined some key and recent developments of Barbados 'agricultural sector; these include the establishment of a National Agricultural Health and Food Control Programme (NAHFCP) to ensure that the country's animal and plant health and food safety systems comply with international standards and that the country's agricultural and fisheries sectors are internationally competitive.

Table 11 below shows the production estimates of the selected commodities from 2008 to2012for roots and tubers as well as small ruminants.

Table 11.Estimated production of selected commodities 2008–2012 ('000 kg).

Commodities	2008	2009	2010	2011	2012
Total roots crops:	**2,027**	**3,417**	**3,124**	**1,475**	**2,358**
Sweet potato	884(44)	1,102 (32)	1,176 (38)	506 (34)	1,211(51)
Cassava	466 (23)	691 (20)	399 (13)	308 (21)	185 (8)
Total livestock:	**26,099**	**26,705**	**26,313**	**25,488**	**21,803**
Mutton	85	89	106	113	104
Milk	6694 (26)	7014 (26)	6701 (25)	5810 (23)	6146 (28)

Source: Barbados Ministry of Agriculture .**Annual Crop and Livestock Production Estimates** – 2000 to 2012;
Note: percentages are in parentheses; all units in '000 kg

[31] Source: Encyclopedia of the Americas. Country Overview. Barbados http://www.nationsencyclopedia.com/economies/Americas/Barbados.html#ixzz2V2cLHVn9

[32] Source: Index Mundi. 2013. Barbados demographics profile 2013 http://www.indexmundi.com/barbados/demographics_profile.html

[33] Source: Rawlins, GCE. Case study. Barbados. Ministry of Agriculture and Rural Development. Planning Unit. http://unctad.org/en/Docs/ditctncd20031p2_en.pdf

[34] Source: Innis, S. Ministry of Agriculture, Food, Fisheries and Water Resource Management. National Consultation - Repositioning the agricultural sector – background document on a white paper for agriculture. May 2012 http://www.nationsencyclopedia.com/economies/Americas/Barbados-AGRICULTURE.html

The other roots crops that are included in the total (Table 11) are eddoes[35], onions and yams. The figures show that during the period, sweet potato was consistently the major root and tuber crop grown in Barbados. Apart from 2012, where cassava contributed only 8% to total root and tubers production, the report revealed that cassava, along with yams and onions, is popular and is competing for second place in the production process.

The other products included in total production are pork, beef, veal, poultry, turkey and eggs. During the five years represented in the table, mutton production constituted less than 0.01% of total livestock production in Barbados. Although there was no distinction between milk produced by cattle and that produced by small ruminants, the average annual contribution of milk to total livestock production during the period was 26%.

[35] Eddoes, *Colocasia esculenta var antiquorum, is* a tropical starchy root crop that is very closely related to taro. In the Caribbean it is generally consumed boiled or baked.

The roots and tubers value chain and ICT usage – Barbados

In this section, sweet potato and cassava are represented as the roots and tubers of interest. Table 12 presents a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed in the sweet potato and cassava value chain.

Table 12. Snapshot of the sweet potato and cassava value chains: Key highlights and ICT uses – Barbados.

INPUT SUPPLY	
Key highlights	**ICT usage**
- Farmers supply cuttings and primary labour - Commercial farmers import large equipment - Agro Chemicals is the major importer of agricultural inputs such as fertilisers, chemicals and equipment. Over 60 small outlets are supplied island-wide - MOA, BAS and Barbados Agricultural Development and Marketing Corporation(BADMC) provide technical support - Allied agencies assist with technical support and improved planting materials	- Mobile voice and SMS – Used for communicating with producers, suppliers of input materials and coordinating the activities of staff and colleagues. - Mobile messaging apps – Input suppliers, particularly businesses that supply fertilisers, pesticides and herbicides use the mobile messaging apps such as *BlackBerry Messenger (BBM)*and *WhatsAPP* to communicate with their regular customers. They also use these apps for internal staff communication and activity management. - Organisational websites – Input suppliers, both in the State and private sector use their organisational websites to push information about their activities, services and products to their stakeholders/customers. - Computers and internet – Input suppliers use their internet connected devices to (1) access services offered on the Ministry of agriculture website (agriculture.gov.bb) and (2) access information from FAO, IICA, International Plant Protection Convention (IPPC), CODEX, International, Plant Protection Agency (IPPC0), World Trade Organisation(WTO), Environmental Protection Agency(EPA), USDF websites and services. - Accounting/Warehouse management systems- Suppliers of fertilisers, pesticides, herbicides, etc. use warehouse management software packages and accounting programmes to administrate their operations. - TV and radio- Input suppliers both state and private sector use radio and TV to communicate with mainly producers, but also other value chain stakeholders. Some of the programmes in Barbados include *Green Living* and *Talk ya Talk Agriculture*. Major players in this node include: - farmers - large farms stores(Agro Chemicals Inc and Carter's Company Limited) - government (MOA, BAS, BADMC), - allied agencies (CARDI, IICA, FAO and Super Centre)

	- financiers (Agricultural Development Bank, CDB, EU)
PRODUCTION	
Key highlights	**ICT usage**
- A few large commercial operators with over 100 ha - A few small farmers with less than 1 ha of land - Production is not market driven but is influenced strongly by tradition - Agro-research and advanced techniques not well disseminated to smallholder farming community - Use of a combination of mechanisation and manual labour - Low-cost operation with minimal use of fertilisers and chemicals	- Mobile voice and SMS – Large farms use these technologies for managing and coordinating their workers' activities. Most producers use the technologies to communicate with input suppliers and markets (gathering market intelligence and maintaining relationships). - - Computers and internet – Used for conducting research and gathering market and price information from websites, videos and various sources. Major players in this node include: - small farmers - commercial operators (incl. Valley Plantations, ARMAG and BADMC)
POST PRODUCTION: Harvest; Post Harvest; Value Added	
Key highlights	ICT usage
- Harvest is driven by farmer perception of crop maturity - Farmer employs labour to harvest for target markets - No formal contract with processors - The products are gathered into heaps in the field - Use of recycled bags, pans and baskets for packaging before being transported manually to the farm gate - The product is picked up by the trader to be transported to the market or prescribed location - Flour, frozen cassava, some chips - Multipurpose facilities are expected to be operational by 2014 - Restaurants to use cassava and sweet potatoes chips - Some grading at supermarkets	- TV and radio – Used as a source of pertinent information for harvesters and processors. - Computers and internet – Used for gathering market intelligence, word processing, accounting and e-mail communications - Inventory management and accounting software- Used for business administration and managing stock of goods available. Major players in this node include: - farmers - traders - processors - cottage industries - processors (Valley Plantations, ARMAG and BADMC) - supermarkets - households.

MARKETS/MARKETING	
Key highlights	**ICT usage**
- Sold mainly in local municipal market and supermarkets - Competition mainly from other CARICOM countries - No traceability - Import cassava flour from Tobago	- Computers and internet – Used for gathering market intelligence through research and e-mail communications with other value chain stakeholders. - Productivity software – Used for business administration and efficiency through word processing, accounting, inventory management applications. - Mobile phones (voice, SMS, BB, etc.) – Used for communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - Design and graphics software – Used to create promotional materials, packaging, labels and advertisements for the products on offer to customers. Major players in this node include: - municipal markets - greengrocers - supermarkets
CONSUMPTION	
Key highlights	**ICT usage**
- Both sweet potato and cassava are eaten fresh preferably as boiled staples	- Computers and internet – Used for gathering market intelligence through internet research and e-mail communications with suppliers/sellers, etc. - Productivity software – Used for business administration and efficiency through word processing and accounting. - Mobile phones (voice, SMS, BB, etc.) – Communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - Forecasting, purchasing, accounting and inventory management systems– Hotels/restaurants use such systems to project their current and future food needs and make the relevant budgets and purchases. Major players in this node include: - households - restaurants - hotels

CASE STUDY 10

MOBILE MESSAGING APPS ON SMARTPHONES (BARBADOS)

***Application users**: Input suppliers; businesses that sell inputs (herbicides, pesticides, fertilisers, production tools, etc.) to producers/farmers.*

***Platform description**: With the mobile subscription rate in Barbados averaging around 127%, smartphone that run complex applications are widely used. With increasing smartphone and mobile data usage, there is increased uptake of the instant messaging (IM) applications that run on these devices.*

Several farm stores, hardware stores and suppliers of chemicals, fertilisers and other inputs use mobile messaging applications on their smartphones to communicate and keep in touch with their regular customers (usually farmers) and staff. The main mobile messaging applications used are:

- *BlackBerry Messenger (BBM) – persons who use the BlackBerry platform of smartphone devices are likely to use this app that comes as standard with the device and is free to other Blackberries.*
- *Whatsapp – This is a cross-platform (Apple, Blackberry, Android, etc.) mobile messaging app which allows users to exchange messages without having to pay for SMS.*

BBM is a proprietary internet-based instant messenger and video telephony application included on BlackBerry devices that allows messaging between BlackBerry users. Messages sent via BBM are sent over the internet and use the BlackBerry PIN system, so communication is only possible between BlackBerry devices. More recently however, BlackBerry has announced plans to make the BBM application available for other main smartphones.

Currently users of the Android and iPhone platforms in Barbados use other mobile messaging apps that provide similar functionality to BBM. One of the more popular of these is WhatsAPP messenger. This cross-platform mobile messaging app allows users to exchange messages with other users without paying for SMSs as is the case with BBM and most other mobile messaging apps.

***Financial aspects:** Most of the available mobile messaging apps are freely-downloadable from the various online App stores (Google Play, Apple App Store, BlackBerry World). As far as the user is concerned, the main cost apart from purchasing the smartphone device is subscription to a mobile data plan from a mobile service operator.*

CASE STUDY 10 (CONTINUED)

Results and impacts achieved: *Input suppliers have reported using mobile messaging to keep in contact with their customers, mostly producers/farmers who regularly buy their products and may seek further information.*

These input suppliers also use these mobile messaging applications to communicate and keep in touch with their regular staff members, noting that several of these businesses, especially those that sell chemical pesticides, herbicides and fertilisers offer services to producers that are similar to the extension services offered by the State. These services are used to guide and advise users of chemical products on safe and proper application techniques. Input suppliers are interested in the effectiveness of their products when applied to production, and they form relationships with producers so that they can gain valuable feedback about product effectiveness in the field.

The overall impact of using these mobile messaging applications has been to cost effectively increase the productivity of input suppliers as it relates to marketing their products, building relationships with key customers and gathering market intelligence.

Perspectives on the deployment: *This case highlights the use of general purpose technologies in the agriculture space. These mobile messaging apps are a subset of the larger array of social media tools that have become extremely popular and widespread within recent years. This case shows that this penetration has extended into the agricultural sector of SIDS and has become a viable means and tool to assist with the coordination of value chain activity.*

It will be important for countries to continue with the process of creating an enabling environment for these and similar telecom services to proliferate, so that end users and businesses can access them for innovative personal and business applications.

CASE STUDY 11

LIVESTOCK MANAGEMENT MOBILE APPLICATIONS (BARBADOS)

***Application users**: Livestock farmers/producers*

***Platform description**: A few staff members that work on small ruminant farms in Barbados use livestock management applications that are available on smartphone and tablet PC devices. There is currently a multitude of livestock management apps available for download on all of the major mobile app stores (e.g. Google Play, Apple App Store).*

These applications usually vary from each other in implementation but many provide features that allow livestock farmers to access and maintain their farm stock data. Many allow core livestock information to be recorded including animal data, births, deaths, medicines, movements and weights. Data can be input manually or imported from external sources.

For the most part, these apps are used by producers in Barbados to schedule animal movements, manage animal stock and traceability, record animal genetics and lineages and manage station processes.

A few example of the apps available are:

- *iHerd (Android) (*http://iherd.com.au/about/) – *iHerd provides the user with lifetime traceability of the herd such as treatments and location movements and is a simpler approach than other software applications which require information to be recorded in the paddock and then entered manually into the computer.*

  iHerd allows the farmer to enter the information onto the computer server while out in the field (paddock), therefore saving time.

- *Ranch manager (iPhone and iPad) (*http://www.lionedge.com/*) – Livestock software designed for the modern livestock business. Keep detailed livestock records. Manage ID, pedigree and breeding. Record multiple actions including treatments, sales and animal movements. Track animal and herd performance and profit/loss. Keep a ranch calendar and add unlimited notes to keep organised.*

  Records animal-specific records all in one customised livestock program. Cattle, sheep, goats, horses, donkeys, deer, elk, alpaca, llama and dogs – it can handle any combination (see Livestock Edition Software for various combinations).

- *Farm manager (iPhone and iPad) – Farm manager is an app designed for farmers. It allows farmers to record cropping, livestock and machinery procedures and to easily access this information.*

CASE STUDY 11 (CONTINUED)

- *iCattleMgr (iPhone and iPad) – iCattleMgr is a utility to allow cattlemen to log cattle records on their iPhone and iPad. It can be used to record calving, breeding, vaccine and other treatments and any other relevant information.*

- *iLivestock (Android)- Farm Livestock (Android) – Market leading app for farmers and smallholders with livestock to access and maintain their farm stock data, wherever they are. All core livestock information can be recorded, including animal data, births, deaths, comments, medicines, movements and weights. Data can be input manually or imported from external sources e.g. an EID stick reader via Bluetooth.*

***Financial aspects:** Many of the more professional implementations of these apps are not free; others are free to download and use. However these mobile and tablet device apps provide cost-effective solutions to manage livestock production processes.*

***Results and impacts achieved:** These livestock management apps are basically productivity applications that have helped livestock farmers to:*

- *improve station processes*
- *save time and money*
- *simplify herd management and stock traceability*
- *create archives of production and process data/information that they can quickly reference to generate reports and make decisions.*

***Perspectives on the deployment:** Most of these are cost-effective even though the apps are not free to download. The lesson is that in many cases it is not necessary to re-invent the wheel. Regional projects to develop new ICT systems should first review the landscape to determine if there already are platforms that can be used to meet the targeted end. Where solutions are identified, promotion and training activities should present this information to stakeholders and help to familiarise them with the services discovered.*

The small ruminants value chain and ICT usage – Barbados

In Barbados, small ruminants are reared primarily for meat. Table 13 offers a representation of the small ruminant meat value chain, with specific focus on sheep and goats giving a snapshot of the major players, key highlights and ICT uses per node, based upon feedback from actors surveyed.

Table 13 Snapshot of the sheep and goat value chains: Key highlights and ICT uses – Barbados.

INPUT SUPPLY	
Key highlights	**ICT usage**
- Some farmers retain special animals for breeding stock and will sell to other farmers - Farmers maintain low-cost operations - Major costs include veterinarian services and feed supplements - Government collaborates with allied agencies to provide improved farming systems and breeding stocks - Barbados Goat and Sheep Farmers' Association (BGSFA) provides technical advice and improved market access for small ruminant meat and milk products	- Mobile voice and SMS – Used for communicating with producers, suppliers of raw materials for materials and coordinating the activities of staff and colleagues. - Mobile messaging Apps – Private sector input suppliers, use the mobile messaging apps such as *BlackBerry Messenger (BBM)* and *WhatsAPP* to communicate with their regular customers. They also use these apps for internal staff communication and activity management. - Company manufacturing database – The main livestock feed producer operates its own database and analyses system for recording national livestock feed demand/sales data as well as for generating historical analyses and projections. - Hoboware – This is a software system that the dominant livestock feed producer users for displaying, graphing and analysing data. - Organisational websites – Input suppliers, both in the state and private sector use their organisational websites to push information about their activities, services and products to their stakeholders/customers. - Computers and internet – Input suppliers use their internet connected devices to a) access services offered on the Ministry of agriculture website (agriculture.gov.bb), b) access information from FAO, IICA, IPPC, CODEX, International, Plant Protection Agency (IPPC0), WTO, EPA, USDF websites and services. - Feed simulation software – The dominant livestock feed producer uses a software system that prescribes the best resource/raw material mixes for producing feeds for different animals and nutrition requirements. This system informs the manufacturing processes and materials used in feed production. - Poultry farm monitoring system – This is another system used by the main livestock feed producer that monitors the light intensity, temperature and humidity of their own livestock pens.

	- TV and radio – Input suppliers both State and private sector use radio and TV to communicate with mainly producers, and other value chain stakeholders. Some of the programmes in Barbados include *Green Living* and *Talk ya Talk Agriculture.* Major players in this node include: - farmers - government (Greenland Agricultural Station, MOA) - allied agencies (CARDI, IICA, FAO) - BGSFA - farm stores - veterinarians
PRODUCTION	
Key highlights	**ICT usage**
- Small ruminants stock consists mainly of sheep (Barbados Black Belly) - A few large producers with over 300 animals - Sheep and goats are reared primarily for fresh meat - Small quantity of fresh milk is produced for personal use - Few sheep go into lamb chops production - The local breeding station focuses on preserving the local breed of sheep - Most farmers are involved in low cost operations using very little chemicals and fertilizer inputs.	- Mobile voice and SMS – Large farms use these technologies for managing and coordinating their workers' activities. Most producers use the technologies to communicate with input suppliers and markets (gathering market intelligence and maintaining relationships). - Computers and internet – Used for conducting research and gathering market and price information from various sources. - Livestock management apps – several mobile device apps are being used to record livestock farm information and manage animal movement/housing schedules, feeding schedules, genetics information, etc. These apps are downloadable on the mobile/tablet device platforms currently available (mainly Android, iPhone, Windows) Major players in this node include: - Individual farmer - Local breeding stations(Greenland Agricultural Station)
POST PRODUCTION: Harvest; Post-harvest; Value added	
Key highlights	**ICT usage**
- Individuals select choice animals for purchase - Farmers cull unproductive animals for sale - Farmers select animals for sale when approached by buyers - There is no established dairy facility therefore the milking of animals is done haphazardly - Some farmers have special	- TV and radio – Used as a source of pertinent information for harvesters and processors. - Computers and internet – Used for research (gathering market intelligence); for administrative tasks (word processing, accounting) and communications with suppliers and markets (e-mail). Major players in this node include: - farmers - traders - butchers - supermarkets

holding areas for culled and marketable animals - Animals are transported in vehicles that are not adequately equipped to transport live animals - There is no traceability - Few local supermarket currently engage in some levels of product differentiation, - Some level of packaging, special cuts and storage.	
MARKETS/MARKETING	
Key highlights	ICT usage
- Little cold storage at municipal market - Most of the meat is sold in the local supermarkets - There is little or no importation of fresh meat - Live sheep (and semen for artificial insemination) are exported mainly to neighbouring islands.	- Computers and internet – Used forgathering market intelligence through research and e-mail communications with other value chain stakeholders. - Productivity software – Used for business administration and efficiency through word processing, accounting, inventory management applications. - Mobile phones (voice, SMS, BB, etc.) – Used for communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - Design and graphics software – Used to create promotional materials, packaging, labels and advertisements for the products on offer to customers. Major players in this node include: - supermarkets - municipal markets - CARICOM
CONSUMPTION	
Key highlights	**ICT usage**

- The local consumers demonstrate preference for fresh local meats - Hotels and high-end restaurants demand special cuts and lamb chops.	- Computers and internet – Used for gathering market intelligence through internet research and e-mail communications with suppliers/sellers, etc. - Productivity software – Used for business administration and efficiency through word processing, accounting. - Mobile phones (voice, SMS, BB, etc.) – Used for communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - Forecasting, purchasing, accounting and inventory management systems– Hotels/restaurants use such systems to project their current and future food needs and make the relevant budgets and purchases. Major players in this node include: - households - restaurants - hotels

e-Readiness country profile – Barbados

Table 14 gives a summary of the key issues which affect the level of sophistication of ICT use within the Barbados agricultural sector. The analysis also gives an indication of the preparedness of the nation to achieve operational effectiveness and efficiency gains within the sector through additional investment in ICTs.

Table 14.e-Readinesscountry profile – Barbados.

Pillar	Country characteristics	Element rating
Business environment	ICT knowledge at marketing and consumer nodes high	High
	ICT knowledge at production node relatively high	High
	Inter-nodal information exchange inadequate	Low
	Information products exist	High
	Final products are a mix of perishable and processed goods	Medium
	Domestic consumption > domestic production	High
Governance	Several national plans defined (National Strategic Plan; Medium Term Development Plan; National ICT Strategy)	High
	National plans address agriculture and ICT	Medium
	Several farmer associations and non-governmental organisations (NGOs) exist	High
	Operational arrangements, guidelines and linkages not well functioning	Low
HR capacity	General population has good ICT capacity	High
	99% population literacy rate	High
	State sector possesses skills in the end-user uses of ICTs	Medium
	Production and processing nodes have good ICT capacity	High
Psychographics	Demonstrated commitment to ongoing research and development	High
	Official ministry website contains outdated information	Low
	Average age of farmers at just below 60	Low
	No recent ICT-based innovations or deployments specifically for the agricultural sector by the State	Low
	Technology innovations, usage and adoption among agriculture business sector lacklustre	Low
Infrastructure	Easy farmer access to mobile phones and modern ICTs	High
	Mobile voice (127%); Mobile data uptake (77%)	High
	Mobile network coverage 99%	High
	Internet users 71.8%	High
	Widespread availability of computing hardware and software	High

Key:

High – indicates that the factor being considered is such that it lends itself to the host country benefiting greatly from additional investment in ICTs along the value chain.

Medium– indicates that the factor being considered is such that it lends itself to the host country receiving only a nominal benefit from additional investment in ICTs along the value chain.

Low– indicates that the factor being considered is such that it does not lend itself to the host country benefiting proportionately from additional investment in ICTs along the value chain. It indicates that this or other critical factors need to be addressed first before ICT investments will return maximum value.

Jamaica

Overview of the agricultural sector

Jamaica is located south of Cuba and west of Haiti. It is the largest of the English-speaking islands in the Caribbean, covering a total land area of 11,000 km^2 (4,411 mi^2). The interior is very mountainous: the Blue Mountain Peak rises to a height of 2,256 m. The average annual rainfall is 1,000 mm (36 in).

According to a recent Ministry of Agriculture Paper,[36] Jamaica's low food production and high dependency on food imports has resulted in an unprecedentedly high and rising food import bill. The country also has a worrying food security status, given its exposure to external economic shocks as well as climate change. The paper stated that most of the food consumed in Jamaica is imported, either raw or semi-processed for final processing, while a small and declining portion comes from national or regional production.

Based on a recent JAMPRO(Jamaica Promotions Corporation)publication however, domestic crop production is reported to have been on the rise over the last 3 to 4 years and recorded a significant increase in output of 18.3% in 2011 over 2010;[37] food exports increased by 11% during the same period.

A Ministry of Finance paper also reflected that while the general economy of Jamaica declined by 0.1%, the agricultural sector grew by approximately 2.9% in 2012.[38] The growing trend of the agricultural sector appears sustainable, as the paper alluded to several development initiatives that are being undertaken by the government, including the recent (2013) passage of the National Food Nutrition and Security and National Food Safety Policies.

According to the Rural Agricultural Development Agency (RADA), sweet potato is the third most widely grown root tuber in Jamaica, after yams and cassava. The main varieties now propagated are Blue Bud, Clarendon, Flog Hall, Mother Edwards, Quarter Million and Six Weeks. The ideal production areas for sweet potato are St Catherine, St Ann, St James and St Elizabeth.

Although cassava is grown in all 14 parishes of Jamaica, approximately 80% of the total national production is produced in four parishes (Manchester, St Elizabeth, St Catherine and Clarendon) which are situated towards the south-central part of the island[39]. Total production of cassava in 2012 was 18,020 tonnes.[40]

Sweet and bitter cassava are the two distinguishable types of cassava found in Jamaica and both types are acceptable by consumers. While the sweet varieties may be eaten raw or cooked, the bitter varieties have to be processed to eliminate potentially toxic cyanogen. The refined product is either dried by fire or naturally by the sun before it is used to make *bammies*[41], flour, pancake mix and

[36]Source: Ministry of Agriculture and Fisheries 2013.Tabling of the food and nutrition security policy.
[37]Source: Jampro Publication, 2012.
http://www.jamaicatradeandinvest.org/sites/default/files/resources/agriculture_brochureAug2012.pdf

[38]Source: Ministry of Agriculture and Fisheries, MoAF 2013 Ministry Paper, 2013 - Tabling on the achievement of the sector
[39]Source: Ministry of Agriculture 2008. Marketing and Credit Division. Cassava demand study.
[40] Source: Ministry of Agriculture 2012. All-island estimates of crop production by quarter. 2012.
http://www.moa.gov.jm/AgriData/data/crop_production_2012.pdf
[41]Bammy – a flatbread made from cassava flour

other by-products. In Jamaica, the extracted starch is used by local households or sold in the municipal markets for use on clothing or for other domestic purposes.

With regard to small ruminants rearing occurs in all 14 parishes of Jamaica. However, production is predominant in St Elizabeth, Clarendon and St Catherine. These parishes are closest to the two local small ruminants breeding and research stations – Bodles Research Station in St Catherine and Honslow Small Ruminant Facility in St Elizabeth.

The roots and tubers value chain and ICT usage – Jamaica

In Jamaica, the sweet potato and cassava value chains are similar in many ways. With respect to the first two nodes of the value chain (Input Supply and Production), the stakeholders are almost identical, performing similar activities and maintaining similar relationships. The cassava value chain however, becomes more differentiated from sweet potato at the subsequent nodes of the value chain (post-production, marketing and the consumer).

In this section, sweet potato and cassava are represented as the roots and tubers of interest. Table 15 presents a snapshot of the major players, key highlights and ICT uses per node, among actors surveyed in the sweet potato and cassava value chain.

Table 15. Snapshot of the sweet potato and cassava value chains: Key highlights and ICT uses – Jamaica.

INPUT SUPPLY	
Key Highlights	ICT Usage
- The Christina Potato Growers Cooperative Association (CPGCA) provides clean seeds, market intelligence and technical support to farmers - 5 large suppliers import material inputs imported and sublet supplies to small outlets - Government offers a variety of support mainly through RADA - Financial and other support are offered through local banks, regional, international agencies)	- Computers and internet – Apart from their use by the State sector employees in administrative activities, extension officers and other sector support organisation use these technologies for gathering news and research findings (MOA, JIS newsfeeds), e-mail communication with clients, accessing weather forecasts and accessing/tracking crop prices from services such as the Jamaica Agricultural Marketing Information System(JAMIS). - RADA YouTube channel – RADA has a library of videos featuring a number of issues related to Jamaican Agriculture. From Farmer tutorials on agronomic techniques and practices to news and developments impacting the agro-food sector. The channel is used to disseminate information to value chain stakeholders, especially producers. - Ministry of Agriculture and Fisheries(MoAF) informational CDs and DVDs – These media are used to disseminate training materials for producers and producer groups in videos and other forms. The material is generally played on DVD players and computers in public centres and in homes. - Agency websites and e-Services – Organisational websites are used provide information to all value chain stakeholders. Certain

	specialised services such as the JAMIS website provide commodity prices and market information. - Mobile voice and SMS – Extension officers use these technologies to communicate and maintain relationships with their producer clients. - SMS alerts: weather, disaster management, market information – The State sector has implemented several SMS alert services that aim to benefit value chain stakeholders, particularly producers. - Tablet PCs – RADA extension officers use tablet PCs with access to mobile data services to remotely access farmer information on their central database and update these records while they are in the field. Furthermore they use these devices to take pictures of pests, diseases and other problems encountered in the field for further analyses. The devices are also used to e-mail communications with their clients and colleagues. - Researcher virtual communities of closed user groups (D Groups)- This service was reported to be used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - Web 2.0 Tools: Cloud storage- Many input suppliers use the available cloud storage tools such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low-cost alternative to implementing their own storage solutions and intranet. Major players in this node include: - commodity associations (CPGCA) - government (MOA, RADA, Scientific Research Council (SRC)) - allied researchers (CARDI, IICA, Canadian International Development Agency (CIDA) and USDA) - farm stores (Agro Grace, Hardware and Lumber, Antilles Chemicals) - financiers (Local Development Banks, CDB, CARICOM, EU, IDB, FAO, CIDA)
PRODUCTION	
Key highlights	ICT usage

- the crops are grown mainly by small famers with less than 1 ha; - a few large farmers with over 20 ha - use of manual labour - use of mostly 'farm saved 'planting materials - some farmers of CPGCA use clean seeds - use of chemicals and fertilizers are minimal	- YouTube (research on farming practices) – Certain farmers with internet access have reported regular use of YouTube.com to search for video tutorials on agronomic best practices and techniques that they can use in their production activities. - Social media (mainly Facebook and Twitter) – Producers with access have reported the use of social media to communicate with their peers/colleagues and share information with each other (agronomic techniques, market information, sources of input supplies, etc.) . - Skype – Used as a low-cost (free) alternative for voice communication with peers and other stakeholders who may use the service as well. - TV and radio –Producers use the programmes available as sources of information on production activities and techniques and on sector wide news and developments. (Farmtalk Power 106 FM, Jamaica Information Service, etc.) - Jeffrey Town Community Radio – The programmes produced by this community station are used as a source of farming, weather and climate change information and knowledge by the farmers in Jeffery Town. - Agency websites/e-services (JAMIS, Agricultural Business Information System(ABIS), MoAF, etc.) –Producers use these web services to gather market prices, market intelligence, research on agronomic techniques, climate/weather reports, etc. Major players in this node include: - individual farmers
POST PRODUCTION: Harvest; Post-harvest handling; Value added	
Key highlights	**ICT usage**
- Sweet potato is usually marketed as fresh produce - Majority of cassava is consumed in the processed form - Seven major processors for cassava in Jamaica - Processors are the usual buyers of fresh cassava from farmers - The primary value added cassava products in Jamaica is the '*bammy*'	- Computers and internet – Used for e-mail communication with both domestic and international producers/suppliers and buyers. Also used for administrative tasks such as word processing accounting, inventory management and research. These tools are further used to accessing the domestic e-Services available, such as JAMIS. - Mobile voice and SMS – Used for general communication and maintenance of relationship with suppliers/producers and buyers/customers. - Social media (Facebook, etc.) – Used to promote brands and products to customers.

- Sweet potato is processed into pudding and chips on a small scale	Major players in this node include: - farmers - traders - CPGCA - processors (cassava): Mello Bammies, Carleston Jamaica Bammies, Reggae Style Bammies, Island Bammies, Tijule Company Limited, Twickenam Industries and Flour Hill Bammies - a few small/household processors
MARKETS/MARKETING and CONSUMPTION	
Key highlights	**ICT usage**
- Main markets for sweet potato and cassava: Individual consumers, local hotels restaurants - Fresh sweet potato is sold to the municipal markets and greengrocers - The major export markets for Jamaican sweet potato are the USA, Canada and the United Kingdom (UK) - Processed cassava products are sold predominantly at the local markets - A small portion of processed cassava is exported, mainly to the USA and Canada	- Computers and internet- Used for e-mail communication with producers/suppliers and buyers/consumers. Also for research and administrative tasks through productivity software such as MS Word, Excel, Access, Quickbooks, etc,. - Sophisticated inventory, purchasing and forecasting systems- many of the larger hotels use these systems for managing information about their stock of food supplies. These systems are able to produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions. - Mobile voice and SMS- Communication and maintenance of relationship with suppliers/producers and buyers/customers. Major players in this node include: - municipal markets - greengrocers - supermarkets: Mega Mart, Shoppers' Fair, Hilo - exporters - gift shops - local hotels: Grand Lido, Breezes, Franklyn D. Resort (FDR) - restaurants: (Scotties, Island Grill, Juicy Patties) - households

CASE STUDY 12

CHRISTIANA POTATO GROWERS ASSOCIATION, CPGPA (JAMAICA)

CPGPA was registered on 23 March 1959. It is located in the Christiana settlement and has over 5,000 active members within a 50-mile radius, farming in 5 out of Jamaica's 14 parishes. Most of the farms are on undulating to hilly terrain without irrigation and are less than a hectare. Most grow one crop per year without mechanisation.

The CPGCA is the driver for the roots and tuber value chain and the association provides the chain with key embedded services such as:

- *collection, grading, packaging, distribution to buyers;*
- *importing of Irish potatoes in the off-season and occasional exports of roots;*
- *organising test and demonstration plots and training in new varieties and agronomic management practices;*
- *provision of disease free planting material;*
- *providing farm input supplies at competitive prices and in some cases with credit;*
- *advocacy for government policy and enabling environment;*
- *income generation services from development partners to fund developmental projects;*
- *coordination and administration of chain operations.*

In the process of delivering these services, several rudimentary ICTs are used such as:

- *a database of buyers and their contacts;*
- *the online Jamaica Market Information System (JAMIS) to access weekly information on prices at the farm gate, municipal markets, supermarkets and wholesale prices. In addition to using JAMIS, CPGCA e-mails volume and prices information to the database.*
- *a database maintained on the farms with bio data, crops and cropping history including yields, pest problems.*

However, CPGCA hopes to expand its current use of ICTs to include the following:

- *a bar-coding system which allows the chain to meet the buyer requirements for traceability and logistics*
- *an inventory management system given that the CPGCA stores roots to meet off-peak demand.*
- *a production planning system that uses historical demand and farm production performance to schedule planting dates, propose harvesting dates and plan sales and distribution.*
- *smartphone systems that facilitate information sharing in real time with buyers and producers on prices, logistics etc.*

CASE STUDY 12 (CONTINUED)

- *Mobile phone technologies that transmit weather forecasts and agronomic advisories. These technologies should have the flexibility to deliver text messages for those literate farmers, as well as voice messages for those who prefer to receive advisories in voice.*
- *Radio and TV programmes (and possibly a CPGPA owned radio station) to disseminate value chain coordination information and training programmes*
- *A GPS system that allows chain locations and logistics assets to be specified and to define the size of parcels lots so that yields and productivity coefficients can be easily worked out and producers appropriately advised*
- *Electronic payments system which transfers payments for good received directly of farmer accounts*

Source: Alvin Murray, CEO, CPGCA

The small ruminants value chain and ICT usage – Jamaica

In Jamaica, small ruminants are reared primarily for meat. Table 16 offers a representation of the small ruminant meat value chain, with specific focus on sheep and goats giving a snapshot of the major players, key highlights and ICT uses per node, based upon feedback from actors surveyed.

Table 16.Snapshot of the sheep and goat value chains: Key highlights and ICT uses – Jamaica.

INPUT SUPPLY	
Key highlights	**ICT usage**
- Government is the major supplier of breeding stock - Technical support is supplied by the livestock association and RADA - Some farmers retain special animals for breeding stock and may sell to other farmers - Use of grass as the main animal feed - Some farmers used feed supplements and chemicals; - Veterinary services can be accessed privately or through government providers.	- Computers and internet – Apart from their use by State sector employees in administrative activities, extension officers and other sector support organisations use these technologies for gathering news and research findings (MOA, JIS newsfeeds), e-mail communication with clients, accessing weather forecasts and accessing/tracking crop prices from services like JAMIS. - MoAF informational CDs and DVDs – These media are used to disseminate training materials for producers and producer groups in videos and other forms. The material is generally played on DVD players and computers in public centres and in homes. - Agency websites and e-services– Organisational websites are used to provide information to all value chain stakeholders. Certain specialised services such as the JAMIS website provide commodity prices and market information. - Mobile voice and SMS – Extension officers use these technologies to communicate and maintain relationships with their producer clients. - SMS alerts: weather, disaster management, market information –

	The State sector has implemented several SMS alert services that aim to benefit value chain stakeholders, particularly producers. - Tablet PCs – RADA extension officer user tablet PCs with access to mobile data services to remotely access farmer information on their central database and update these records while they are in the field. Furthermore they use these devices to take pictures of pests, diseases and other problems encountered in the field for further analyses. The devices are also used to e-mail communications with their clients and colleagues. - Researcher virtual communities of closed user groups (D groups)- These are used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - Web 2.0 tools: Cloud storage- Many input suppliers use the available cloud storage tools available online such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low cost alternative to implementing their own storage solutions and intranets. Major players in this node include: - farmers - farmer associations (Jamaica Livestock Association(JLA), Jamaica Goat Farmers' Association(JGFA), Jamaica Sheep Farmers Association (JSFA) - government (RADA, Bodles Research and Honslow Facility) - veterinarians - farm stores (Jamaica Broilers, Caribbean Broilers, Agro Grace)
PRODUCTION	
Key highlights	**ICT usage**
- Animals are grown mainly for fresh meat; - The production of milk is not established - *Ad hoc* farm operation and random slaughtering	- Computers and internet –e-mail communication with input suppliers. Use of productivity software(MS word, Excel, Access, Quickbooks, etc.) for maintaining herd information and databases - Social media (mainly Facebook and Twitter) – Producers with access have reported the use of social media to communicate with their peers/colleagues and share information with each other (agronomic techniques, market information, sources of input supplies, etc.) . - TV and radio- producers use the programmes available as sources of information on production activities and techniques and on sector-wide news and developments (Farmtalk Power 106 FM, Jamaica Information Service, etc.)

	- Agency websites/e-services (JAMIS, ABIS, MoAF, etc.) –Producers use these web services to gather market prices, market intelligence, research on agronomic techniques, climate/weather reports, etc. Major players in this node include: - individual farmers - Jamaica 4H club - a few large farmers
POST PRODUCTION: Harvest; Post-harvest handling; Value added	
Key highlights	**ICT usage**
- Little or no cold storage for fresh meat and there is no traceability - Supermarket engage in some levels of packaging and storage of local small ruminant meat - Many imports	- Computers and internet – Used for e-mail communication with both domestic and international producers/suppliers and buyers. Also used for administrative tasks such as word processing accounting, inventory management and research. These tools are further used to accessing the domestic e-services available, such as JAMIS. - Mobile voice and SMS – Used for general communication and maintenance of relationship with suppliers/producers and buyers/customers. - Social media (Facebook, etc.) – Used to promote brands and products to customers. Major players in this node include: - farmers - individuals - traders - butchers - supermarkets
MARKETS/MARKETING	
Key highlights	**ICT usage**
- Meat shops and municipal markets sell most of the fresh meat - goat meat is generally sold undifferentiated on the fresh market - Special cuts of sheep meat are available - The local fresh meat constitute about 10% of the total small ruminant meat market	- Computers and internet – for e-mail communication with producers/suppliers and buyers/consumers and for research and administrative tasks through productivity software such as MS Word, Excel, Access, Quickbooks, etc. - Mobile voice and SMS –communication and maintenance of relationships with suppliers/producers and buyers/customers. Major players in this node include: - meat shops - individuals - a few supermarkets - municipal markets

CONSUMPTION	
Key highlights	**ICT usage**
- Consumers' demands are driven by cultural heritage, special events, taste and preference for locally produced fresh meat - The use of especially goat meat is culturally related (at weddings, parties, funerals and other special events)	Computers and internet – Used for e-mail communication with producers/suppliers and buyers/consumers. Also for research and administrative tasks through productivity software such as MS Word, Excel, Access, Quickbooks, etc. - Sophisticated inventory, purchasing and forecasting systems – Many of the larger hotels use these systems for managing information about their stock of food supplies. They can produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions. - Mobile voice and SMS – Used for communication and maintenance of relationship with suppliers/producers and buyers/customers. Major players in this node include: - individuals - households - restaurants - hotels

CASE STUDY 13

RADA EXTENSION SERVICE - COLLECTION AND PROVISION OF INFORMATION (JAMAICA)

***Administrator**: Rural Agricultural Development Authority (RADA) Jamaica*

***Description**: RADA in its efforts to enhance its extension service through the collection of real-time and accurate data, has equipped its extension officers with tablet PCs that they use to remotely access RADA databases that store farmer and production data. Using Digicel's 4G mobile technology, extension officers can access and update farmer and production information while they are in the field and interacting with producers.*

With the ratio of farmers to extension being about 1,500 to one, this technology intervention is intended to increase the productivity of extension officers and RADA's ability to maintain accurate and up-to-date farmer and production data stores for sector planning, policy and value chain stakeholder use.

***Challenges met in deploying the service:** There have been minimal challenges in the deployment and use of the hardware provided by RADA and its extension officers.*

***Financial aspects:** Digicel business handed over to RADA 130 Huawei Media 7 Lite Tablets on 21 June 2013 as part of a resigned closed user group (CUG)/ICT contract between the two organisations.*

***Results and impacts achieved**: While it may be too early to properly analyse and evaluate the impacts in detail, the use of the technology in the field has increased the productivity of extension officers in terms of their ability to access and update farmer and production information. As can be expected, apart from just accessing and updating information, extension officers access many of the other features and available apps on the devices for their work activities, for example taking pictures of pests and disease for further analysis.*

***Perspectives on the deployment**: The ratio of cultivators to extension officers is still problematic (approx. 1 officer to 1,000 farmers). While the technology will significantly increase the productivity of extension services, additional extension officers will need to be employed and trained (under this model) in order to sufficiently meet the needs of producers and ensure that RADA databases hold reasonably up-to-date information at any given time.*

CASE STUDY 13 (CONTINUED)

Alternatively, another possibly long-term model is one in which the farmers generate the content (i.e. update their information, take pest photos, etc.), query the JAMIS website and manipulate the device with minimum intervention (or intervention in exceptionally difficult cases). This would greatly reduce the need for the State to undertake the expenditure to support an expanded RADA infrastructure (personnel, vehicles, buildings and equipment). This however will require a radical change in leadership thinking as well as a long-term commitment to farmer training and capacity building.

This case illustrates the importance of leveraging agreements and partnerships with telecom operators and other technology firms that are granted concessions to do business in the Caribbean. In this case, such arrangements should be exploited to benefit the agricultural sector. Historically in the Caribbean such arrangements are not usually leveraged for the agro-business sector such as has been the case in other sectors e.g. education.

While RADA is charged with collecting farmer and production data, many sector stakeholders, even within the State sector, do not have a clear sense of which organisation or department is responsible for the coordination of information collection and dissemination activities. There is the need for the State to clearly define responsibilities and communicate clearly to all stakeholders.

e-Readiness country profile – Jamaica

Table 17 gives a summary of the key issues that affect the level of sophistication of ICT use within Jamaica's agricultural sector. The analysis also gives an indication of the preparedness of the nation to achieve operational effectiveness and efficiency gains within the sector through additional investment in ICTs.

Table 17.e-Readiness country profile – Jamaica

Pillar	Country characteristics	Element rating
Business environment	- ICT capacity at marketing and consumer nodes is high.	High
	- The opportunity exists to connect production and demand using ICT	High
	- Rich information being produced at node	High
	- Mistrust among certain nodes was evident, leading to limited inter-nodal information sharing	Low

	- Final product of the value chain is physical and perishable	Low
Governance	- Defined strategic plans exist for both ICT and agriculture at the national level	High
	- Dedicated ministry for national ICT policy and strategy development	High
	- Insufficient awareness of the policies and strategic plans	Low
	- Gaps exist in operational guidelines e.g. no agreement on 'good husbandry practices'	Medium
	- No guidelines for crop or production scheduling for 'non-aligned' farmer groups	Medium
HR capacity	- State sector actors seemed trained and skilled in ICT use	High
	- Producers and non-State sector organisations have generally less than adequate HR capacity	Low
	- At the post production, marketing and consumer nodes, ICT capacity seemed satisfactory	High
	- Insufficient pool of trained ICT staff available at these later nodes of the value chain	Medium
Psychographics	- Government spearheading many positive reforms in the national ICT sector	High
	- Innovate ICT initiatives deployed within the sector recently	High
	- Agri-sector executives agree that ICTs can assist in bolstering value chain efficiency	High
	- Operationally, many agri-actors do not use the ICT tools that are available although they are aware of them	Low
	- Smallholder farmers are not generally interested in technology	Low
Infrastructure	- Government has implemented an array of ICT infrastructures and initiatives	High
	- Mobile phone subscription rates exceed 100%	High
	- Broadband subscriptions low (< 10%)	Low
	- Apparent barriers to internet usage and uptake of broadband	Medium

Key:
High – indicates that the factor being considered is such that it lends itself to the host country benefiting greatly from additional investment in ICTs along the value chain.

Medium– indicates that the factor being considered is such that it lends itself to the host country receiving only a nominal benefit from additional investment in ICTs along the value chain.

Low– indicates that the factor being considered is such that it does not lend itself to the host country benefiting proportionately from additional investment in ICTs along the value chain. It indicates that this or other critical factors need to be addressed first before ICT investments will return maximum value.

CASE STUDY 14

AGRICULTURAL BUSINESS INFORMATION SYSTEM , ABIS (JAMAICA)

Platform owner/Administrator*: Rural Agricultural Development Authority (RADA)*

Platform description*: ABIS is a web-based information system developed by RADA. This platform is intended to be the main database for farmer and production data in Jamaica; the service being specifically designed for Agricultural extension officers in the field who are now equipped with internet connected mobile and tablet devices.*

While the platform's database was initially intended for use by RADA extension officers and state personnel the ABIS website provides some services to the non-state sector stakeholders. Some of information/services that are available through the ABIS website include:

- *Custom queries to generate crop, livestock and property reports.*
- *Trader Module – informs farmers of potential market possibilities.*
- *Technical Guide Module – access to best practice guides to farmers.*
- *Track farmer's production for trading (alerting/informing market of produce availability).*
- *Stakeholder and crop searching.*

Financial aspects*: Limited information is available, as ABIS has been incorporated into the operation programme of RADA and is currently supported by RADA's internal ICT staff. The platform's maintenance cost is approximately US$2,500 annually. This includes hosting, software subscriptions and related costs.*

Challenges met in deployment:

- *The inability to keep data current due to the cost of in-field internet connectivity, devices and established data collection methodology;*
- *Reliance on an external/overseas hosting provider to maintain 98% availability/uptime;*
- *Promoting the platform to ensure greater/wider acceptance/appreciation and use of the value of the system by the industry stakeholders.*

Results and impacts achieved: *The ABIS platform is one of the main repositories of farmer and production information for Jamaica. The main impacts observed since its deployment include:*

- *increased use and reliance on data from the platform and applications by state sector value chain stakeholders;*
- *increased queries from stakeholders and members of the public for information from the application;*
- *disaster recovery intervention efforts are being guided by information produced from the application;*
- *field/extension staff are now able to collect and upload data from the field or where appropriate using computers (laptops/Tablets) and broadband wireless connections;*
- *increased efficiency/productivity of monitoring and reporting activities. Field staff are able to gather and update sector records and data in a more timely manner;*
- *improved quality in-field decision making due to the increased access to information from the application;*
- *raising the profile of field service delivery and the corporate image of RADA.*

CASE STUDY 14 (CONTINUED)

Key successes: *Strength and robustness of the platform's design and the core database and data structures which has facilitated:*

- *the ease of scaling the core platform with new modules and sub-systems over the years.*
- *98% Availability/Uptime of application.*
- *the scalability of the system to facilitate external interest/stakeholder use/partnership/collaborations such as:*
  - *the praedial larceny receipt book management subsystem with Jamaica Agricultural Society (JAS);*
  - *the farmer registration activity tracking subsystem with the Coffee Industry Board (CIB);*
  - *tourism/agriculture linkages with the Ministry of Tourism and Entertainment;*
  - *agriculture open data initiative with Mona School of Business and management (MSMB).*

Perspectives on the deployment: *The ABIS concept is seen as best practice in terms of sector governance. In this case, a single repository of farmer and production data/information that is administered by RADA – the organisation that is charged with collecting agricultural data and providing extension services – is an ideal.*

The main challenge lies in the ability to ensure the timeliness and accuracy of the information in the ABIS database. Several stakeholders have asserted that the information in the ABIS system is not always up to date or accurate. This may well be the situation due to RADA's ability to update the database with data in a timely manner. The current situation is that the current ration of extension officers to producers is approximately 1,500 to 1. Even though extension staff are equipped with the technology to remotely access and update the ABIS data store while in the field, there is still the need to increase RADA's human resource capacity or to incentivise producers to update their production information themselves.

The current situation is that producers, especially the smaller farmers, are not inclined to share information about their current production; many of these smaller farmers are not formally registered in the current system. The value of the information that the ABIS system can provide to stakeholders and planners depends on solving the human resource constraints of RADA and farmer attitudes about sharing their production data and registering with the State.

Comparison of ICT usage across study countries

Comparisons across the five countries reveal that ICT usage in the studied value chains is most pervasive in Trinidad and Tobago. This is facilitated by the national infrastructure that provides widespread access of mobile and broadband internet at reasonable costs to end users. There are a number of ICT-based services developed specifically for the agro-food sector that are accessible to users. What Trinidad and Tobago lacks are appropriate governance structures that will allow the services available to drive greater value and hence usage of the agro-sector ICT services available.

Jamaica demonstrated the second highest usage of ICTs in the agro-food sector. Like Trinidad and Tobago, Jamaica has a number of ICT-enabled services specifically developed for the sector. Jamaica has also implemented sector governance frameworks that facilitate sector information gathering and dissemination. However the weak link is in the producers' ability to access the services that are currently in place.

ICT usage in Barbados is comparable to that in Trinidad and Tobago and Jamaica; value chain stakeholders are taking advantage of the nation's connectivity infrastructure, personal hardware devices and software to benefit their activities. Unlike Jamaica and Trinidad however, Barbados does not have any substantial ICT-enabled services deployed specifically for the agro-food sector.

Guyana has developed some ICT services for the agricultural sector. The uptake and usage in this country is limited by the national infrastructure. Owing to Guyana's relatively large landmass compared to other Caribbean territories, its connectivity infrastructure is not as ubiquitous and the costs of access are perceived to be restrictive to many producers. The Guyanese input suppliers, especially in the State sector, have taken the opportunity to make the most effective use of the mobile handset technologies that they have – a display of the maximisation of the utility of the devices and connectivity available.

St Kitts and Nevis shows the lowest ICT usage of the study countries. Apart from the Ministry of Agriculture's website, there are no ICT services specifically deployed to benefit the agro-food sector. The day-to-day usage of ICT by producers and other value chain stakeholders to enhance their activities is also low.

Tables 18 and 19 present a cross-country comparison of the ICT usage across the value chains and countries under review.

Table 18.Comparison of ICT usage across study countries (sweet potato and cassava value chains).

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
INPUT SUPPLY				
- **Mobile voice and SMS-** Extension staff use these technologies to communicate and maintain relationships with their clients. SMS is also used to access produce prices through the NAMISTT SMS service. - **Computers and internet**- State and private sector organisations use these technologies for conducting desk research, administrative tasks and record keeping as well as maintaining e-mail communication with stakeholders across the value chain. - **Researcher virtual communities of closed user groups (D Groups)-** These are used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for	– **Mobile voice and SMS** - The extension services of many the Input Suppliers (NAREI, GLDA, etc.) use mobile handset technologies to communicate with and disseminate information to producers and other value chain stakeholders through voice and SMS. – **BlackBerry Messenger (BBM)-** Most NAREI Extension officers use some form of the BlackBerry Smartphone device and thus use the BBM capabilities of these devices to communicate with each other. The communications range from coordinating extension activities to communicating problems and challenges encountered in the field and seeking advice from colleagues. – **NAREI extension officer BBM group**- Extension staff members have created a private BBM forum where they can communicate with	- **Mobile voice and SMS**- Used for communicating with producers, suppliers of input materials and coordinating the activities of staff and colleagues. - **Mobile messaging Apps**- Input suppliers, particularly businesses that supply fertilizers, pesticides and herbicides use the mobile messaging apps such as *BlackBerry Messenger (BBM)* and *WhatsAPP* to communicate with their regular customers. They also use these apps for internal staff communication and activity management. - **Organisational websites-** Input suppliers, both in the state and private sector use their organisational websites to push information about their activities, services and products to their stakeholders/customers. - **Computers and internet-**	- **Mobile voice and SMS**- The main usage is in communication with producers and maintaining relationships with them. - **Computers and internet**- Used for data entry, gathering information and research. Also for administrative tasks record keeping and communication with stakeholders via e-mail. - **TV and radio** -Used mainly by large chemical companies and the DoA to disseminate information to stakeholders. These programmes are mainly targeted to actors on the production node. - **Social media** (Facebook, blogs, etc.) - Organisations mainly in the State sector, use these technologies to	- **Computers and internet**- Apart from their use by state sector employees in administrative activities, extension officers and other sector support organisation use these technologies for gathering news and research findings (MOA, JIS newsfeeds), e-mail communication with clients, accessing weather forecasts and accessing/tracking crop prices from services like JAMIS. - **RADA YouTube channel**- RADA has a library of videos featuring a number of issues related to Jamaican Agriculture. From Farmer tutorials on agronomic techniques and practices to news and developments impacting the agro-food sector. The channel is used to disseminate information to value chain stakeholders, especially producers. - **MoAF informational CDs**

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - **Organisational Websites and e-Services-**The Ministry of Food production and other input suppliers use their websites to provide sector relevant information to their stakeholders including, current developments, production manuals, information for accessing services, etc. E-Services such as NAMISTT provide stakeholders with domestic produce price information, market intelligences, market forums for doing business, etc. - **Social Media (Blogs, Youtube, Facebook)-** As with organisational websites social media services are used by input suppliers, both state and private sector, to push information to value chain stakeholders	each other and log their work related BBM messages for forum members to view and contribute to conversations. This forum is a valuable information resource for extension officers, as past conversations and posts are archived for reference. – **Mobile phone camera-** NAREI extension officers use their mobile device cameras to take pictures of plant pests, diseases and other problems that they and their clients encounter in the field. These images are brought back to the main office for analysis and diagnosis by experts and researchers so that the most optimal solutions can be found and relayed back to the producers. **This use of mobile phone cameras** is particularly useful for extension officers; they use the images to better communicate problems with experts and colleagues and determine the best solutions for the problems, since no	Input suppliers use their internet connected devices to a) access services offered on the Ministry of agriculture website (agriculture.gov.bb), b) access information from FAO, IICA, IPPC, CODEX, International, Plant Protection Agency (IPPC0), WTO, EPA, USDF websites and services. - **Accounting/Warehouse management systems**- Suppliers of fertilisers, pesticides, herbicides, etc. use warehouse management software packages and accounting programmes to administrate their operations. - **TV and radio**- Input suppliers both state and private sector use radio and TV to communicate with mainly producers, but also other value chain stakeholders. Some of the programmes in Barbados include *Green Living* and *Talk ya Talk Agriculture*.	disseminate information to stakeholders and to gathering feedback from the same.	**and DVDs-** These media are used to disseminate training materials for producers and producer groups in videos and other forms. The material is generally played on DVD players and computers in public centres and at homes. - **Agency websites and e-services-** Organisational websites are used provide information to all value chain stakeholders. Certain specialized services such as the JAMIS website provide commodity prices and market information. - **Mobile Voice and SMS**- Extension officers use these technologies to communicate and maintain relationships with their producer clients. - **SMS alerts: weather, disaster management, market information**- The State sector has implemented several SMS alert services that aim to benefit value chain stakeholders, particularly

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
and elicit responses and comments on the content that they push out. - **Web 2.0 Tools: Cloud storage** – Many input suppliers use the available cloud storage tools available online such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low cost alternative to implementing their own storage solutions and intranets. - **CDs/DVDs** – These media are used to disseminate training materials for producers in video presentations and other forms. These are distributed to producers and producer groups who can play the material on DVD players and computers in public centres or in homes.	individual extension officer is experienced in all matters. – **Productivity software (Word, Excel, Access etc.)** - Laptop and desktop PCs with productivity software (Microsoft Word, Excel, Access, etc.) are used by NAREI, GLDA and other input suppliers for performing administrative tasks and record-keeping as well as for e-mail communications with colleagues, researchers and other stakeholders. – I**nternet** for research – Input supplier personnel use the internet as an invaluable tool for desk research especially for personnel involved in research and providing extension services. The ability to access the multitude of resources available online is a basic requirement for input suppliers. – **Village PA systems-** Organisations that provide information and extension services to crop farmers such as NAREI occasionally			producers. - **Tablet PCs –** RADA extension officers use tablet PCs with access to mobile data services to remotely access farmer information on their central database and update these records while they are in the field. Furthermore they use these devices to take pictures of pests, diseases and other problems encountered in the field for further analyses. The devices are also used to e-mail communications with their clients and colleagues. - **Researcher virtual communities of closed user groups (D groups)** – This service was reported to be used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - **Web 2.0 Tools: Cloud storage**- Many input suppliers use the available

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
	use these local systems to announce and promote events and gatherings organized by state agencies in farming communities throughout Guyana. These Village PA systems are usually microphone, amplifier and speaker systems mounted on automobiles that drive slowly through villages while they make announcements or presentations.			cloud storage tools such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low cost alternative to implementing their own storage solutions and intranets.
PRODUCTION				
- **Mobile voice and SMS**– Mainly used to communicate and maintain relationships with suppliers, buyers and peers. SMS is also used to access produce prices through the NAMISTT SMS service. - **Computers and internet**– Used for e-mail communication with input suppliers, buyers and peers. Use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records. Also	– **Mobile voice and SMS** – The mobile handset is the most used technology device by Guyanese farmers. Producers use this technology as the primary communication tool for connecting with their peers, extension officers, input suppliers, buyers and markets by mostly applying the voice and SMS services. A few have applied the platform for accessing commodity market prices through New GMC's AMIS service. This service allows users to make requests of commodity prices by making SMS queries to the AMIS.	- **Mobile Voice and SMS**– Large farms use these technologies for managing and coordinating their worker's activities. Most producers use the technologies to communicate with input suppliers and markets (gathering market intelligence and maintaining relationships). - **Computers and internet**– Used for conducting Research and gathering market and price information from websites, videos various sources.	- **Mobile voice and SMS**– Used to communicate and maintain relationships with extension officers, buyers, processors and other producers. - **Computers and internet–** Used mainly for individual information gathering and research pertaining to agronomic practices/techniques. - **TV and radio**– The *Agriculture in Context* is a popular programme is used to get information on the local development	- **YouTube** (research on farming practices)– Certain farmers with internet access have reported regular use of YouTube.com to search for video tutorials on agronomic best practices and techniques that they can use in their production activities. - **Social media (mainly Facebook and Twitter)–** Producers with access have reported the use of social media to communicate with their peers/colleagues and share information with each other (agronomic techniques, market

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
used for internet research on inputs, buyers and agronomic techniques.	AMIS answers the query with an SMS message that contains the current price of the commodity. – **Mobile phone cameras** – Farmers that are familiar with ICTs use their mobile phone cameras to take pictures of pest and disease incidents that they experience on their farms. These images are then shown to the extension officers when they visit the farms. – **Social networking platforms**- Producers who have access to internet connectivity and are users of the **Social networking** services available such as Facebook, Twitter, etc.) use these same social networking applications to communicate and share information with their colleagues. A few of the larger crop producers do have their own Facebook pages that they use to market their products and build a public awareness of their activities.		in the sector. - **Social media** – Used to communicate with peers and share information.	information, sources of input supplies, etc.) . - **Skype**– Used as a low-cost (free) alternative for voice communication with peers and other stakeholders who may use the service as well. - **TV and radio**– producers use the programmes available as sources of information on production activities and techniques and on sector-wide news and developments. (Farmtalk Power 106 FM, Jamaica Information Service, etc.) - **Jeffrey Town Community Radio**- The programmes produced by this community station are used as a source of farming, weather and climate change information and knowledge by the farmers in Jeffery Town. - **Agency websites/e-Services** (JAMIS, ABIS, MoAF, etc.) –Producers use these web services to gather market prices, market intelligence,

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
	Harmony Products is an example of one such farm[42]. – **Computers and internet**- Used for basic e-mail communications with colleagues, buyers and input suppliers. The Internet is also an invaluable tool for desk research on agronomic practices, buyers and prices for both local websites (New GMC website) and foreign websites such as NAMIS.			research on agronomic techniques, climate/weather reports, etc.
POST PRODUCTION: Harvesting; Post Harvest; Value Added				
- **Computers and Internet**- Used for e-mail communication with suppliers and buyers. Use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records as well as Internet research on inputs, buyers and agronomic techniques. - Social Media (Blogs, YouTube, Facebook)- As with organisational websites social media	– **Mobile voice and SMS**- Wholesalers and retailers use voice and SMS to communicate with producers and negotiate terms and prices for produce. – **Productivity software**- Used for business' administrative tasks (word processing, record keeping and accounting). – **Computers and Internet** - Used for e-mail communications with producers/suppliers and	- **TV and radio** - Used as a source of pertinent information for harvesters and processors. - **Computers and internet**- Used for gathering market intelligence, word processing, accounting and e-mail communications - **Inventory management and accounting software**- Used for business administration and managing stock of goods available.	- **Mobile voice and SMS**- Used to communicate and maintain relationships with producers/suppliers buyers, to get information on availability of produce and on demand for commodity/value added products. - **Computers and Internet**- Used for e-mail communication with producers/suppliers and other stakeholders and for administrative tasks (word processing accounting), as well as	- **Computers and internet**- Used for e-mail communication with both domestic and international producers/suppliers and buyers. Also used for administrative tasks such as word processing accounting, inventory management and research. These tools are further used to accessing the domestic e-Services available, such as JAMIS. - **Mobile Voice and SMS**- Used for general communication and

[42] Web Site: http://www.facebook.com/harmonyproductsgy/info

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
services are used by stakeholders in this node to push information to suppliers, buyers and markets.	other stakeholders specifically with regard to gathering price information and negotiating terms.		research.	maintenance of relationship with suppliers/producers and buyers/customers. - **Social Media** (Facebook, etc.) - Used to promote brands and products to customers.
MARKETS/MARKETING				
- **Digital display boards** - NAMDEVCO uses digital display boards at the major municipal markets across the country to push daily wholesale and retail prices to farmers, wholesalers, retailers and buyers. - **Point of Sale and inventory systems**- Many retailers, especially supermarkets use point of sale hardware and software systems that include cash registers, barcode scanners, etc. these systems integrate with the businesses' inventory management systems.	– **Mobile voice and SMS**- These groups of stakeholders use voice and text messaging on mobile cellular devices to communicate with producers and wholesalers for negotiate terms and prices.	- **Computers and internet**- Used for gathering market intelligence through research and e-mail communications with other value chain stakeholders. - **Productivity software-** Used for business administration and efficiency through word processing, accounting, inventory management applications. - **Mobile phones (voice, SMS, BB, etc.) -** Used for communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - **Design and graphics software**- Used to create	- **Mobile voice and SMS**- Used for communicating and maintaining relationships with producers/suppliers buyers, getting information on availability of produce and demand for the commodity/value added products. - **Accounting/Inventory management systems** - These are used to effect business administration and managing stock of goods available.	- **Computers and Internet**- Used for e-mail communication with producers/suppliers and buyers/consumers. Also for research and administrative tasks through productivity software such as MS Word, Excel, Access, Quickbooks, etc,. - **Sophisticated inventory, purchasing and forecasting systems**- many of the larger hotels use these systems for managing information about their stock of food supplies. These systems are able to produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
- **Social media (Facebook, etc.)** - A few of the major supermarket chain use social media pages to promote their brands and advertise their offerings. TTABA also uses its Facebook presence to communicate supply opportunities for its members. - **Computers and internet**- Used for e-mail communication with producers/suppliers and buyers/consumers and for administrative tasks through productivity software (MS word, Excel, Access, Quickbooks, PeachTree, etc.). Research and access to market prices and intelligence through NAMISTT, Ministry of Food Production websites and others is also facilitated. Further other government e-services are accessed such as TTBizLink, a service that allows users to access forms for access to import/export		promotional materials, packaging, labels and advertisements for the products on offer to customers.		procurement decisions. - Mobile Voice and SMS- Communication and maintenance of relationship with suppliers/producers and buyers/customers.

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
licenses and other business services. - Mobile voice and SMS- Used for communication and maintenance of relationships with suppliers/producers and buyers/customers as well as for access of current produce prices through the NAMISTT SMS service.				
CONSUMPTION				
- **Computers and internet**- Used for e-mail communication with producers/suppliers/ retailers and consumers and administrative tasks through productivity software (MS word, Excel, Access, Quickbooks, PeachTree, etc.). Also used to find wholesale and retail prices of produce through the NAMISTT service. - Sophisticated inventory, purchasing and forecasting systems – many of the	– **Computers and internet –** Used for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms, as well as administrative tasks (word processing, record keeping, accounting) and conducting research.	- **Computers and internet**- Used for gathering market intelligence through internet research and e-mail communications with suppliers/sellers, etc. - **Productivity software –** Used for business administration and efficiency through word processing and accounting. - **Mobile phones (voice, SMS, BB, etc.)** - Communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - **Forecasting, purchasing,**	- **Computers and internet–**Used for e-mail communication with producers/suppliers and other stakeholders. Also used for research and administrative tasks (incl. word processing and accounting). - **Sophisticated inventory**, purchasing and forecasting systems at hotels- many of the larger hotels use these systems for managing information about their stock of food supplies. These systems are able to produce reports and analyses of current and projected demand for	

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
larger hotels use these systems for managing information about their stock of food supplies. These systems are able to produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions in order to satisfy demands of hotel guests. - **Mobile voice and SMS-** Used for communication and maintenance of relationship with suppliers/producers and buyers/customers as well as accessing produce prices through NAMDEVCO's SMS platform.		**accounting and inventory management systems**- Hotels/restaurants use such systems to project their current and future food needs and make the relevant budgets and purchases.	certain products. Administrators use the analyses to make the best procurement decisions to ensure hotel guests are satisfied.	

Table 19. Comparison of ICT usage across study countries (small ruminant value chains).

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
INPUT SUPPLY				
– **Mobile voice and SMS** –Extension staff use these technologies to communicate and maintain relationships with their clients. – **Computers and internet**– State and private sector organisations use these technologies for conducting desk research, administrative tasks and record keeping as well as for e-mail communication with stakeholders across the value chain. – **Researcher virtual communities of closed user groups (D groups)** – These are used to maintain a network of experts, professionals and researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing	– **Mobile voice and SMS** – The extension services of many of the input suppliers (GLDA, etc.) use mobile handset technologies to communicate with and disseminate information to producers and other value chain stakeholders through voice and SMS. – **VoIP, teleconferencing–** Researchers in particular used VoIP and teleconferencing applications to communicate and collaborate with students and fellow researchers and experts around the region and further abroad. – **Computers and internet**- Used for e-mail communications with colleagues, researchers and other stakeholders. The internet is also an invaluable tool for desk research especially for personnel involved in research and providing extension services. The	- **Mobile voice and SMS-** Used for communicating with producers, suppliers of raw materials for materials and coordinating the activities of staff and colleagues. - Mobile messaging apps – Private sector input suppliers use mobile messaging apps such as *BlackBerry Messenger (BBM)* and *WhatsAPP* to communicate with their regular customers. They also use these apps for internal staff communication and activity management. - **Company manufacturing database** – The main livestock feed producer operates its own database and analyses system for recording national livestock feed demand/sales data as well as for generating historical analyses and projections. - 'Hoboware' – This is a software system that the	- **Mobile voice and SMS** – The main usage for extension officers and suppliers of chemicals and feed is in communication with producers and maintaining relationships with them. - **Computers and internet**– State sector organisations and other actors use these technologies for conducting desk research, administrative tasks and record keeping as well as for e-mail communication with stakeholders across the value chain. - TV and radio– Used to disseminate information to stakeholders. Programs are mostly targeted to actors on the producer node. - Websites, **Social**	- **Computers and internet** – Apart from their use by State sector employees in administrative activities, extension officers and other sector support organisations use these technologies for gathering news and research findings (MOA, JIS newsfeeds), e-mail communication with clients, accessing weather forecasts and accessing/tracking crop prices from services like JAMIS. - **MoAF informational CDs and DVDs**– These media are used to disseminate training materials for producers and producer groups in videos and other forms. The material is generally played on DVD players and computers in public centres and in homes. - Agency websites and e-Services– Organisational websites are used provide information to all value chain stakeholders. Certain specialised services such as the JAMIS website provide

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
solutions to challenges encountered. – Organisational websites – The Ministry of Food production and other input suppliers use their websites to provide sector relevant information to their stakeholders including, current developments, husbandry manuals, information for accessing services, etc. – **Social Media** (Blogs, YouTube, Facebook) – As with organisational websites, social media services are used by input suppliers, both State and private sector, to push information to value chain stakeholders and elicit responses and comments on the content that they push out. – Web 2.0 Tools: Cloud storage – Many input suppliers use the available cloud storage tools available online such as Dropbox and Google Drive to store and share content for	ability to access the multitude of resources available online is a basic requirement for input suppliers. – Productivity software – Microsoft Word, Excel, Access, etc. are used by GLDA and other input suppliers for performing administrative tasks and record keeping.	dominant livestock feed producer users for displaying, graphing and analysing data. - Organisational websites – Input suppliers, both in the State and private sector use their organisational websites to push information about their activities, services and products to their stakeholders/customers. - **Computers and internet** – Input suppliers use their internet connected devices to:(1) access services offered on the Ministry of agriculture website (agriculture.gov.bb);(2) access information from FAO, IICA, IPPC, CODEX, International, Plant Protection Agency (IPPC0), WTO, EPA, USDF websites and services. - Feed simulation software- The dominant livestock feed producer uses a software system that prescribes the best resource/raw material mixes for producing feeds for different animals and nutrition requirements. This system informs the manufacturing processes	**Media** (Facebook, blogs, etc.) – Organisations mainly in the state sector, use these technologies to disseminate information to stakeholders and to gather feedback from the same.	commodity prices and market information. - **Mobile voice and SMS-** Extension officers use these technologies to communicate and maintain relationships with their producer clients. - SMS alerts: weather, disaster management, market information – The State sector has implemented several SMS alert services that are to benefit value chain stakeholders, particularly producers. - **Tablet PCs**- RADA extension officer user tablet PC with access to mobile data services to remotely access farmer information on their central database and update these records while they are in the field. Furthermore they use these devices to take pictures of pests, diseases and other problems encountered in the field for further analyses. The devices are also used to e-mail communications with their clients and colleagues. - Researcher virtual communities of closed user groups (D groups)- These are used to maintain a network of experts, professionals and

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
the benefit of their staff and organisations as a low cost alternative to implementing their own storage solutions and intranets. – **CDs/DVDs** – These media are used to disseminate training materials for producers in video presentations and other forms. These are distributed to producers and producer groups who can play the material on DVD players and computers in public centre or at homes. – **GIS: SALIS** – Ministry of Food Production, Land and Marine Affairs employs a GIS-based system for managing an inventory of all State agricultural lands. – **CCTV Surveillance Cameras** – The Sugar Cane Feed Centre uses CCTV cameras to mitigate theft incidents on its premises. These cameras are placed at strategic locations on the estate to monitor		and materials used in feed production. - Poultry farm monitoring system – This is another system used by the main livestock feed producer that monitors the light intensity, temperature and humidity of their livestock pens. - TV and Radio- Input suppliers both state and private sector use radio and TV to communicate with mainly producers, but also other value chain stakeholders. Some of the programmes in Barbados include *GreenLiving* and *Talk ya Talk* Agriculture.		researchers in the sector as a resource that can be leveraged for sharing ideas, expertise, knowledge and developing solutions to challenges encountered. - Web 2.0 Tools: Cloud Storage – Many input suppliers use the available cloud storage tools available online such as Dropbox and Google Drive to store and share content for the benefit of their staff and organisations as a low-cost alternative to implementing their own storage solutions and intranets.

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
the activities on the compound.				
PRODUCTION				
- **Mobile voice and SMS –** Mainly used to communicate and maintain relationships with input suppliers, buyers and peers. - **Computers and internet –** Used for e-mail communication with suppliers and buyers and Internet research on inputs, buyers and husbandry practices. Also, use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records.	– **Mobile voice and SMS –** Producers use this technology as the primary communication to connect with their peers, extension officers, input suppliers, buyers and markets by mostly applying the voice and SMS services. A few have applied the platform for accessing commodity market prices through New GMC's AMIS service. This service allows users to make requests of commodity prices by making SMS queries to the AMIS. AMIS answers the query with an SMS message that contains the current price of the commodity. – **Social Media**:Producers who have access to internet connectivity and are users of the social networking services available such as Facebook, Twitter, etc.) use these same social networking applications to communicate and share information with their colleagues. In this regard	- **Mobile Voice and SMS –** Large farms use these technologies for managing and coordinating their worker's activities. Most producers use the technologies to communicate with input suppliers and markets (gathering market intelligence and maintaining relationships). - **Computers and internet –** Used for conducting Research and gathering market and price information from various sources. - Livestock Management Apps- several mobile device apps are being used to record livestock farm information and manage animal movement/housing schedules, feeding schedules, genetics information, etc. These apps are downloadable the mobile/tablet device platforms currently available (mainly Android, iPhone, Windows)	- **Mobile voice and SMS –** Used for communicating and maintaining relationships with extension officers, buyers, processors and fellow producers. - **Computers and internet –**Used for individual information gathering and research pertaining to husbandry practices/techniques. - TV and Radio- The *Agriculture in Context* is a popular programme tuned into by production actors to get information on local developments in the sector. - **Social Media –** Used to communicate with peers and share information.	- **Computers and internet –**Use of e-mail communication with input suppliers. Use of productivity software(MS Word, Excel, Access, Quickbooks, etc.) , for maintaining herd information and databases - **Social Media** (mainly Facebook and Twitter)- Producers with access have reported the use of social media to communicate with their peers/colleagues and share information with each other (agronomic techniques, market information, sources of input supplies, etc.) . - **TV and Radio-** producers use the programmes available as sources of information on production activities and techniques and on sector wide news and developments. (Farmtalk Power 106 FM, Jamaica Information Service, etc.) - Agency Websites/e-Services (JAMIS, ABIS, MoAF, etc.) Producers use these web services to gather market prices, market intelligence,

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
	several farmer groups/associations use these platforms to disseminate information to their members. For example the West Berbice Sheep and Goats Farmers Association[43]administers an open Facebook group through which they promote their activities and interface with their members and the public. – **Computers and internet** – Used for basic e-mail communications with colleagues, buyers and input suppliers. **The internet** is used for conducting research on agronomic practices, buyers and prices for both local websites (New GMC website) and foreign websites such as NAMIS.			research on agronomic techniques, climate/weather reports, etc.
-	–	-	-	POST PRODUCTION: Harvesting; Post Harvest; Value Added
- **Computers and internet** – Used for e-mail communication with suppliers and buyers and Internet research on inputs,	– **Mobile voice and SMS** – Used to communicate with producers and negotiate terms and prices for produce. – Computer and internet-	- **TV and radio** – Used as a source of useful information for harvesters and processors. - **Computers and internet**- Used for research	- **Mobile voice and SMS** – Used for communicating and maintaining relationships with producers/suppliers.	- **Computers and internet** –- Used for e-mail communication with both domestic and international producers/suppliers and buyers. Also used for

[43] Web Site: https://www.facebook.com/groups/116942875011189/

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
buyers and husbandry practices. Also, use of productivity software (MS Word, Excel, Access, PeachTree, etc.) for keeping business and activity records. - **Social Media** (Blogs, YouTube, Facebook)-As with organisational websites social media services are used by stakeholders in this node to push information to suppliers, buyers and markets. - Mobile voice and SMS– Mainly used to communicate and maintain relationships with suppliers, buyers and peers.	Used for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms. – **Productivity and accounting software** – Used for business administrative tasks (incl. word processing, record keeping, accounting).	(gathering market intelligence); for administrative tasks (word processing, accounting) and communications with suppliers and markets (e-mail).	Also used for getting information on availability of produce and demand for commodity/value added products.	administrative tasks such as word processing accounting, inventory management and research. These tools are further used to accessing the domestic e-services available, such as JAMIS. - Mobile voice and SMS – Used for general communication and maintenance of relationship with suppliers/producers and buyers/customers. - **Social Media** (Facebook, etc.) - Used to promote brands and products to customers.
MARKETS/MARKETING				
– **Point of sale and inventory systems** – Many retailers, especially supermarkets use point of sale hardware and software systems that include cash registers, barcode scanners, etc. these systems integrate with the businesses'	– **Mobile voice and SMS** – Used to communicate with producers and negotiate terms and prices for produce. – Computer and internet – Used for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information	- **Computers and internet** – Used forgathering market intelligence through research and e-mail communications with other value chain stakeholders. - Productivity software- Used for business administration and efficiency through word processing, accounting, and inventory management applications.	- **Mobile voice and SMS** – Communicating and maintaining relationships with producers/suppliers buyers getting information on availability of produce and on the demand for the commodity/value added products. - **Computers and**	- **Computers and internet** – Used for e-mail communication with producers/suppliers and buyers/consumers. Also for research and administrative tasks through productivity software such as MS Word, Excel, Access, Quickbooks, etc,. - Mobile voice and SMS- Communication and

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
inventory management systems. – **Social Media** (Facebook, etc.) – A few of the major supermarket chain use social media pages to promote their brands and advertise their offerings. TTABA also uses its Facebook presence to communicate supply opportunities for its members. – **Computers and internet**-Used for e-mail communication with producers/suppliers and buyers/consumers. Administrative tasks through productivity software (MS word, Excel, Access, Quickbooks, PeachTree, etc.). Research and access to market prices and intelligence through NAMISTT, Ministry of Food Production websites and others. Further other government e-services	and negotiating terms. – **Productivity and accounting software –** Used for administrative tasks (word processing, record keeping, accounting). – Fax – sending invoices and other printed communications to domestic and international suppliers and other stakeholders.	- **Mobile phones (voice, SMS, BB, etc.)** – Used for communicating and maintaining relationships with their suppliers, customers and other relevant value chain stakeholders. - Design and Graphics software- Used to create promotional materials, packaging, labels and advertisements for the products on offer to customers.	**internet**– Used mainly for e-mail communication with both domestic and international producers/suppliers and other stakeholders. Also for administrative tasks (word processing accounting (Quickbooks), and research. - **Accounting/** - **inventory management systems** – These are used to facilitate business administration and managing stock levels of goods available for sale.	maintenance of relationships with suppliers/producers and buyers/customers.

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
are accessed such as TTBizLink, a service that allows users to access forms for access to import/export licenses and other business services. – **Mobile voice and SMS** – Used for communication and maintenance of relationships with suppliers/producers and buyers/customers and to access current produce prices through the NAMISTT SMS service.				
CONSUMPTION				
- **Computers and internet** – Used for e-mail communication with suppliers and buyers and Internet research on inputs, buyers and husbandry practices. Also, use of productivity software (MS word, Excel, Access, PeachTree, etc.) for keeping business and activity records. - Sophisticated inventory, purchasing and forecasting systems-	– **Mobile voice and SMS** – to communicate with wholesalers, retailers and producers to negotiate terms and prices. – Computer and internet – Used for e-mail communications with producers/suppliers and other stakeholders specifically with regard to gathering price information and negotiating terms. – Productivity and	- **Computers and internet** – Used for gathering market intelligence through internet research and e-mail communications with suppliers/sellers, etc. - Productivity software – Used for business administration and efficiency through word processing, accounting. - **Mobile phones (voice, SMS, BB, etc.)** - Used for communicating and maintaining relationships with their suppliers,	- **Computers and internet** – Used for e-mail communication with producers/suppliers and other stakeholders as well as administrative tasks (word processing accounting (Quickbooks) and research. - Sophisticated inventory, purchasing and forecasting systems at hotels-	- **Computers and internet** - Used for e-mail communication with producers/suppliers and buyers/consumers. Also for research and administrative tasks through productivity software such as MS Word, Excel, Access, Quickbooks, etc,. - Sophisticated inventory, purchasing and forecasting systems- many of the larger hotels use these systems for managing information about their stock of food supplies.

Trinidad and Tobago	Guyana	Barbados	St Kitts	Jamaica
Many of the larger hotels use these systems for managing information about their stock of food supplies. These systems can produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions in order to satisfy the demands of guests. - **Mobile voice and** SMS – Communication and maintenance of relationship with suppliers/producers and buyers/customers.	accounting software Used for administrative tasks (incl. word processing, record keeping and accounting). – **Telephone** – Used to communicate with wholesalers, retailers and producers to negotiate terms and prices. – **Fax** – Sending invoices and other printed communications to domestic and international suppliers and other stakeholders.	customers and other relevant value chain stakeholders. - **Forecasting, purchasing, accounting and inventory management systems**- Hotels/restaurants use such systems to project their current and future food needs and make the relevant budgets and purchases.	many of the larger hotels use these systems for managing information about their stock of food supplies. These systems are able to produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions to in an attempt to ensure maximum satisfaction of the customers.	These systems are able to produce reports and analyses of current and projected demand for certain products. Administrators use the analyses to make the best procurement decisions. - **Mobile voice and SMS** – Used for communication and maintenance of relationship with suppliers/producers and buyers/customers.

5. Challenges reported in target value chains in the Caribbean

A short questionnaire was administered to practitioners as part of the Study across the five countries (i.e. Barbados, Jamaica, Trinidad and Tobago, St Kitts and Nevis and Guyana).One of the key questions asked of study participants was to identify the top five challenges facing their value chain, from their nodal perspective. Table 20 below gives a summary of the key challenges identified:

Table 20. Key challenges in the roots and tubers and small ruminants value chains in the Caribbean.

Rank	Key challenge	Frequency reported
1	Price/Availability of input supplies/infrastructure	43
2	Lack of up-to-date local information (farmers/production/buyers/research)	33
3	Access to trained labour/technical human resource/extension human resources	25
4	Poor value chain communication (both within nodes/agencies and among nodes/agencies)	24
5	Credit/Budget/Funding availability	23
6	Lack of ICT/ICT usage/training	16
7	Sustainability of market opportunities	13
9	Inadequate storage/packaging/transport/abattoir facilities	12
8	Praedial larceny (theft)/Animal attacks on livestock	11
10	Unstable sector policy/priorities/commitment by government	10
11	Poor animal and farm management practices	9
12	Limited range of fresh produce/inconsistency of supply/quality of Product/high price	8
13	Farmers' commitment (invest in agriculture, attending training courses, adopting new fertilisers regime, marketing agreements, to form farmer groups)	8
14	Inadequacy of total supply (small scale of farming)	7
15	Attitude of farmers to change	6
16	Land issues (tenure, size, productivity, etc.)	6
17	Declining youth involvement/lack of innovative initiatives for youth	4
18	Other challenges	47
	Total number of responses	**305**

Key Challenge [1] Price of inputs

The data indicates that the number one issue across the region is the prices/cost of production inputs. This may not be such a surprising outcome as throughout the five countries, farmers represented a high proportion of the total number of persons surveyed. The majority of responses (14%) cited the high

price of inputs (incl. fertiliser, seed, feed, veterinary services etc.) and the equipment needed for land preparation (e.g. tractors and irrigation systems) as a key barrier to higher volume, more efficient and year-round production within the subsector. Many producers complained that they were being sandwiched between the high and rising cost of inputs and the stable farm-gate prices for produce. Some even intimated that the price that they were receiving at the farm gate had not increased in over 10 years.

Key Challenge [2] Lack of up-to-date local information

The second key challenge identified was the paucity of up-to-date and reliable information that is available to actors all along the value chain. This challenge showed itself in many forms. Supermarkets in Barbados in the marketing node of the chain noted that they did not have a good sense of who the farmers were and what the national level of production of a given commodity (e.g. carrots or mutton) was. They reported that they did not have information about the costs of production and they sometimes negotiated prices with farmers that they believe could have been below the farmers' costs. Some respondents also reported that they doubted the accuracy of the import data that is available from the government. Without reliable and timely data on the quantity of imports or the level of local production, buying decisions cannot be optimised. This can lead to spoilage (or inadequate produce) on shelves, incorrect demand signals to local producers and over-reliance on imports.

Two other example cases are illustrative: In one county, the consultants were not able to ascertain from any relevant authority (including the sheep and goat farmers association) information on the total number of sheep and goat farmers in the country. In another, we were told that though information does exist on the national marketing information system, the information in many cases may be outdated with some of deceased farmers logged in the system as being active. Appendix 5 gives a full list of reported information needs per node.

Key Challenge [3] Availability of trained personnel

Training at all levels was the third most popular challenge cited by respondents across the region. The lack of technical training and insufficiency in the availability of trained personnel, including persons with ICT skills, was seen as a key impediment for the sector. These included farmers, farm labourers, extension officers, ministry personnel and other input suppliers such as veterinarians and health officers.

The lack of availability of these critical HR components within the sector has necessarily had the knock-on effect of increasing the price of these services. Farmers complain of the price of skilled labour, veterinary services, 'office' staff for record keeping, etc. Additionally farmers also complain that certain extension officers "can't help me", because "they don't know nutt'n (anything)". Whether this is a fact or a perception, this results in extension information/advice not being received and possibly leads to crop losses or bad planning decisions with regard to crop choice, equipment purchases, pesticide use, etc. In Jamaica, the RADA personnel declared that they had just over 140 extension and assistant officers available to service Jamaica's approximately 166,000 farmers.

Key Challenge [4] Communication across the value chain and within nodes

In contrast to challenge no. 2, wherein the information needed by value chain actors was either not being produced or not kept being kept up-to-date, another interesting discovery was that in some cases the information was being produced – at the farm level in terms of livestock and breeding records; at the government level in terms of ministry aggregate econometric data; and at the supermarket level in

terms of historical demand (sales quantity/price) per food category, etc. – but was not being shared with the appropriate counterparts along the value chain.

While indeed the information does exist, it is not being communicated to other nodes on the chain and each node is making decisions (what to produce/buy, how much, what policies to pursue, etc.) in isolation. The value chains are therefore highly fragmented and sometimes quite dysfunctional.

As an example, in one of the focal countries, all restaurants have to submit to the Hotel and Tourism Authority the quantity of local produce and meat which they purchase on a monthly basis in order to qualify for the associated tax rebate. This information goes back for at least five years. It is clear that the absolute numbers as well as the trends in this data (which is consistently captured) could be of great value for planning and programme targeting purposes, however it is not clear that the Ministry of Agriculture is aware that this information is available and/or leverages it in their work.

Key Challenge [5] Credit and funding availability

Another pervasive challenge that was reported was with regard to financing. The non-availability of financing to move ahead with projects was a common complaint, particularly from actors early in the chain – ministry representatives, representatives of research institutions, extension services and farmers. One established livestock (sheep and goat) farmer lamented that he could not find an officer from the Ministry of Agriculture or from an allied agency (such as IICA/CARDI) to give assistance, with regard to putting together a funding application for an international agency grant to expand his farm.

Tissue culture laboratories lamented that they do not have the resources to satisfy the demands being requested of them. Extension agencies reported that their budgetary constraints mitigate the completeness of the service that they would like to give.

Other challenges

There were many other significant challenges that were mentioned by respondents; these were praedial larceny (theft) and animal attacks on livestock; the lack of ICT usage; the lack of sustainability of (particularly export) market opportunities; issues relating to land tenure and ownership; and insufficient youth involvement, among others.

One challenge of note was the perception of lack of commitment by farmers toward attending training courses, adopting new fertilisers and agronomic practices, honouring production contracts and forming farmer groups.

Other challenges were mentioned, the importance of which varied from country to country. Some of these reported challenges are listed in Table 21.

Table 21. Additional list of issues reported in regional roots and tubers and small ruminant value chains

18. Inadequate training/training programmes 19. Low farm-gate prices 20. Disease and pests 21. Inadequate emphasis on consumer education 22. Inadequate municipal markets 23. Availability/quality of genetic stock 24. Insufficient research 25. Dependency on imports 26. Traceability/animal tagging 27. Competition from imports	28. No incentive for high quality 29. Bureaucratic delays 30. Inadequacy of local demand 31. Weather 32. Inadequate chemical disposal facilities and or information on these facilities 33. Overall industry decline 34. Global economic slowdown 35. Mark-up to final consumer too high 36. No legal recourse for larceny and breaking contracts

6. e-Readiness summary

e-Readiness comparison of findings of the various countries

Business environment

The Barbados market opportunity is mainly in supplying its highly developed tourism sector, the agro-processing sector and domestic consumers. This situation is similar to that of Jamaica, and to a lesser extent St Kitts and Nevis. In all three cases, the application of ICTs should focus on developing the information services that will allow domestic producers to supply the mentioned sectors at the appropriate time, at the required quality and quantity. The tourism sector stakeholders (hoteliers, restaurants, caterers, etc.) in Barbados, Jamaica, St Kitts, and Trinidad and Tobago are relatively ICT savvy and are reasonably open to sharing information about their food demand, quality, procurement and process requirements and policies. The current situation is that most of the producers encountered in Barbados, Jamaica and St Kitts are unaware of the information that tourism sector stakeholders provide or are willing to provide and are not able to take advantage of the opportunities available.

The market opportunity in Trinidad and Tobago seems to be mainly with supplying the nation's agro-food processing sector and export markets. These markets are known to be ICT savvy. Investing in systems that can provide value chain stakeholders with market intelligence and opportunity matching will bring significant benefits to the Trinidad and Tobago agro-food sector. To a lesser, but not insignificant extent, the tourism/hospitality sector presents an opportunity that many local producers still have not fully been able to exploit.

Guyana's market opportunity is primarily with CARICOM and international export markets, particularly in North America and the EU. Guyana has not yet developed extensive agro-processing and tourism sectors that demand significant food inputs. One of the main challenges for Guyana is to upgrade the physical infrastructures that support agriculture (roads, storage facilities, ports) and services (shipping, air-freight, government services). The ability of the agricultural sector to see growth through the proper application of ICTs is constrained by the infrastructure and service challenges. Guyana's food production can supply its domestic needs, but there is an opportunity to increase sector efficiency through the provision of domestic market information and intelligence.

Across all five countries, the business environment is faced with issues of mistrust between value chain stakeholders, particularly between producers and State sector input suppliers and sometimes with marketers. Also across all five countries, there were incoherent structures for information-sharing within state institutions, between State institutions and, to some extent, with the public.

Jamaica and Trinidad and Tobago are the two territories that stand to gain the most by successfully implementing ICT services to connect their producers to markets. Both countries have large market opportunities (agro-processing, tourism, domestic consumers, export markets) that they can exploit. These two countries also have the land resources to more consistently meet the opportunities, unlike the smaller territories (Barbados and St Kitts and Nevis).

Guyana also stands to gain significantly if they use ICTs to plug into export markets. The nation has the land and water resources to ensure that they meet the opportunities more than any of the other four territories, however physical infrastructure and human resource constraints need to be resolved.

Governance

Across all five territories, there exists a coherent set of strategies and organisational structures to govern the sector and execute sector policy. However, in terms of information gathering, collation, sharing and dissemination, there is a general lack of predictability. There exist incoherent structures for information-sharing within State institutions, between State institutions and to some extent, with the public. The result is that many stakeholders are not entirely sure of where to get certain kinds of sector-specific information and who the responsible stakeholders are. These are challenges that will need to be resolved and will facilitate the sharing of timely and accurate data/information through ICTs.

All five territories have either defined an agro-sector strategy, either in a dedicated document or as part of a broader national strategy outline. The Guyana and Jamaica agro-sector strategy documents specifically highlight the role that ICTs should play in the sector; the Jamaican document further goes on to highlight the need for effective marketing information systems and supportive distribution infrastructures and networks.

All five territories have national ICT plans or strategies, but the Guyana ICT strategy document has been a draft document since 2006, the St Kitts and Nevis ICT strategic plan has not been updated since 2006 and it is not clear whether the latest strategy document for Trinidad and Tobago (SmarTT) launched in 2012 has received formal cabinet approval as State policy.

Operationally, the agro-sectors of Barbados, Guyana and St Kitts do not provide formal guidance on production. There is no system for production scheduling, produce tracking or traceability. Jamaica in theory does have the structures in place, but coordinating production activities and traceability is poorly coordinated, especially as it relates to non-aligned farmers and farmer groups. In Trinidad and Tobago, there is a system of scheduling crop production and grading through the contract farming system used by TTABA. The challenge in Trinidad is in enforcing policy and regulatory compliance. There are cases of farmers breaking production contracts in situations where they see better market opportunities after making and signing commitments.

Human resource capacity

The human resource needs vary significantly across the five study territories. In Guyana, there is a critical need for skilled ICT personnel within the State sector – both technical ICT resources able to design, implement/install, configure and maintain ICT systems and strategic ICT resources that can develop ICT strategy, policy, legislation and turn strategic goals into system requirements. Further, there is the need for training of current State sector personnel at the strategic, technical and end-user levels. Also, training activities for producers and other value chain stakeholders will be necessary for injecting capacity that will significantly benefit the functioning of the Guyana agriculture value chains.

St Kitts and Nevis faces similar human resource challenges to Guyana. Here too there is a critical need for additional skilled ICT personnel within the State sector, in terms of both technical and strategic ICT resources. There is also the need for training activities for producers, to get them up to speed on technology usage fundamentals.

In Jamaica, the weak link in ICT capacity rests with the production node, especially smallholder farmers. Their general comfort level with the everyday use of computers and the internet is low. ICT literacy and

expertise among small farmers is particularly low. Capacity building activities should especially target the production and non-State sector input suppliers. Stakeholders in the State sector, marketing, value added and consumer nodes have the personnel with the ICT knowledge to effectively use ICTs for their benefit. The State sector has a sufficient pool of both technical and strategic ICT resources.

The need in Trinidad and Tobago is for strategic ICT personnel in the State sector, particularly at the executive and senior management levels to provide policy and strategy guidance and translate high-level objectives into ICT requirements. Some amount of training for production personnel will be beneficial; while most production personnel can use ICTs, they generally prefer not to and instead opt for pen and paper in keeping records.

As is the case with Trinidad and Tobago, the need in Barbados seems to be for strategic ICT personnel in the State sector, particularly at the executive and senior management levels. Apart from this, the economy possesses the human resource skills that can be leveraged by the agro-food sector.

Psychographics

Across the study countries, there is an openness to learning about and applying new innovations and technologies that can lead to sector benefits. The ideal situation would be a display of enthusiasm, active pursuit and aggressive application of new technologies and business models; this is not the case.
The Barbados agricultural sector is open to learning about and applying new innovations and technologies that can lead to sector benefits. The current reservation on further technology usage can be mitigated with targeted training together with promotion and awareness activities, especially for producers. This situation is generally mirrored in Guyana and St Kitts and Nevis; smallholder farmers generally are not inclined towards new technology and although at a cognitive level they believe it represents the future, they do not see the practical link between up-skilling their ICT literacy/skill and achieving enhanced livelihoods.

In Trinidad and Tobago, State sector executives at many institutions, with a few exceptions (the National Agricultural Marketing and Development Corporation [NAMDEVCO]for example), do not demonstrate a grasp of the role and opportunities that ICTs present for the nation or the sector and are not inclined to pursue policies/strategies/legislation/regulations that enables the widespread use of ICT innovations in the economy. This challenges the sector to move forward with ICT initiatives that can significantly increase its productivity. Apart from NAMDEVCO, there are few other organisations or personnel in the sector that are viewed as ICT champions.

The Jamaican agro-sector seems to be the most interested in applying new technologies and innovations. Not only this, but there is a demonstrated understanding of the link between ICTs and national productivity by State sector personnel with influence and the business community. This is generally the case except at the production node. Smallholder farmers generally are not inclined toward technology and though at a cognitive level they believe it represents the future, they do not see the practical link between up-skilling their ICT literacy/skill and achieving enhanced livelihoods.

Infrastructure

All five territories possess the minimum network infrastructure to support ICT systems and services that can advance the sector. Barbados, Guyana and St Kitts and Nevis are lacking in terms of the number and quality of e-services available to the agro-food sector. For these countries, it will be necessary to develop the services that can provide a rich set of timely data and information to all relevant stakeholders. Jamaica and Trinidad and Tobago offer an array of e-services that supply relevant

information to most value chain stakeholders. The challenge for Jamaica and Trinidad is to ensure that systems are in place to ensure that the information and data supplied is up to date and that it is formatted to the needs and dispositions of the target stakeholders. Also, the further development of the current services is necessary to develop online capabilities to match commodity-trading opportunities online.

Summary of overall findings on agriculture value chains in the Caribbean

The study found that outside of the more established/traditional commodities such as poultry, banana, sugar cane, rice and cattle, the following are the characteristics that have been found to be true in the main, with regard to agriculture value chains in the Caribbean – particularly for smallholder farmers:

- Farmers produce commodities that are 'pushed 'into the marketplace (supply push).
- Farmers are generally isolated from a majority of end consumers.
- Famers have little control over input costs or prices received for their goods.
- Generally, only where farmers sell produce in local markets is there a direct link to the consumer.
- Farmer/producer production quantities are constrained by the capacity in the local market.
- Farmers/producers tend to receive minimal profit; farmers often complain of 'gluts' in the market and associated low prices.
- Economic transactions between actors, or between nodes, tend to be independent of any awareness of what is happening in the wider value chain.
- There is little (or no) production scheduling in some countries (particularly for the focal commodities).
- There is insufficient (or a complete lack of) processing facilities, as well as inadequate storage.
- Farmers/producers are largely isolated from the larger more sophisticated consumers (e.g. hotels, large restaurants, cruise ships) and their associated demand preferences (re: quality, size, quantities etc.).
- Research and development is focused on production and on reducing costs of production.
- There is little (or insufficient) consumer education.

Thus, in the effort to enhance the performance of the regional agricultural sector, stakeholders should be extremely cognizant of the critical role that the appropriate use and leverage of ICTs can facilitate with regard to addressing the realities above.

CASE STUDY 15

CAFAN AGRI-FOOD RADIO TALK SHOW (GRENADA)

***Description**: CAFAN, a leading small farmer organisation, represents over 500,000 farmers who work mainly in the fruit, vegetable and root crop sectors and has had radio talk shows to serve its members over the years. In many cases these shows have been pioneered by Roderick St Clair, an agricultural professional from rural Grenada, who established a communication platform to engage national agricultural stakeholders to dialogue on behalf of the farmer network. The first show was a weekly radio talk show in 2010 called 'the Topsoil'. The one hour agriculture radio talk show, invited sector stakeholders for interviews in either the studio or in the field which were captured with voice recorder.*

In 2011 the service was expanded into the Eat Caribbean Regional Value Chain Talk (talk show), which focused on agri-food chain development across the region as well as policy issues of concern to the Caribbean Farmers Network (CAFAN).

Later there was the establishment of the ACP Agriportal (African, Caribbean and Pacific States Agriculture web portal) an ICT platform for sharing knowledge between the developing countries with particular emphasis on ACP states and utilizing ITC and social media.

This portal includes:

- *Blog – /or* www.acpagriportal.com
- *Podcast of* radio programs of Caribbean Agriculture Forum radio talk show *can be found on (/) and other interviews, lectures and audio and video resources*
- *Twitter feeds @acpagriportal*
- *Facebook https://www.facebook.com/theagricultureforum*
- *Discussion Forums (Agri Chat)*
- *News feeds from the ACP*
- *Links to blogs, websites, slide presentations, video, radio station*
- *Equipment for displaying advertisements of existing and new sponsors*

In April 2012, the Caribbean Agriculture Forum was developed which is aired on City Sound FM 97.5 Radio Station (http://www.citysoundfm.com) and distributed on podcast via/which focuses on technical, business and policy issues for primary agriculture in Grenada.

***Financial Aspects:** The cost of establishment of the site was US$5,000 that was for research, program development and establishment of podcast facility. The operational cost was US$1000/mth, which was for producing, hosting and payment for radio time to air each episode.*

The main challenge was resources and US$26,000 was provided by the FAO-managed, Italy-funded, "Promoting CARICOM CARIFORUM Food Security Project". Some small revue was generated through advertisements sold to input suppliers. As a result of lack of further resources the programme came to an end after 26 weeks.

CASE STUDY 15 (CONTINUED)

The cost of establishing the studio (including equipment) was EC$15,000 in materials and time. Operating costs were EC$2000/mth including payment for radio time. Small revenues were earned by sales of advertisements to a local and regional input supplier, fish processing plant, rum factory and a local appliance and electronic store.

Results and impact achieved: *The Eat Caribbean Value Chain shows were aired live from the Grenada Broadcasting Network Klassic 535 AM radio station and streamed live on-line, distributed by podcasts and e-mail blasts to targeted users within the Caribbean, USA, Canada, Latin and South America through the FAO Agri-Carib list (FAO-Carib-Agri@fao.org) to over 50,000 stakeholders with an interest in the Caribbean agri-food sector. Podcasts were also available on the Eat Caribbean website.*

The radio shows have received positive feedback by the Grenadian and Caribbean farming community and policy makers as well as development partners such as CARDI, CARICOM, CTA, IICA and the FAO. There are over 50 countries logging onto the ACP Agrifoum portal since its establishment in March 2013.

Perspectives on the deployment: *This case shows that a significant impact can be made by individuals or small groups, who are well trained in various ICT capacities and are given sufficient funding. The City Sound FM 97.5 Radio Station was produced in a home rudimentary studio established in Grenada. The equipment used included a digital voice recorder, laptop computer, mixing board, microphone and telephone. Software included audio-editing software skype, blog/website. Podcasts, e-mail blasts, a web portal blog, Facebook and Twitter were also used to expand the reach of the programme. The fact the programme only lasted 26 months however shows that need for a sustainable business/funding model for these kinds of initiatives.*

Source: *Roderick St. Clair*

CASE STUDY 16

MARKETING AND NATIONAL IMPORTING BOARD (GRENADA)

The Marketing and National Importing Board (MNIB) is a key actor in many agri-food value chains in Grenada. It was established in 1973 under the Marketing Board Act and reports to the Minister of Economic Development and Trade. Its mandate is to market produce from Grenada and import specified commodities and general merchandise and provides government with a mechanism to regulate and control the prices of those specified commodities to consumers and to develop the agri-food sector through its produce marketing function.

In collaboration with the Ministry of Agriculture, Ministry of Health, Ministry of Trade, CARDI - Grenada office and the Grenada Bureau of Standards, the MNIB provides a range of services to develop key value chains which sell to local retailers, hotels, public intuitions such as the school feeding programme, vendors, as well as exporters of fresh produce to the UK, the USA, Canada and CARICOM.

***Platform description:** The MNIB's ICT architecture includes:*

- *A website www.mnib.gdwhich is currently being reviewed to accommodate online ordering and sales.*
- *Point-of-sale software for tracking and evaluating sales performance. The system is currently being upgraded to implement a WAN (Wide Area Network) linkage between the mini-marts and the central accounts system using ICT technologies. Currently the procurement and distribution operation at the pack house is connected with high speed internet and through a WAN link to the main office and accounts system. These all would provide real time information for faster decision making.*
- *A procurement system supported by Quickbooks Enterprise software platform which not only prints farmers' checks but can give detailed transaction reports to guide purchasing decisions and farmers' performance.*
- *Social media platforms such as Facebook (www.facebook.com/gmnib) and twitter account will soon be launched.*
- *A DIGICEL Grenada PBX telephone system is being installed to use the internet to move calls through the company. If someone is not at his or her desk, the phone system can forward the call to his/her mobile handset anywhere in the world which will be linked to the*
- *Closed User Group (CUG) plan and as such customers and farmers would be more readily serviced. The CUG plan "Agri-Talk" targeted all the stakeholders working with MNIB related value chains. There are approximately 100 persons on the plan currently. Skype is also being used for communication to overseas clients as well as meeting and discussions between the mini-marts.*
- *Also, MNIB is currently in process of designing a GIS (Geographic Information System) in conjunction with a local NGO to track key farms that MNIB is interested in doing business with. This will be linked to Google maps and information about each farm will be updated. For example, the database would include information on number of plants, pest levels, levels of production, rainfall, soils.*

CASE STUDY 16 (CONTINUED)

Financial aspects: *Over the past five years MNIB has invested over EC$100,000 (US$35,000) in upgrading its computer hardware, software and training to strengthen its ICT capacity and connectivity. The new system will also make it cheaper for mobile users doing business with the company. Overall, the monthly cost of telephone is expected to drop by over 60% with the implementation of this system and the efficiency of this new system will reduce busy tones when customers are trying to reach the company.*

The CUG plan allows members of the plan to talk unlimited for one flat rate. It allows persons without credit on their pre-paid mobile phones to still be able to make a call to another member of the plan once their CUG subscription is up to date. Additionally, members of the plan can purchase handsets at discounted prices. A monthly subscription price of EC$12.00 was negotiated for persons with pre-paid mobile phone accounts while EC$10.00 for persons with postpaid accounts verses the normal rate of EC$18.00.

Perspectives on deployment: *The most frequent use of the technology has been for exchanges on information on market prices; making arrangements for delivery of produce; following up on banking transactions; and sharing of solutions to production and input supply information.*

Overall, the impact of the use of the basket of ICTs is to track and coordinate market demand and supply; manage pricing and promotions; coordinate demand and supply including sending advisories to farmers on when to plant; improve communication within the MNIB and information exchange between chain stakeholders; and improve accounting and traceability across the chains while reducing operational cost. With the CUG, farmers, harvesters, agro-processors hucksters and the MNIB staff can speak more easily without worrying about the cost of communication, which is especially important for farmers and SMEs.

The MNIB considers their investment in ICTs to be a key plank in their business development strategy, especially since they work across a large number of small farmers and SMEs and this allows it to mange a very diverse base of markets, products and value chains in a commercially successful manner.

Source: *Fitzroy James, CEO, MNIB*

7. International agricultural value chain systems (best practices)

In commercial value chains internationally, in the case of best practices arrangements, farmers are linked to the needs of consumers, working closely with suppliers and processors to produce the specific goods required by consumers. Using this information intensive approach and through continuous innovation and feedback between different stages along the value chain, the farmer's market power and profitability can be enhanced. Rather than focusing profits on one or two links, players at all levels of the value chain can benefit. Well functioning value chains generally have intensive use of ICTs and are said to be more efficient in bringing products to consumers. Therefore all actors, including small-scale producers and poor consumers, should benefit from value chain development.

The market 'pull' is based on integrated transactions and information. Consumers purchase products that are produced according to their preferences. The farmer becomes the core link in producing the products that the consumers desire.

Research and development, whilst including techniques targeted at increased production, is also focused on collecting information on consumer needs and attempts to take account of all of the links and dependencies in the value chain, e.g. processing, environmental and social costs or considerations, as well as factors such as health impacts, education and learning.

Communication is in all directions. It is important, for example, that consumers and processors are made aware of factors that limit production, and farmers and other producers are made aware of consumer requirements. Researchers and nutritionists communicate with consumers to influence demand toward healthier food, thus rewarding farmers who incorporate good agronomic practices.

INTERNATIONAL PRACTICES/TRENDS/INNOVATIONS IN THE APPLICATION OF ICTS TO AGRICULTURE

The items and case studies presented in this section represent international best practice cases and are meant to illustrate successful experiences in the use of ICTs to benefit the agricultural sector and general food industry (See Case studies No. 17–21).

The selection of these practices has been carefully done to illustrate how ICTs, including mobile technologies, can be used in:

- coordinating of production efforts;
- matching of opportunities with suppliers;
- gathering of market intelligence from extra-regional markets;
- assessing of the impact of disease;
- storing and projecting of farm yields per crop and availability for market;
- accessing of customer preferences and aggregate demand information;
- accessing of information about the productivity of different cultivation methods;
- accessing of knowledge about climate-aware farming techniques.

Use of satellite imagery

In order to improve the management of agricultural resources, it is necessary to obtain reliable data on not only the types, but also the quality, quantity and location of these resources. Satellite or aerial remote sensing (RS) technology has been used to improve the present systems of acquiring and generating agricultural and resources data.

Vegetation images –show crop growth from planting through to harvest, changes as the season progresses and abnormalities such as weed patches, soil compaction, watering problems, etc. A geo-referenced[44] and or thorectified[45] image can locate these problem areas and the size of the area affected can be easily determined. This information helps the farmer make informed decisions about the most feasible solution. In addition to highlighting problematic areas, images will also help monitor the effectiveness of any corrective actions that may be implemented. Images can act as an early indicator of crop yield. This early predictor of yield can aid the farmer in making marketing decisions and allocating resources.

Traceability

The EU General Food Law, Article 18 Regulation (EC) No 178/2002, defines traceability as the ability to track food, feed, food-producing animal or substance intended to be, or expected to be used for these products at all of the stages of production, processing and distribution.[46]

One reason for the increased emphasis on the traceability of agricultural production is that there is increasing consumer demand for quality and food safety. As a result, exporters want to be able to trace production back to the specific farm from which it came in order to ensure quality and safe production and handling procedures. Although traceability is required so as to be able to respond to quality standard requirements, it also helps large buyers track, manage, pay and reward small producers.

Agricultural goods destined for international markets need to meet certification requirements guaranteeing the quality and identifying the source of the product. GLOBALGAP is a private sector body that sets voluntary standards for certification of agricultural products. All goods are checked for quality and exporters are required to provide details of everyone who handled the product through the supply chain, from the farmer to the exporter and include transporters, traders and warehouses.

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[44] To georeference something means to define its existence in physical space – establishing its location in terms of map projections or coordinate systems. The term is used both when establishing the relation between raster or vector images and coordinates and when determining the spatial location of other geographical features. Examples would include establishing the correct position of an aerial photograph within a map or finding the geographical coordinates of a place name or street address.

[45] An orthophoto, orthophotograph or ortho-image is an aerial photograph geometrically corrected ('orthorectified') such that the scale is uniform – the photo has the same lack of distortion as a map. Unlike an uncorrected aerial photograph, an orthophotograph can be used to measure true distances, because it is an accurate representation of the earth's surface, having been adjusted for topographic relief,lens distortion and camera: http://en.wikipedia.org/wiki/Orthophoto

[46] As reported in ICT in Agriculture , Module 12 Improving Food Safety and Traceability - http://www.ictinagriculture.org/sourcebook/module-12-improving-food-safety-and-traceability

CASE STUDY 17

LIVESTOCK TRACKING AND TRACEABILITY IN NAMIBIA

HTTP://WWW.NAMLITS.COM/SCRIPTS/CGIIP.EXE/WSERVICE=LITBR/OE/LITWHOME.P

***Description**: The Namibian Livestock Identification and Traceability System (NamLITS) is a central computerised database with an extensive network linking workstations at most Directorate of Veterinary Services (DVS) offices to the database in the capital, Windhoek.*

This system has been implemented to create the ability to track and trace animals for the purposes of:

- *managing animal disease surveillance and control programs;*
- *managing animal disease emergencies;*
- *validating animal health status claims and meat safety guarantees;*
- *facilitating regional and international trade.*

The website, NamLITS online makes it easier for users to manage livestock movement records. The system can be used to:

- *apply for animal movement permits;*
- *update farmer contact details held on the central database;*
- *view livestock movement history of individual cattle;*
- *query cattle movement records;*
- *view a list of all cattle on each farm;*
- *view a list of cattle that have moved 'on' or 'off' farms;*
- *view a list of all permits issued to farmers;*
- *view a list of outstanding movement permits.*

This system works through a system of animal tagging. All cattle are required to be identified by a primary and secondary ear tag by the age of six months. Both a radio frequency identification (RFID) for automated data input and a visual plastic ear tag that supports remote pastoral production where there is limited or no technological support. Both tags have the same unique number.

***Perspectives on the deployment:** In Namibia the Implementation of this system required that national government, industry participants, donor agencies and the international community walk in lockstep. The roles of each of these stakeholders are summarised as follows:*

Government- Through the different ministries and institutions is responsible for:

- *zoning of diseased and disease-free areas;*
- *registration of keepers//owners as well as premises where animals are kept;*
- *identification//tagging of animals;*
- *animal movement control and monitoring;*
- *overall governance and competent authority;*
- *legislation regarding animal identification, regulation of stock brands and stock theft;*

CASE STUDY 17 (CONTINUED)

- *acts as implementation unit through Veterinary Services;*
- *serve as trainer, communications channel and facilitator.*

Industry participants-

- *Meat Board of Namibia - Maintain the integrity of the ear tag ordering system and assist with the development of funding arrangements.*
- *Owners and keepers of livestock - Their responsibility is in complying with the system requirements such as keeping livestock registers up to date, rounding up cattle and presenting them for tagging and complying with notification requirements for animal movements and for other animal events.*
- *Abattoirs, auctioneers and traders - In order to operate the system they are required to purchase RFID reading equipment and accessories and to acquire computers and appropriate software. Regarding compliance they have to supply accurate details of buyers and sellers of livestock, notify animal movements and other animal events, check cattle identification and carry out documentation checks and report non-compliance to DVS officials.*
- *Livestock transporters - reporting animal movement events.*
- *Farmer organisations- Assisting with problem solving, support for communication and training activities and reporting of non-compliance.*

Donor agencies- The Millennium Challenge Account (MCA) Namibia Compact, providing grant funding for public investments in education, tourism and agriculture (livestock and indigenous natural products), was signed on 28 July 2008 between the Republic of Namibia and the US Government, acting through the Millennium Challenge Corporation (MCC). An amount of US$304.5 million is available for development in the target sectors, over and above current government allocations and assistance from other development partners.

International community- Involvement of the international community in terms of organisations that regulate world trade and health (animal and human) standards is invaluable. These are the World Organisation for Animal Health (OIE), International Committee of Animal Recording (ICAR), the International Organisation for Standardization (ISO), the Codex Alimentarius of the Commission of the European Union (EU), World Health Organisation (WHO) and the World Bank.

***The Caribbean Context:** A system such as NamLITS is interesting because it can be seen as a best practice for resolving or mitigating some of the challenges faced by the regional small ruminant sector. These issues are:*

Mobile applications

Applications and services using mobile phones range from simple text messaging services to increasingly advanced software applications that provide both livelihood improvements and real-time public services. In the agricultural sector, these include price information, market links, extension and support and distribution, logistics and traceability.

m-Farmer initiative

The GSMA, the body that represents the interests of mobile operators world-wide, recently announced the launch of the mFarmer Initiative Fund, supported by a grant from the Bill and Melinda Gates Foundation. Through the mFarmer Initiative Fund, the GSMA Development Fund's mAgriProgramme will accelerate the provision of high-quality agricultural information services through mobile channels and by 2013 the initiative aims to provide two million farmers in developing countries with an invaluable and transformative business resource. The GSMA Development Fund accelerates economic, environmental and social evolution through mobile technology. Within the Development Fund, the mAgriprogramme exists to catalyse the deployment of mobile solutions benefiting the agricultural sector

More information can be found
at:http://www.gsma.com/mobilefordevelopment/programmes/magri/mfarmer-initiative

The case studies that follow outline successful examples of the application of mobile technology to value chain optimisation and are potential applications that can be implemented in the Caribbean:

CASE STUDY 18

AGRICULTURAL COMMODITY EXCHANGE INDEX - ESOKO IN GHANA

Platform description: *This agricultural commodity index tracks the prices of selected agricultural products across the country. The Esoko Ghana Commodity Index (EGCI) is a rural communication platform that publishes a cash market price index composed of data on physical commodities. The index, which is published weekly, tracks prices at wholesale and retail levels. Esoko seeks to improve incomes by building healthy markets. Also, large buyers (for e.g.) can set up an Esoko account to assist with the management, of their procurement and liaise with farmers to schedule production. Currently Esoko is active in ten countries throughout Africa with different partnership agreements that include public sector agricultural projects, Esoko country franchises and licensed partners.*

Technology and operation

The updates for farmers and traders are delivered by SMS. The technology platform makes use of both web and mobile devices to push and pull market information from the field.

Esoko enables consumers to request services through Short Messaging Service (SMS) codes.
There are four key services provided by the platform.

- *Live market feeds: real-time SMS alerts on market prices and offers that are automatically delivered to subscribers. Users can submit offers into the system directly using SMS.*
- *Direct SMS marketing: businesses can target specific groups of users and target procurement or extension messages to reduce their travel and communication costs.*
- *Scout polling/production monitoring: enterprises can set up automatic SMS polling for field activities to track inventories, crop activities, etc. to monitor and report on crop cycles and yields.*
- *Online profiling and marketing: any user or business gets a customisable web space that can advertise their goods and services. This space can be updated using Esoko's mobile-to-web content management service.*

In the absence of a proper warehouse receipt system and a regulatory framework that would support the operation of a commodity exchange in Ghana, the system has established a network of enumeration agents stationed in market centres. These agents feed Esoko with critical data like prices, offers and industry profiles. Markets were selected based on their regional location and strategic importance.

Results and impacts achieved: *Results demonstrate that farmers have been able to improve revenues by negotiating better prices, or selecting more favourable markets for their produce. Traders have been able to procure product more quickly and at better prices for everyone.*

CASE STUDY 18 (CONTINUED)
AGRICULTURAL COMMODITY EXCHANGE INDEX - ESOKO IN GHANA

Perspectives on the deployment: *In this case the Esoko technology platform as used was supported by a system of people, groups and institutions which would ensure that there is a capacity for the commodity exchange to provide timely and accurate market price information for all stakeholders. Similar human capacity and governance arrangements will be required in the region will be required for a similar system to prove successful in the Caribbean.*

The Caribbean context: *There are a number of systems that perform similar roles such as the NAMISTT, JAMIS and ABIS systems. These platforms provide market information and intelligence to Stakeholders, however there have been a few questions raised about the accuracy of the information presented. The implementation of this agricultural commodity exchange especially as it relates to its governance should be studied so that the similar services in the Caribbean can improve the quality of information presented to stakeholders.*

On the technology side, there are a number of technologies that are available that have proven successful and can be leveraged by regional associations. In addition to providing market information, platforms like Esoko also can assist organisations - such as TTABA, Christianna Potato Growers Co-operative Association who currently are using the basic ICTs to coordinate the activities – schedule the production of their members Platforms such as these should be evaluated for their local relevance within any holistic decision process of advancing ICTs in agriculture in the region.

Extracts Taken From: eTransform Africa: Agricultural sector Study- Sector Assessment and Opportunities for ICT (4 Feb 2012); Web site: http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/Agriculture_FullReport.pdf; Accessed on Oct 5, 2013.

CASE STUDY 19
DRUM NET

Platform Description: *DrumNet is a value chain information system which has been built in an effort to significantly improve information flows between and along value chain nodes by directly linking large-scale buyers, farmers, transporters and field agents through an integrated marketing and payment system. DrumNet members, organized into co-guaranteed solidarity groups, are able to access required farm inputs (seeds, fertilizers, pesticides, etc.) transportation services and buyers through an established line of credit using their DrumNet transaction card. Before farmers plant crops, DrumNet negotiates contractual arrangements between buyers and farmers and at harvest time coordinates produce aggregation, grading and transportation through agreements with local field agents and transporters. Market data and transaction details are made available to participating farmers.*

ICT in DrumNet's operations –DrumNet facilitates the information flows across the value chain, predominantly via the use of SMS. Large-scale buyers are informed about what was planted, so they can estimate production and plan accordingly. The buyer is also able to monitor crop progress and pass on important extension information to growers. Input retailers are updated on which products to stock at what time and producers are informed of collection dates and locations long before harvest.

DrumNet facilitates and tracks payment following a successful buyer-seller transaction, ensuring credit is repaid to the bank and payment to producers are both secure and accurate. DrumNet's IT system provides the internal controls to track and report on compliance throughout the process. It also retains data for the establishment of user and credit ratings.

To facilitate information dissemination, DrumNet has set up support centres – simple, stand-alone facilities catering to clients who require financial, market and technical information in order to make more profitable transactions. Each support centre is equipped with a computer with a dial-up connection to the Internet and a mobile phone (GSM) to link up with the central hub in Nairobi, which acts as the main server/database and provides an access centre for the storage and retrieval of information.

The centres have been designed to keep start-up and operating costs low and allow the agents to reach rural areas typically untouched by such services. In addition, by working collaboratively with organisations that provide up-to-date information on comparative market prices throughout the region, DrumNet offers information on leading production methods for the more profitable crops. It works with farmers through established learning organisations such as self-help groups, cooperatives andfarmerfield schools to maximise the peer-to-peer dissemination of this information. DrumNet charges a modest fee for its brokerage, administrative and transactional services.

CASE STUDY 19 (CONTINUED)

Facilitation by the government- The Ministry of Agriculture organizes farmers into self-help groups (SHG). Government extension agents have set up —Field Farmers' Schools that provide technical assistance in certain crops chosen by the members of the newly created SHG. This method consists of a demonstration plot which is visited several times a month over the course of the cropping season. The program, however, does not provide credit in the form of inputs nor marketing contacts. In this sense, the government's work and DrumNet can be seen as complementary.

Additionally, DrumNetstaff participate in NGO meetings organized by the local government whereby the government learns about the involvement of the different NGOs and the targeted export crops. This enables government extension agents to later focus their efforts in creating SHGs whose members are interested in DrumNet crops.

Results and impacts achieved:

1. *The integration of the two processes of pre and post-harvest operations contributes to both risk and cost reduction and is the real value of DrumNet. Farmers reduce transaction costs by accessing both credit and markets through their interactions with DrumNet, paying off loans with their farm produce proceeds.*
2. *Large-scale buyers are also freed from the requirement of managing cumbersome transaction intensive credit programs to ensure reliable supplies of produce. Instead they write a single check to DrumNet every month, thereby reducing costs.*
3. *Banks and financial institutions are able to tap into a currently inaccessible market for savings and credit while avoiding high transaction costs. The process creates an enabling environment for agricultural finance in several ways. Banks are assured at the time of lending that farmers have a market for their produce and the means to adequately serve that market which indicates a healthy revenue stream.*
4. *Banks minimize the problem of loan diversion by offering in-kind credit to farmers for inputs and directly paying certified (and monitored) input retailers after distribution of the inputs. Cashless payment through bank transfers reduces strategic default, since farmers cannot obtain revenue until their outstanding loans are fully repaid.*

Perspectives on the deployment: *For the endeavour to function properly, each supply-chain partner must comply with an established set of procedures and rules. Once one actor fails to comply because he or she does not find value in the arrangement, the overall value of the supply-chain approach is lost. DrumNet has experienced its share of noncompliance. Farmers have opted to side-sell produce outside buyer agreements to attain quick cash or evade loan obligations. Buyers have at times failed to honour contract terms and input retailers have engaged in dishonest practices as well. Even banks have strayed from the program by delaying payments and introducing unexpected fees to farmers.*

Farmers' inability to attain sufficient crop yields has also negatively affected the project and its overall service package. Poor yields have often resulted from poor weather conditions. Kenya has experienced several years of irregular and insufficient rain, especially in the eastern portion of the country. Consequently, many farmers have produced only small or extremely stunted harvests.

CASE STUDY 19 (CONTINUED)

The Caribbean context: *There are a number of farmer groups, associations, cooperatives and large buyers of agriculture commodities in the Caribbean that may want to implement a system for coordinating activities and providing market information to their members or producers. Like Esoko, the Drum net system is one of those that should be evaluated for local relevance. Further, the value of these systems is multiplied when there are greater numbers of producers and buyers. As such a regional (rather than a country by country) approach should be considered. This however will require good co-ordination and standardization of processes/outputs across a wide array of entities; including banks. This may seem to be more feasible for value chains that are more mature and vibrant rather than those which are still in their early stages of development (such as cassava and goat).*

Extracts Taken From: eTransform Africa: Agricultural sector Study- Sector Assessment and Opportunities for ICT (4 Feb 2012); Web site: http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/Agriculture_FullReport.pdf; Accessed on Oct 5, 2013.

Bioinformatics

Bioinformatics is the field of science that combines information technology and computer science with biology. The initial focus of bioinformatics was the creation and maintenance of a database to store biological information. It has since evolved to encompass other key areas, such as the analysis and interpretation of various types of biological data, including genome sequencing. In 2005, a rice cultivar became the first commercially important plant to have its genome fully mapped.

This is particularly important because rice is a staple food for much of the world's population. The rice sequence can be used to locate genes, with a view to improving yields and making rice more nutritious.

Biotechnologymust be viewed as just one element in a comprehensive sustainable agriculture and food security strategy focused on broad-based agricultural growth, not a technological quick fix for region-wide hunger.

Precision agriculture

Precision agriculture, is a technique that uses technology to collect and analyse data for the assessment of variations in soil or climate conditions, in order to guide the application of the right agricultural practices, in the right place, in the right way, at the right time. It relies greatly on new technologies, including the global positioning system (GPS), sensors, satellite or aerial images and information management tools, to collect information on such variables as optimum sowing density, fertilisers and other input needs. This information is then used to apply flexible practices to a crop.

Farm automation

Farm automation involves the use of control systems, such as computers, to derive higher yields with more predictable results through farming processes that are more efficient, less labour intensive and less time-consuming.

Source: *Information and Communications Technology for Food Security and Sustainable Agriculture in the Knowledge Economy*-http://www.unescap.org/idd/events/cict-2008/CICT_INF1E.pdf

CASE STUDY 20

PEST NET

www.pestnet.org

Platform description: *PestNet is a free to use e-mail network that helps people worldwide obtain rapid advice and information on crop protection, including the identification and management of plant pests. It started as a service for the Pacific, rapidly expanded to South East Asia, set up a separate service for the Caribbean and now welcomes anyone interested in crop protection anywhere in the world.*

PestNet makes use of Yahoo's free 'Yahoo! Groups' feature, which links all participants in an online discussion group that includes facilities for uploading and downloading photographs and documents. Members can send digital photos of insects, weeds or affected crops for identification and diagnosis by experts. They can also view photos of pests with expert information on management practices. The website also provides a comprehensive database of plant protection resources, with links to the organisations' websites.

This platform has members from government and non-government organisations, universities and the private sector, as well as farmers and students. Any organisation, group or individual can join. All they need is access to e-mail, a question to ask, information to give, or just an interest in plant protection and being part of a worldwide network.

Perspectives on the deployment: *PestNet is a simple, low cost e-mail network that has helped people in the Pacific and South East Asia to obtain rapid advice and information on plant protection, including the identification and management of plant pests. Founded in 1999, the network now has over 1300 participating members. It links the Pacific, South-East Asian and Caribbean regions with plant protection specialists worldwide.*

The overall result of this service has been to provide users with global expertise and experience through the basic internet connection using e-mail and an archive of material that they can use to identify pest problems and issues. This is particularly important in a globalised environment where new plant pests and diseases are able to move over international borders and continents to parts of the world with no experience of mitigating their effects. Such an easy to use network becomes important in identifying pest problems and finding solutions.

The Caribbean Context: *The NAREI BBM case (See Case Study 5) shows that Guyana is already beginning to develop a pest//vector and disease database. It is our view that such efforts should be coordinated at a regional level, such that all CARICOM countries are contributing to and benefiting from a single shared database. It is not necessary for each individual territory to implement such a platform; economies of scale should be exploited for the region in this regard. This would greatly benefit participating countries and can easily become a signal and invaluable resource for the region. Such databases can also have links to international databases such as Pest Net, but also those located in the US, Europe and other places around the world.*

ICTs–Transforming Agricultural Extension?;http://www.anancy.net/documents/file_en/WD8034.pdf; Accessed on Oct 2, 2013.

CASE STUDY 21

DIGITAL GREEN

www.digitalgreen.org

Platform description: *Digital Green is a non-profit organisation that partners with NGOs and government agencies to improve the effectiveness of their field extension services by disseminating agricultural practices through video. The process developed from the idea that farmers prefer interpersonal methods of receiving information on new and innovative farming practices over receiving that information through mass media methods (Gandhi et al. 2009).*

Operation: *The key elements of the platform are:*

- *The NGO partner capacity for video content generation (storyboards and single technology/practice developed);*
- *The making of videos by NGO field staff and community resource people (CRPs);*
- *Editing and uploading of the videos on a dedicated platform;*
- *Community service provider (CSPs) or video mediators, who present and discuss the video for technology dissemination (Gandhi et al. 2009).)*

Digital Green takes the existing practices identified by the partner NGO as the seed content for the first 15–20 videos, which feature local early adopter farmers or farmer groups describing a technology or practice.

Videos are about eight minutes in length and are shown to farmer groups using either a pico projector, which is a handheld, battery-powered digital device capable of storing more than 20 videos, or a compact disc video player attached to a television set. Farmer groups are mobilised by the partner NGO and these groups are also involved in the selection of CSPs and CRPs.

The CSP is a local mediator who mediates the video screening and who is a resident of the same communities, where they share Digital Green video-based content. CSPs conduct at least three screenings each week in each village during suitable evening hours at a location chosen by the CSP and the NGO field staff. CSPs receive a maximum of INR 250 per screening. In many cases, the mediators were the first adopters of the practices; through continued exposure to the videos, they have developed expertise in the techniques being shown. Videos are repeated if the audience demands them. During the video presentations, farmers' feedback, questions and concerns are transcribed and entered into a database. This information is then reflected in the production of new videos.

Perspectives on the deployment: *Financially, Digital Green receives core funding from the Bill and Melinda Gates Foundation. This has meant that there is a strong and stable financial foundation both to cover the costs of video production as well as for the stipends paid to CSPs and CRPs from the farming communities.*

CASE STUDY 21 (CONTINUED)

The system is one that relies on heavy NGO and state involvement. Digital Green partners with seven NGOs (BAIF, PRADAN, Access Livelihoods, Pragati, Varrat, ASA, Society for the Elimination of Rural Poverty (SERP) and Samaj PragatiSahayog) and in six states of India (Jharkhand, Madhya Pradesh, Orissa, Bihar Andhra Pradesh and Karnataka).

In the Digital Green villages, 85% of farmers adopted at least one new agricultural practice, whereas only 11% did so in the control villages (Gandhi et al. 2009.). To date 1,918 videos have been produced and screened 68,988 times and involving 75,107 farmers (www.digitalgreen.org, accessed August 13, 2013).

The Caribbean context: *As far as the methodology for creating and disseminating content to farmers, certain aspects of this system can be looked at an appropriated for the Caribbean context. One of the main challenges for disseminating research and new agronomic and husbandry techniques in the Caribbean is that many times the information is not presented in terms and language that are readily consumable by smallholder farmers. The Digital Green methodology can and should be applied to creating video content that is more in line with farmer's communication preferences for learning and up-taking new methods. RADA has a similar service and Trinidad also uses video in their extension services, however the full package can be developed//matured based on the Digital Green example.*

Gandhi, R., R. Veeraraghavan, K. Toyama, and V. Ramprasad. 2009. —Digital Green: Participatory Video and Mediated Instruction for Agricultural Extension. *University of Southern California Annenberg School for Communication* 5 (1): 1–15.

Extracts taken from- The Relevance of Content in ICT Initiatives in Indian Agriculture; Web Site: http://www.iadb.org/intal/intalcdi/PE/2012/11075.pdf; Accessed on Oct 2, 2013.

8. Recommendations for strengthening ICT use in the Region

ICTs (technologies that communicate information) have a critical role to play in facilitating the exchange of critical information among actors of regional value chains, so as to promote chain effectiveness and to reduce the dysfunction, silos and lack of awareness reported by many interviewees. ICTs can also play an integral role in facilitating training though dissemination of information to key target segments. Three (3) of the top five (5) challenges reported by value chain practitioners (challenges 2, 3 and 4) relate to the need for better information and training systems.

In identifying recommendations for increased uptake in agro-value chains, there must be an appreciation of the key benefits of ICTs, which are described below:

Key benefits of ICTs as an information access and exchange tool within value chains

Collaborating with stakeholders

Value chain planning and effectiveness requires the provisioning of accurate and updated information on items such as the impact of disease(s) and weather on types of crop; customer food preferences and trends; aggregate demand per crop; climate-aware farming techniques; extension officer feedback and scientific field measurements. This information must be generated and disseminated across value chain actors in an appropriate and timely fashion.

The challenge, however, is that this data/information belongs to multiple autonomous organisations along the chain, such as government departments, non-governmental organisations (NGOs), international organisations, businesses (e.g. processors) and farmers. ICTs create options for maintaining two-way communication among these stakeholders, thus easing information flow and feedback so that the best decisions can be made by all of the actors involved.

Addressing knowledge gaps

Farmers have little information on the kinds of crops they should grow, how they should grow their crops, what planning they need to do with respect to their area and soil conditions and what the market dynamics are, etc. Many of the above-mentioned gaps can be dealt with to an extent with better and timely locally relevant information that is facilitated through uptake and usage of ICTs and ICT-based services.

Planning and monitoring

Monitoring and evaluation must be done to measure both financial and physical progress with regard to plans and initiatives undertaken in the sector. ICT systems can be used to combine information from multiple sources, thereby facilitating flexible reporting. They can also assist agencies involved in budget and policy making, as well as monitoring progress in recipient communities, thereby helping to ensure wise use of scarce resources.

Market intelligence is the ability to quickly gather information from the marketplace and embed insights into products and services. In the case of agriculture, it is the ability of input suppliers, farmers, processors, distribution and retail actors, to gather information on consumers (food nutrition programmes, cruise ships, hotels, households, export etc.) as well as the consumption context (e.g. festivals, national/religious holidays, events e.g. weddings, etc.). With this information producers will be able to better cater for taste, quantity, quality and delivery preferences of the consumer and so be able to earn a premium for their goods/services, as customers pay for the greater value that they receive.

Competitive intelligence is the ability to use and analyse publicly available information and competitive trending as a basis for decision-making, enabling real time response to the competitive environment. In the context of agriculture, this would allow regional value chains to understand developments within other global chains and determine best responses. Developments may include changes in weather conditions that force an increase of imports in consumption markets. Alternatively this may refer to the ability of local chains to forecast an increase in the cost of imported input materials, thus triggering a search for alternative sourcing prior to being fully impacted by crippling price increases (for e.g.).

Customer service is the ability to provide fast service response times, flexible dispute resolution; the producers in domestic value chains have the opportunity to make more information available to both domestic and international consumers with regard to the quality and availability of output of the regional sector. An opportunity also exists in the ability to automate frontline customer service response (allowing customers to self-serve – e.g. ordering process goods online) enabling customer service representatives (CSRs) to give greater attention to more complex matters.

Opportunity recognition includes the ability to access information on a global scale (electronic exchanges, market reviews, industry reports etc.) resulting in the uncovering of unmet market needs, requests for service (incl. RFPs) and other potential business opportunities (for example opportunities to better connect with the regional tourism sector).

Transparency – The public disclosure of information in business-to-business electronic exchanges, government e-procurement systems and other types of electronic marketplaces add an additional factor of transparency and democratise economic activity, while decreasing average transaction costs. This type of infrastructure and economic climate can be a key factor/motivator for investment by larger or international firms, lowering their cost of doing business and encourages them to link local supply chains into their global activity.[47]

Price discovery– The economies of the Caribbean have traditionally been and are largely still exporters of primary agricultural or mineral goods. With ICT, it is now possible to follow these products upmarket and understand the price-level escalation dynamic closer to the end consumer. This phenomenon can play a big role in famers gaining better prices for their produce, if/when they are able to connect more with higher-end/higher volume buyers e.g. supermarkets, high-end hotels, restaurants, school feeding programmes, export markets etc.

Disintermediation –Once the right information has been gathered, informed business cases can then be made by large farmers or farmer groups to deepen processing capability in order to sell directly into

[47] Gov. of Trinidad and Tobago. 2008. 'Digitizing Trinidad and Tobago's economic activity.' Draft national e-Business framework. Ministry of Public Administration. http://www.witsa.org/news/2009-1/img/TrinidadTobago_DraftConsultativeDocument_ProposedNationale-BusinessPolicy.pdf

end-user markets (disintermediation) and capture the full value and rents available along the product/industry value chain. ICTs can facilitate the virtual collaboration and agglomeration of capacity and capability to meet large orders based on farm assets that may be significantly geographically dispersed (i.e. ICTs can assist farmers to collaborate to meet large orders or other buyer requirements).

The need for continuous promotion, awareness and education

Promotion awareness and education among stakeholders is critical to the success of the recommendations.

Information by itself is not knowledge. Just being aware of the other actors within your value chain, or customer preferences does not by itself lead to increased collaboration or updated farming practices. It is therefore imperative to train and promote continuous learning in agricultural communities towards enhancing their capacity in finding enhanced techniques and business practices. It is also important to promote education among decision makers, highlighting the way policy decisions can impact farmer and value chain outcomes. This is because sometimes decisions affecting farming communities are taken (without consultation) by external decision-makers, including national and local governments and private companies, and even by entities in other countries.

There are a number of online tools now available (and documented within the ICT directory produced by this study) that include training materials, maps, videos, research studies and other resources that can be used to raise awareness and advocate for ICT-enhanced agricultural implementations. The Web 2.0 phenomenon has further added a collaborative dimension to many of these portals and networks.

With the above discourse as context, the following recommendations and key projects are proffered to enhance value chain effectiveness across the region:

1. **Increase awareness of the benefits of applying ICTs in the agricultural sector**

Overall, the deployment and use of ICTs in the regional agricultural sector is not pervasive. In order to take advantage of the potential of ICTs to assist with value chain communication, coordination and enhancement, there is a clear need to communicate with agri-sector value chain stakeholders the role of ICTs in developing the Caribbean agri-business sector.

Many of the challenges observed and expressed by study participants can be (at least partly) addressed by sensitising the public on the need for greater use of networked technologies in agriculture. Interestingly the innovative use of ICT can assist, even with the challenge of funding for the sector, once the appropriate data is collected and business cases are made.

Sharing such information with policy makers will be critical to the effort to get the policy support that will be required for the advancement of value chains. There are also key linkages to other issues and sectors such as poverty alleviation and tourism– issues which are important to Caribbean economies – which can beneficially be explored through the appropriate use of ICTs. As such the following projects are recommended:

☞ **KEY PROJECT:** ***Digitisation and dissemination of agricultural content***

The State sector holds a large volume of sector specific content that is useful both for State and private sector stakeholders. This information includes agronomic best practices, training manuals, production data, historical data, farmer registration records, etc. The usefulness of much of the data depends on its accessibility and the media forms that it takes. Sector stakeholders stand to benefit by having a repository of digitised content that is readily accessible by all stakeholders. Thus Caribbean governments should pursue initiatives to digitise all relevant agricultural content that does not currently exist in digital formats. The scope of these initiatives would include (but is not limited to):

- digitising paper documents.
- translating technical information into digital forms that stakeholders can consume (e.g. video).
- active dissemination of this information through the range of media forms including social media, radio, TV, websites, e-newsletters, SMS as well as other media as appropriate.

This project will directly assist with Key Challenges – 2, 4, 6, 11, 17, 18, 24, 26 and 29.

CASE STUDY 22

m-Fisheries

This is an example of ICT integration in small scale fisheries. The objective of the mFisheries is to develop capacity in the Caribbean to pursue opportunities arising from the provision of innovative mobile-enabled services for its poor communities and to provide related empirical data and analysis to inform Caribbean policy and regulation

Source: mfisheries website:http://cirp.org.tt/mfisheries/index.php?option=com_contentandview=articleandid=48andItemid=56

☞ **KEY PROJECT:***'ICTs in agriculture 'promotion and awareness campaign*

An aggressive 'ICTs in agriculture 'promotion and awareness campaign is recommended to get all stakeholders working together as necessary. This campaign should highlight the following:

- the need for greater ICT uptake/usage to improve value chain effectiveness;
- success stories in-country, in the region and internationally of producers and value chains which have leveraged ICTs and seen good rewards;
- best practices and pitfalls – when and where the use of ICTs for agriculture value chains are recommended;
- the ICT applications/services currently available for stakeholders to leverage for their benefit;
- the organisation(s) responsible for collection and dissemination of sector data and information;
- the 'how tos' and procedures for submitting and accessing information from the responsible organisation(s);
- the point persons responsible and contact information.

This project will directly assist with key challenges: 2, 4, 6, 10, 15, 17, 21 and 24.

☞ **KEY PROJECT:** ***Mobile applications and youth***

There is currently a multitude of livestock management apps available for download on all of the major mobile app stores (e.g. Google Play, Apple App Store). Many of these represent cost-effective ways of increasing the efficiency of on-farm management, even though the apps are not free to download.

These applications usually vary from each other in specifics but many provide features that allow livestock farmers to access and maintain their farm stock data. Many allow core livestock information to be recorded including animal data, births, deaths, medicines, movements and weights. Data can be input manually or imported from external sources.

A mobile applications regional project should be developed which engages youth in particular to lead with regard to learning how to build and use smart phone or tablet-based ICT applications for the benefit of integration of agricultural value chains. Where existing solutions are identified, or new bespoke solutions built, promotion and training activities should be pursued so that the capabilities developed by regional youth and key information generated by the project is made widely available to agro-stakeholders in the region.

See Case study 22 for information on 'm-Fisheries', a project of the University of the West Indies for ICT integration in small scale fisheries based on mobile application technologies.

2. Build an enabling environment for producers to be able to sell their produce online

The competitive capabilities of small farmers and agri-businesses need to be improved to a point where they can competently cope with the oncoming competitive pressures that globally accessible markets bring.

Looking at the success of certain regional online retailers of agricultural produce, (e.g. D'Market Movers, TT Grocery.com, trinitrolley.com etc.), the region should seek to build the capacity of farmers/farmer groups to enable them to connect with suppliers and buyers online. *See case study 23 for information on D'Market Movers.* This may involve training in website building etc., or it may entail the establishment of an online platform in which the farmer businesses can easily establish a web presence and take advantage of complimentary facilities (such as, for example an ability to post orders, a profile page where stakeholders can easily showcase their businesses, etc.).

Online services should be implemented which specifically match regional buyers with regional sellers/producers.

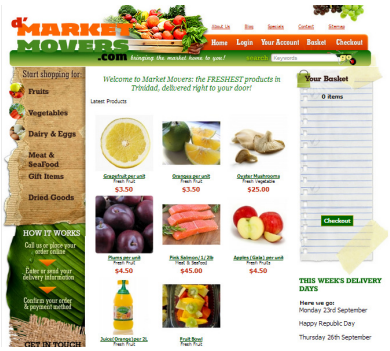
Such a development would directly assist with key challenges:1, 2, 4, 6, 7, 12, 17, 21, 27, 28, 29, 30, 34 and 35.

☞ **KEY PROJECT:** ***Electronic agribusiness development centre(s)***

CASE STUDY 23

D'Market Movers

Customers can browse the website **dmarketmovers.com** *and place an order online or via telephone, choosing when and where they want their goods delivered. Payment is collected upon delivery.*



Source: Love and Virtual Veggies:www.outlish.com/market-movers-love-and-virtual-veggies

This project involves the establishment of a sustainable prototype electronic agri-business development centre, which aims to successfully coach 20 SME agri-firms in e-business; using commercial-grade, free, open-source, or otherwise affordable business solutions. In its first 18 months of operation, the centre can produce e-business case studies of all its efforts with these 20 firms, which will be edited by university lecturers and/or ICT and agricultural sector professionals/consultants and used in e-commerce workshops locally and regionally. Once the prototype centre/programme meets its objectives, the model can be adapted, with a refined mandate to 'graduate' 30–50 firms each year, to create 'communities of practice' and to foster open-source and e-commerce as a national competitive strategy.

In addition to the operational project, governments throughout the region will have to ensure that the enabling legislative framework (e-transactions and data protection regulations for example) is in place to facilitate such an initiative.

This project will directly assist with key challenges: 3, 4, 5, 6, 10, 17, 18, 27, 28, 29, 30and 31.

3. Focus on building agriculture e-services

The region should implement ICT-based agriculture services that should be made publicly available to current and potential stakeholders to ensure that:

- given the high mobile penetration rate in the Caribbean, mobile application platforms which are specifically geared to support the needs of regional agriculture are established;

- there is the establishment of regional agricultural value chain information systems to ensure that information on production, prices, land, demand and market opportunities are available to value chain stakeholders to best inform their decision-making;

- beyond applications of weather forecasting, applications which deal with disaster risk management (DRM) such as hazard mapping and early warning technologies are available and used by stakeholders all long the value chain, as the region is prone to climate risks.

These actions will directly assist with key challenges: 1, 2, 4, 6, 7, 17, 19, 21, 24, 25, 29 and 31.

☞ **KEY PROJECT:** ***Online service to link the regional agriculture and tourism sectors***

It is recommended that online services are implemented that specifically match buyers with sellers in the region. The tourism sector is significant in the regional economy and there is correlation, co-dependency and tremendous opportunity for making greater linkages between agriculture and the tourism industry; these opportunities and possibilities should be aggressively explored.

Mechanisms to ensure that information on demand (both actual and potential) for regional agricultural produce is channelled to producers for action, is critical. Customers such as boutique hotels, hotel chains, the cruise ship industry and restaurants present an enormous opportunity for Caribbean farmers as an outlet for 'export 'of their produce, sold in local shores. This is a high-end and sustainable demand market that currently is under engaged.

This project will directly assist with key challenges: 1, 2, 4, 5, 6, 7, 12, 13, 22, 27, 28, 29, 30, 31, 34, 35, 36 and 37.

☞ **KEY PROJECT:** ***Knowledge-sharing platform for regional agriculture and ICT experts***

The establishment of a database of Caribbean-based agricultural sector experts, and ICT experts (e.g. GIS experts, ICT for development experts, etc.) who are or can be of benefit to the agricultural sector, as well as agri-value chain, is recommended. This application can be a semi-closed user group for persons who support regional value chains – across institutions, academia, business and government – to share research, techniques, publications, profiles, contact information and project initiatives and results. This would be a platform for gaining consensus on technical, agronomic and related ICT issues in the region as well as sharing best practices, market opportunities and project experiences.

This project will directly assist with key challenges: 2, 3, 6, 17, 18 and 24.

4. Increase governance mechanisms, inter-operability and monitoring and evaluation

One of the weaknesses identified within the study was the ineffective linkages along value chains and the lack of structure in many areas, including guidelines for record-keeping and traceability. Additionally, the study revealed challenges with respect to crop/production scheduling and effective mechanisms to advise and support those on the production node on: produce grading, health and safety issues, packaging and labelling requirements etc.

As such, measures should be enabled to put such structures in place along with monitoring, evaluation and feedback mechanisms so that adjustments and remedial action can be taken as and when required. Additionally, given that governments as well as the private sector have a number of information repositories, a process of establishing data standards, inter-operability frameworks and standards for

data collection should be embarked upon. This will facilitate the easy sharing of information between and among nodal actors. The following actions should be prioritised:

1. Update and finalise national ICT policies: A quick scan of national ICT strategies and policy reveals that many of these are either still in draft form or have not been updated over the past five years. Caribbean countries should finalise and implement their national ICT plans, to ensure that legislative, regulatory and policy arrangements which support the advancement of value chains and the agricultural sector in general (e.g. rules that reduce the cost of text messaging to disseminate critical disaster risk management as well as market information to farmers) should be put in place.

2. Update and finalise regional and national agriculture policies/strategies: Regional and national agriculture and food production policies and strategies should coherently articulate the role that ICTs should play in moving the agro-food sectors of the region forward and outline the required ICT projects, initiatives and key performance indicators that will advance the sector in this regard.

☞ **KEY PROJECT:** ***Establish direct interventions to kick-start value chain structure and development***

Any investments by governments and other relevant actors in ICTs which help to establish rules/structures which facilitate rich information flows among the regional actors along the value chain, will result in semi-immediate and significant benefits to the regional economy. States have the opportunity to directly capture, in a systematic manner, the food and nutrition needs of the stakeholders over which they have influence (including elderly homes, hospitals the national security services [army, coastguard, prisons, etc.], school feeding/nutrition programmes and entities in the tourism sector). Such information should be channelled in a structured fashion to guide the actors at the production end, (i.e. at the input supply/production/post-production nodes), to ensure that adequate supply can be sourced in-county or from neighbouring countries within the region. This direct intervention by governments, working with relevant value chain stakeholder associations and groups, could result in a rapid closure of the food supply gap, and improved incomes and more sustainable livelihoods for stakeholders (in particular farmers) throughout the chain.

This project will directly assist with key challenges: 1, 2, 4, 7, 9, 10, 12, 13, 19, 22, 25, 27, 30, 33 and 35.

☞ **KEY PROJECT:** ***Use ICTs for spatial analysis, monitoring and management***

Proper agriculture planning and zoning is necessary for many Caribbean territories to move their agricultural sectors to the next level. Spatial information can be collected by satellite or airborne remote sensing and plotted into geographical information systems (GIS). This information should then be leveraged to assist planners to optimise land-use policies, taking into consideration desired production levels and the capability/availability of the land to support production activity.

Also, when soil testing is done to determine what nutrients certain soils lack, this must be translated into what supplements must be added to animal feed or crop fertiliser in order to compensate. Such information can be distributed to or accessed by livestock and crop farmers who wish to graze their animals or grow crops in adjoining areas. ICT applications that facilitate such information exchange preclude the need to have scientists visit every farmer and make more efficient use of scarce organisational resources, while improving the performance of the agri-sector as a whole.

This project will directly assist with key challenges: 2, 3, 4, 6, 11 and 16.

5. Build ICT human capacity

The data collected indicates that improving the human resource capacity in the use and leverage of ICTs, particularly at the input supplier and production nodes, should play a critical role in efforts to enhance value chain effectiveness. The data suggests that actors within the production node (farmers and producers) need greater policy attention as far as building ICT human capacity is concerned.

The following initiatives are recommended.

- Caribbean territories, in partnership with farmer groups, academia and relevant private sector entities, should pursue a series of activities to ascertain the specific training needs and requirements of all (strategic, technical and end-user) value chain stakeholders;

- When deploying training/knowledge transfer in agri-specific areas such as agronomy/husbandry, agro-processing, health and safety practices or marketing, the ICT component that relates to each topic, as well as the existing ICT services that are relevant to each area should always be included and highlighted;

- Certificate and degree programmes in agriculture (agriculture science, agri-business, etc.) should include courses in the strategic use of ICTs in research, production, marketing and inter-nodal information exchange. Both training in ICT strategy and use of relevant ICT tools/devices should be included as part of the core curricula.

- Use ICTs to promote the formation of farmer groups –ICTs can enable and empower farmers to form groups to get the benefits of scale. Through networked technologies, the virtual aggregation of small farmers (producers) across multiple geographies can be aggregated to deliver on large buyer opportunities (for example from the tourism sector). The requirements can be distributed to a number of farmers hooked up to the system who can each indicate their ability to contribute in terms of quantity, quality and timing. This information can then be agglomerated and sent to the buyer. Once terms have been agreed, the technology can then be used to coordinate delivery through a central point of contact or physical centre.

This project will directly assist with key challenges: 3, 6, 13, 14, 15, 18 and 21.

6. Use ICT to decentralise government/sector services

ICTs can play a role in the decentralisation and streamlining of services to agriculture stakeholders via schemes of e-government capacity development and roll-out throughout the region. Making government and agriculture specific services available online, through decentralised government 'one-stop 'centres, on mobile and through government hotlines, (including information on land issues, special incentives and rebates, agri-business support, etc.), can go a long way towards easing the administrative bottlenecks and transportation difficulties currently associated with accessing and completing necessary transactions with governments.

In order to achieve this, Caribbean governments would need to ensure that governance arrangements are structured so that policy agencies co-ordinate their activities and present as coherent as possible a unified service to value chain actors.

These actions will directly assist with key challenges: 2, 4, 6, 10 and 29.

7. Enhance extension services and market information systems

ICTs offer new tools that can be used by extension officers in order to communicate more effectively and efficiently with producers. The strong mobile phone penetration and SMS use in the Caribbean offer a unique opportunity in that perspective. Various initiatives are being tested as the cases described in this report illustrate; they need to be strengthened. A key challenge is how to meet the farmers' telecommunications costs when they use the mobile phone to access advisory services.

Traditional extension systems can be costly to maintain and highly duplicative (extension officers from multiple government/research and private agencies accessing the same farmer with overlapping information and services). This has proven to be highly inefficient from a resource perspective and reduces farmer productivity. Over time, farmers often develop a resistance to extension service on the whole, not being able to discern tangible value received given the time costs associated in dealing with multiple representatives of different agencies.

This means that good agronomic practices, health and safety requirements, market information, government policy and other information are not as widely disseminated as a more efficient system (and the budget being spent on extension services) might suggest. ICT can be used to improve this situation.
The capability of mobile phones should also be greater leveraged and the use of interactive voice recording (IVR) systems can be assessed. For example, once implemented, a livestock farmer should be able to establish a video connection with a researcher/scientist/veterinarian through his smartphone (using Skype) and be guided by the expert remotely toward arriving at a diagnosis of the issue. Alternatively, a semi-skilled extension officer may be used to broker the interaction. The simple yet powerful capability readily available in end-user devices, when used in this manner, can maximise the use of scarce specialised human resources and result in a much improved service at less cost to farmers.

The deepened use of online video systems such as YouTube is encouraged. These videos and other forms of digital content can be reproduced in the form of DVDs/CDs to help farmers who don't have access to internet or internet skills.

Measures should be taken to ensure that:

- there is continuous enhancement of the services currently available to the sector (JAMIS, NAMISTT, ABIS, etc.) to more effectively provide market and producer information to all value chain stakeholders;

- an online service is implemented that aggregates and disseminates information about the regional availability, prices, sellers and locations of production input supplies;

- concessions given to telecoms service providers that operate in the region provide or facilitate certain essential information services to the agricultural sector that are strategically important to the region's development (SMS services for market price access).

☞ **KEY PROJECT:** ***Implementation of a regional pest/vector/disease database, diagnosis and mitigation service***

Several territories, such as Guyana have already begun to develop plant and animal pest, vector and disease databases. Such efforts should be coordinated on a regional level, such that all CARICOM countries contribute to and benefit from a single shared database. It is not necessary for each individual territory to implement such a platform; economies of scale should be exploited for the region in this regard. This would greatly benefit participating countries and can easily become a signal and invaluable resource for the region. Such databases can also have links to international resources such as PestNet and similar services located in other places around the world.

The recommendation is that a regional plant and animal pest and disease database be implemented together with an online service that allows producers, input suppliers and researchers to contribute content (incidences, diagnosis, solutions, mitigation measures) and request information from the database and expert personnel. Such a service should include functionality that allows experts to diagnose pests and diseases in real-time using the voice and camera capabilities of the mobile and tablet devices currently available.

This project will directly assist with key challenges: 2, 3, 4, 6, 20 and 24.

☞ **KEY PROJECT:** ***Implementation of 'video nights' for transmission of good agronomic/husbandry practices***

It is recommended that a project be instituted which leverages the digital green experience, in which a champion agency[48](such as CARDI) partner, with one or more regional NGOs – who are skilled in ICTs and in particular video production – to deliver information on new farming techniques through visual media. Beyond simply creating the requisite videos utilising representatives from local farmer groups, it is recommended that arrangements be put in place to 'air' these videos at a suitable and regular time in the evening once or twice a week at a local community venue. After the video, time should be allocated to field questions from farmers and further endorse the messages of the video through group interaction.

Through the high level of 'on-the-ground 'engagement, and the use of local personnel as facilitators, both within the videos as well as in the post-video discussions, it is believed that this project will gain successes in raising the level of trust between the actors and the capacity of producers to meet the higher demands being placed on them through the value chain structure.

This project will directly assist with key challenges: 2, 3, 4, 11, 15, 17 and 18.

[48] An agency which would lead the development and promotion of the strategy throughout the region and take on the responsibility of convening related agencies for collaborative execution of the e-initiative

8. *Improve transportation arrangements* –ICT can benefit transport systems at various levels, from a one-vehicle trucking business using a telephone to locate a destination or secure a return load, to larger businesses with sophisticated radio systems to locate and identify vehicles automatically and transmit posting instructions from a central control location. Overall cost reductions and efficiency increases will eventually have an impact on the emergence of new food markets and the distribution of food. This use of ICTs can even compensate, in part, for deteriorating transport infrastructure (Economic and Social Commission for Asia and the Pacific/Committee on Information and Communications Technology ESCAP/CICT, 2008). Further, better information has the potential to inform business cases to improve inter-island air and sea services.

9. *Intervene to promote stakeholder coordination*-The State has the opportunity to leverage ICTs to directly capture the food and nutritional needs of State institutions such as hospitals, the army, coastguard, prisons, etc. and channel that information to guide entities at the production end, who are also under its influence. This could result in more sustainable livelihoods for all value chain actors, but in particular, the farmers/producers of the region.

10. Continuous infrastructure modernisation

It is important that the region continues to develop the infrastructure that will ensure universal coverage and availability of mobile telephony and broadband connectivity at an affordable cost.
The telecommunication infrastructure should be more available and accessible by practitioners in the agricultural sector.

Sector specific initiatives should be implemented to ensure that:

1. The telecommunication infrastructure that is available, is accessible by practitioners in the agriculture sector;

2. There is continuous enhancement of the services currently available to the sector(JAMIS, NAMISTT, ABIS, etc) to more effectively provide market and producer information to all value chain stakeholders;

3. Online services are implemented that specifically match Regional buyers with Regional sellers/producers. Especially those in the high value CARICOM countries that have developed agro-processing sectors (Trinidad & Tobago, Barbados, Jamaica).

4. An online service is implemented that aggregates and disseminates information about the Regional availability, prices, sellers and locations of production input supplies.

5. Ensure that concessions given to telecoms service providers that operate in Region provide or facilitate certain essential information services to the Agriculture sector that are strategically important to Region's development. (SMS Services for Market price access)

This project will directly assist with Key Challenges – 1, 2, 4, 6, 7, 10, 12, 14, 17, and 30.

9. The need for and elements of a proposed regional e-agriculture strategy

Over the years, the Caribbean agricultural agenda has continued to be guided/driven by the sequence of initiatives/reports following the declaration of the Treaty of Chaguaramas, July 1973. These include the Regional Transformation Programme for Agriculture (RTP) and 'The Jagdeo Initiative', which was conceptualised to hasten its implementation. Some highlights of the regional agricultural strategy are captured by Norman Girvan's 'priorities for regional action' that are summarised as follows:

- the upgrading of facilities for intra-regional agricultural trade and transport;
- the strengthening of regional collaboration in agricultural research and development and increased funding for regional bodies;
- evaluation of investment opportunities;
- market intelligence-sharing of information with respect to the demand and supply of agricultural commodities.

The implementation of these actions places emphasis on the generation of appropriate technology products and services in areas of:

- post-harvest (including cleaning, storage, sorting, packaging);
- improved/state of the art analytical and (germplasm) storage equipment, capacity-building etc.;
- information management and distribution.[49]

Need for harmonised regional approach toe-agriculture

While each CARICOM State has primary responsibility for its own economic and social development, intra-regional co-operation, including co-operation with international support agencies will be vital to providing the environment and incentives as well as in developing the knowledge, capacities and motivation needed to build a resilient regional agricultural sector. No single nation of the region will be able to achieve its food and nutrition security goals acting alone.

Avoiding duplication

For small Caribbean States, multiple commitments to several organisational frameworks can increase the financial and human resource pressures. In the space of disaster risk management (DRM) for example, regional organisations such as the Association of Caribbean States (ACS), the Caribbean Development Bank (CDB) and Caribbean Disaster Emergency Management Agency (CDEMA) each have a DRM strategy or plan of action. While they all possess similar elements, there appears to be the absence of a single comprehensive, unambiguous framework integrating these operations and providing for greater efficiency. The agricultural sector can learn from this lesson and consideration should be given to the establishment of a streamlined governance system, through, for example, an enhanced CARDI capacity, to provide the region with a more effective collaborative architecture for ICT-enabled agricultural development.

At a more operational level, this study has highlighted that there is an issue of overlapping roles and responsibilities with regard to organisations and initiatives related to agriculture in the Caribbean. In

[49]Extracted from CARDI website at: http://www.cardi.org/welcome-to-cardi/cardi-mandate; accessed Sept 20th 2013.

Trinidad, for example, farmer training is carried out by, the National Agricultural Marketing and Development Company (NAMDEVCO), multiple (but separate) arms of the Ministry of Food Production, TTABA, IICA, and National Flour Mills, among varied other actors. There seems no mechanism for establishing consistency in the information disseminated.

Additionally, there needs to be greater guidance given in terms of what the regional priorities are, to the international agencies which fund agriculture initiatives within the region. There is a need for strengthening and clarification of the framework for institutional collaboration between the various actors involved in agriculture, resulting in greater efficiencies for the entire value chain.

Establishing/deepening linkages with complimentary regional agencies

For an e-agriculture regional strategy/policy to work, a 'champion agency 'must be identified. Such an agency would lead development and promotion of the strategy throughout the region and take on the responsibility of convening related agencies for collaborative execution. Based on the conclusion of the Caribbean Week of Agriculture (CWA) 2013, the suggestion from the participants was that CARDI - backed by the CTA could be joint promoters of the regional e-agriculture Initiative.

While the e-Agriculture champion agency should avoid duplication with the programmes of other agencies, it should as a matter of course and priority, seek to form and strengthen linkages with complimentary agencies and regional projects and initiatives, with a view to synergistically benefiting the agriculture value chains.

One such project currently underway is the Strengthening of Hydro-meteorological Operations and Services in Caribbean SIDs (SHOCS), which is designed to enhance the capacity of national meteorological and hydrological institutions in the provision of early warning services to mitigate impacts of natural hazards. Also the ACS, the Organisation of Eastern Caribbean States (OECS), the Caribbean Catastrophic Relief Insurance Facility (CCRIF), Regional Investment Promotion Agencies, the Caribbean Community Climate Change Centre (CCCCC), the Caribbean Institute for Meteorology and Hydrology (CIMH), regional telecommunications companies and Hotel Associations are prime examples of regional bodies who are active in this value chain space and who have large information sets which must be engaged early in the planning process. Of course traditional actors such as IICA, CARICOM, will also be prime collaborators in such a Caribbean-wide effort.

New international funding opportunities with ICTs

Due to the incorporation of the internationally dynamic space of ICTs into the traditional agriculture effort, a number of new and interesting funding opportunities may become open to the Caribbean and the champion agencies involved. Such avenues of non-traditional avenues of funding to agriculture, which now become available due to the incorporation of ICTs, should be pursued with vigour. One such avenue for Caribbean agriculture initiatives is the Bill and Melinda Gates Foundation.

Elements of the proposed e-agriculture strategy

Strategy is as much a choice of what not to do, as what should be done, with finite resources. It is also a statement of priority that should be closely aligned to regional policy, which should include:

- an assessment of the current state of ICT deployment/knowledge or e-readiness within the region;
- a consensus vision of where the region would like to be in a stipulated timeframe;
- identification and definition of the governance structure, counterparty roles, responsibilities, accountable lead agency and recommended approach to facilitate successful implementation;
- specific initiatives and projects required;
- an indicative budgetary breakdown;
- indicative timeframes to guide implementation and oversight;
- reporting and measurement Key Performance Indicators (KPIs) to determine value for money.

The regional e-strategy must emphasise the delivery of high-quality, relevant and accessible information to the various stakeholders within regional agriculture value chains in a way that enhances the health and operation of these value chains, so as to promote regional food and nutritional security.

The strategy must have an important development dimension. The importance of improving the performance of the agricultural sector through making of better information linkages among the different actors, must be looked at in the light of regional priorities, including poverty alleviation, addressing the country balance of payment (food import and raw material import bills) issues, tourism, disaster management, regional cohesion and sustainable economic development.

The finalisation of such a strategy should be an inclusive process that entails contributions from (or at least active engagement with) a range of actors along the regional value chains through discussions, workshops, regional seminars, and even online interaction mechanisms. The champion agency should however guard against drawing this process out for too long a period. The consultants recommend that this consultative process should take no more than six months. The entire exercise of finalising the strategy and associated governance, monitoring and budgetary mechanisms should take no more than a further three months. Achieving these time objectives will ensure that the process and outcomes remain credible and will give the greatest opportunity for initial and ongoing success of the initiative as ultimately agreed upon.

The following discourse highlights topic areas that are recommended as critical elements of any proposed regional e-agriculture strategy:

Human capacity development

The two spaces of information and communications technologies (a relatively new field of endeavour) and agriculture (one of the oldest human pursuits) have in the Caribbean developed quite separately. There are a many senior practitioners in the agricultural sector, from every node of the sectors value chain, which have no background in ICT and are not particularly aware of the role that information and communication technologies can play in advancing the sector and their own social and economic opportunities.

A major component of any regional e-agriculture strategy will be the establishment of ongoing structures for capacity development, information-sharing and training (at the strategic and technical and

user levels) for agriculture personnel. This will serve to build a cadre of managers, administrators, leaders and practitioners within the sector who fully appreciate the benefit that ICTs bring to the practice of agriculture and who recognise the consequences of not incorporating these technologies into the core processes of the sector, in light of the need for Caribbean food to remain viable within the global context.

Addressing food insecurity

ICTs can be used to address the issue of food insecurity. ICTs can be used to map (assemble information on and create profiles of) food insecure groups – who they are, where they are located and how demand for food and supply from farmers can be matched; with the transaction possibly being paid for by the government. In Trinidad for example, the Government distributes a 'food card'to persons who it believes are food insecure. These are basically debit cards that are preloaded with a credit that can be redeemed at selected groceries around the country. Adding more to this solution, the government could possibly equip farmer markets with card readers so that the credit can be redeemed in exchange for direct produce from farmers.

Creating markets and easing market dysfunction

Small-scale farmers, particularly of produce that is not within the realm of traditional Caribbean export commodities (such as banana, rice, sugar cane etc.) have little experience in marketing of their produce. ICTs represent the opportunity for such farmers to gain access to new channels through which they can access information on demand; signal the timeliness and quantity of their supply; and disseminate information to potential end consumers, processors and associated farmer groups.

Further, food insecurity (high prices, non-availability of certain commodities, high food importation bills, etc.) is often cause by dysfunctional markets. This is not because the capacity for production is absent or in sufficient, but because food is not (or cannot get to) where it is needed (at the right times, in the right quantities, at the right quality, reliably). Solving this problem requires timely and accurate information on food supply (i.e. location, quality, timing, quantity) and food demand (location, price, quality, quantity, timing), to be delivered to the decision maker(s) who may exist at difference nodes along the value chain.

Achieving this however requires the intervention/coordination of a range of stakeholders and a streamlined flow of information between them, which can be facilitated using appropriate ICTs.

Monitoring and forecasting of natural hazards

As the United Nations Development Programme (UNDP) has recognised, Caribbean countries are vulnerable to a range of hazards due to and often exacerbated by, their "...geology, tectonic setting, location and topography," as well as their "...poor land use and environmental management practices" (UNDP 2011).[50]

Disasters are occurrences that can reverse hard-gained development advances and threaten the reputation of organisations or livelihoods of people/nations. The Caribbean is among the world's most vulnerable sub-regions to natural disasters in the world. The data also suggests that the impact of these disasters on the agricultural sector has been increasing in recent years; the need to put in place measures to reduce the vulnerability and impact of these hazards is most critical in this sub-region.

[50] Source: UNDP 2011- Caribbean Implementation of the HYOGO framework for Action, HFA-http://www.preventionweb.net/files/18197_203carby.caribbeanimplementationoft.pdf

The disaster risk management function carried out by national disaster management offices throughout the Caribbean (and throughout the world) deal heavily with information collection, storage, processing, visualisation and dissemination. For e.g. to execute the DRM function, a sample of the objectives for any country may be to:

- develop information systems, (through meteorology or otherwise) to quickly and accurately determine the patterns which may indicate the onset of an impending disaster;
- get early warning information out to populations (including farmers) and guidelines for how individuals should best prepare;
- collect damage and loss assessment information so as to focus response, rehabilitation and compensation efforts;
- gather, visualise and process information to inform crop/livestock zoning, building codes as well as agriculture planning guidelines to enable the 'build back better 'principle in post-disaster situations.

With ICTs such as remote sensing, GIS, satellite phones, hazard mapping, computers, the internet and mobile phones, the constraints on the place and time for interaction have eased considerably and this can play a catalytic role in reducing disaster risks. ICTs are important tools for lessening disaster risks through (1) early warning (2) coordinating and tracking relief activities and resources (3) recording and disseminating knowledge and experiences and (4) raising awareness (UN-APCICT, 2010)

Facilitating indigenous research and development

ICTs such as decision-support systems and GIS and collaborative social platforms can be used by researchers (and research institutions) who are supporting farmers' decision making. These tools can be used to assist achieving consensus on appropriate, good agronomic/husbandry practices and can amplify results of genetic testing, by facilitating the sharing of information with colleague scientists within the regional research community among the islands. Resolving related issues such as crop/livestock nutrient requirements, pest and disease management, health and safety requirements as well as weather forecasting can all be facilitated through the use of web-based collaboration tools.

ICTs benefit even those without connectivity

Even for those (few) places in the region where there is no (reliable or affordable) internet connection, storage media such as CDs, USB storage drives etc. can be used to get agricultural information to farmers and others on the value chain.

For those farmers who don't have access to a computer but have access to a DVD player, educational and informative videos burnt onto DVDs on topics such as good agronomic practices, pest control, livestock management techniques and even pricing information, can be made available to them.

The essential electronic agricultural library (TEEAL) is a full-text and searchable database of articles from 200 high quality research journals, from Cornell University's Mann Library in agriculture and related sciences spanning several years (see www.teeal.org). Digital Green (www.digitalgreen.org) is another non-profit from California who has been doing good work creating videos which are shared with farmers on a consistent basis to improve farming techniques and teach about the business side of agriculture.

Similar efforts can be emulated in the Caribbean and larger ACP region to good effect; even where internet connections are not available or reliable.

10. Glossary of key definitions and concepts

- ***Agriculture value chain***

Definitions of the term 'value chain 'often refer to the complex interrelations between activities geared toward the production and distribution of an economic entity. Further, a given definition may bear on the nature and character of the situation being examined. In the agricultural sector, value chains may be defined as:

"A mapping of the major transformations which occur as a commodity progresses from primary producer to final consumer highlighting the key actors, information flows and value added activities"

Value chain analysis facilitates an improved understanding of competitive challenges, helps in the identification of relationships and coordination mechanisms and assists in understanding how chain actors deal with powers and who governs or influences the chain. Developing value chains is often about improving access to markets and ensuring a more efficient product flow while ensuring that all actors in that chain benefit. Changing agricultural contexts, rural to urban migration and resulting changes for rural employment, the need for pro-poor development, as well as a changing international scene (not least the increase in oil prices) all indicate the importance of value-chain analysis

- ***Node***

"A node is a specific point on the value chain, representing a set of actors or activities, at which a product is exchanged, transformed or processed. Nodes are discrete points along the chain at which value added is traceable, from production through to consumption."

- ***Information and communication technologies (ICTs)***

The term ICTs refers to technologies that are used for the access, storage, processing, transmission, manipulation and visualisation of information that exists in digital or electronic formats. These technologies include the internet, computers, satellite and mobile communication devices, television, radio, private networks (fixed line and wireless), Short Message Service (SMS), Multimedia Messaging Service (MMS), Voice over Internet Protocol (VoIP), Social media (web 2.0), mobile apps, geographic information systems etc.

- ***e-commerce***

e-Commerce in its purest sense is defined as:
'All electronically mediated information exchanges between an organisation and its external stakeholders'
Thus a company which posts information on a brochure website is not engaging in e-commerce. However a company which accepts requests for additional information about specific products and provides that information interactively via their website is engaging in e-commerce. Financial information of course is included in this definition but the concept is broader than the realm of strictly finance.
Other definitions:

- ***Communications perspective-***The delivery of information, products/services or payment by electronic means
- ***Business perspective -***The application of technology towards the automation of business transactions and workflows
- ***Online perspective -*** The buying and selling of products and information online

- ***e-business***

'All electronically mediated information exchanges, both within an organisation and with external stakeholders supporting the range of business processes'

E-business is said to occur when a business has fully integrated ICT's into its operations *both internally and with external stakeholders*; potentially redesigning its business processes or even reinventing its business model. Thus, an organisation can be engaging in e-commerce, through its ability to electronically interact with its customers on-line say, but it may not be an e-business because it has not implemented the back-office functions and business processes which electronically and organisationally support that interaction.

- ***Platform***

Platform, when used in the context of ICTs, usually describes a specific environment on which an which information system rests, which describes the rules protocols and requirements to share and receive information. An application platform would therefore describe the environment in which is required for a particular type of software application or programming code to run.

Additionally, the concept can be taken further to describe the base of installed infrastructure (both hardware and software) that can be leveraged for the purpose of communication or information sharing. As such there is reference to the 'mobile platform' being key to information dissemination initiatives in Africa or in the Caribbean.

- ***e-readiness analysis***

e-readiness analysis assesses the current level of sophistication of ICT use within a sector, industry or organisation and assesses its preparedness to use ICTs to achieve operational effectiveness and efficiency gains, as well as to improve information management, dissemination and collaboration capacities.

11. Appendices

Appendix 1.List of Participants

List of participants – Trinidad and Tobago

First Name	Surname	Organisation
Robin	Persad	Super Market Association of Trinidad and Tobago
Prakash	Ragbir	NAMDEVCO
Nirmalla	Debysingh-Persad	NAMDEVCO
Yvonne	Davidson McKenzie	Ministry of Food Production
Omaira Avila	Rostant	Ministry of Food Production
Raffick	Ali	Ministry of Food Production
Chris J	Ramkissoon	Ministry of Food Production
Shivanna	Ramraj	Ministry of Food Production (ETISD)
Deokee	Bholasingh-Hay	Ministry of Food Production
Evans	Ramkhelawan	Ministry of Food Production
Mynie	Ramlal-Ousman	Ministry of Food Production
Sarah	Maharaj	Ministry of Food Production
Simone	Titus	Ministry of Food Production
Cherry-Ann	Dennis	Ministry of Food Production
Charmaine	Lewis	Ministry of Food Production
Michael	Bobb	Ministry of Food Production
Michael	Gopie	Trinidad and Tobago Agri/Business Association
Ramdeo	Boondoo	Trinidad and Tobago Agri/Business Association – Root and Tuber Produce Association
Shenissa	Pariag	Agribusiness Society of UWI
Alpha	Sennon	Agribusiness Society of UWI

Jason	Siew	Research Division
Luke	Smith	
Yvette	Eastman	National Flour Mills
Marcus	Mycoo	MAFAS Limited
Joan	Petersen	CARDI
Ramdass	Nanhoo	Exchange Food Crop Farmers Association
Michael	Robert	School Nutrition Programme

List of participants – Jamaica

Name	Organisation	**Node on v/c**
JasminHolness	West Indies Alumina Company (WINDALCO)	
Kenneth King	Jamaica Goat Farmer's Association (JGFA)	Producer
Denise Walter	Network of Rural Women Producers	Producer
LiseBouffardRiffaud	Jamaica Goat Farmer's Association (JGFA)	Producer
Dean Collins	Jamaica 4-H Clubs	Producer
Samuel Harris	Rural Agricultural Development Authority (RADA)	Input Supply (Extension)
Nadine Stanley	Rural Agricultural Development Authority (RADA)	Input Supply (Extension)
Barbara Mckay	Ministry of Health (MOH)	Input Supply (Vet Public Health Inspector)
Albert Fearon	Caribbean Agricultural Research and Development Institute (CARDI)	Input Supply (Productionand Transfer)
Raymond Reid	Rural Agricultural Development Authority (RADA)	Input Supply (Extension)
Rohan Smith	Caribbean Agricultural Research and Development Institute (CARDI)	Production
Ralston Barnes	Agricultural Research and Development Institute (CARDI)	Production
Neville Burke	Jamaica Agricultural Society (JAS)	Production
Clive Longmore	Craft	Production

Martin Myers	Leather Craft	Production
Pauline Smith	Network of Women (NOW)	Production
Marsha Johnson	Rural Agricultural Development Authority (RADA)	Input Supply
Leon McKenzie	Ebony Park Farmers	Production (Farmer)
Leslie Simpson	Caribbean Agricultural Research and Development Institute (CARDI)	Input Supplier (technical Assistance)
Shauna Brandon	Inter-American Institute for Cooperation on Agriculture (IICA)	Input Supplier (technical Assistance)
Sheron McFarlane	Food Storage and Prevention of Infestation Division	Input Supplier (Training/Technical Assistance)
Michael Pryce	Ministry of Agriculture and Fisheries, Agricultural Marketing and Importation Division (MOAF)	Marketing
Tracey Ann Wright	Ministry of Agriculture and Fisheries, Agricultural Marketing and Importation Division (MOAF)	Input Supply (technical Assistance)
Sean Black	Fresh and Direct	Marketing (Importer/Exporter)
Sheerin Eyre	University of Technology (UTECH)	Input Supply (Research and Development)
Jodi Spence	Scientific Research Council (SRC)	Input Supply (Research and Development)

List of participants – Guyana

Name	Organisation	Designation
Dr O. Homenauth	NAREI	Chief Executive Officer
Mr C. Paul	NAREI	Research Scientist
MrRohit Singh	NAREI	District Extension Coordinator
Dr Robin Austin	GLDA	Genetic Specialist
Mr Harold Martins	Livestock Farmer	
Mr Roland De Freitas	Livestock Farmer	
Azad Habibullah	GLDA	
R. Ramlagan	GLDA	
Dr Allen	GSA	
Dr Robin Austin	GLDA	Genetic Specialist
Nizam Hassan	NGMC	
Bhola Persaud		Farmer
Leyland Lewis		Farmer
Jail Ali		Farmer
Seelochan Balram		Farmer
Colin Ceaser		Farmer
Lelie Grimes		Farmer
Randolph Ceaser		Farmer
Kelvin Grimes		Farmer
Nathan McIntosh		Farmer
Roy Balkaran		Farmer
G. Persaud		Farmer
Lall Bachan		Farmer
C.L. Grimes		Farmer

SookdeoBudhoo		Farmer
Brigenarine Singh		Farmer
D. Aretha		Farmer

List of participants – St Kitts and Nevis

First name	Surname	Organisation
Charles	Nisbett	Farmer
Bruce	Walters	Department of Agriculture
St. Clair	Williams	Marketing Agent(Middleman)
Lionel	Stephens	Department of Agriculture
Jenaldo	Gilbert	Department of Agriculture
Tom	Buchanan	Department of Agriculture
Esmon	Henderson	Farmer
Eric	Browne	Department of Agriculture
Rodney	Scot	Farmer
Ames	Liburd	Farmer
Angus	Shelford	Farmer
Loretta	Patrick	Farmer/Processor
Dahlia	Lewis	Marriott Hotel
Peter	Dupre	Ballahoo Restaurant
		C&C Supermarket
(Ms.)	Lynch	

List of participants – Barbados

Surname	First name	Institution
Jones	Peter	Super Centre
Maitlaud	Rosina	
Farneur		CAO Ministry of Agriculture
Reid	Joy	Southern Melts Inc
Choo	Benjamin	Choo's Enterprise
Jemmott	Alvin	DiviSouthwinds Hotel

Elcock	Stephen	Valley Plantation
Yard	Adrian	Pinnacle Feed
Hope	Ron	SBI Agro-Chemicals
Lee Hill	E.	Carter and Co. Ltd.
Thompson	Carol	Dixie Farms 1995 Ltd
Michael	Piggot	Barbados Agriculture Development Marketing Company

Appendix 2.National Focal Point Questionnaire

Regional study of ICT in agricultural value chains: Questionnaire #1

Name: _____ _____
Job Title: _____
Organisation: _____
Country: _____
Date: __ _____

Business Environment

This section seeks information on the operating environment and markets in which agricultural products are traded. Considerations here would include products, competitors, new entrants, level of competition and customers.

1) Please list the key agricultural commodity and value added products produced in your country. For each product please indicate whether the product is produced primarily for domestic consumption or for export and who the key buyers are:

Product	**Primary Market** (Domestic/Export)	**Key Buyers** e.g. hotels, restaurants, individual customers, manufacturers, etc.)

2) Are you aware of any online exchanges/marketplaces/services/applications where agricultural products are marketed and traded?
(Yes) (No)

3) If you selected 'Yes' to question above, please indicate the names and URLs (web addresses) for these exchanges (Fill as many rows as you can)

Exchange Name	**URL (web address)**

4) What are the key issues in the roots and tubers and small ruminants value chains as you perceive them (or as indicated in national/sector/institutional documentation?)

Governance

This section seeks to determine the presence of sector-wide strategies, plans, rules, procedures and guidelines; whether they are formally defined or not by national policy, strategy, legislation or regulatory bodies.

5) Does the nation have a government department/ministry/state company that has the mandate for creating and implementing ICT strategy and policy at a national level?
(Yes) (No)

If you selected 'Yes' above, please list the names of the relevant institutions/departments, in the table below.

Name	**Contact Information** (phone number, e-mail address, etc.)

6) Is there a regulatory body that ensures the compliance of standards with regards to agricultural practices, trade, use, transportation and storage of inputs (fertilizers, pesticides, animal feeds, etc.)
(Yes) (No)

If you selected 'Yes' above, please list the names of the relevant institutions/departments, in the table below.

Name	**Contact Information** (phone number, e-mail address, etc.)

7) Does your country have a National ICT plan/strategy? etc.)
(Yes) (No)

8) If the answer to 7) above is 'Yes', does this ICT plan/strategy have a component that speaks to the agricultural sector or e-Agriculture?
(Yes) (No)

9) Does your country have a National Agricultural sector plan/strategy?
(Yes) (No)

10) If the answer to 9) above is 'Yes', does this National Agricultural sector plan/strategy address issues of information technology, learning and innovation?
(Yes) (No)

11) Can you provide us with an organisational chart of the agricultural sector in your country? (i.e. a chart that shows relationships, reporting and communication channels between the various public sector, research and private organisations in the sector)
(Yes) (No)

If you selected 'Yes' above, please include this chart on submission of this completed questionnaire to us.

Human resource capacity

This section seeks to garner an understanding of the presence of ICT trained and skilled personnel working in the agricultural sector and the level of proficiency and expertise that they possess. This category also looks at the level of comfort, proficiency and expertise in the use of ICTs to perform work related tasks by value chain actors and the population at large.

12) Generally would you consider people working in the agricultural sector to be IT knowledge? i.e. are they comfortable with and do they use ICTs, (computers, mobile, internet, tablets, etc.) in their daily work activities?
(Yes) (No)

13) How would you rate the IT knowledge of the public sector agricultural support institutions on a scale of (1 to 5)?

Institution name	**Rate**

**Scale: 1=Not ICT Knowledge; 5=Very ICT Knowledge*

14) On a scale of 1 to 5, how widely available and accessible are ICT training opportunities for the agricultural sector?
(1: None available (2 (3 (4 (5: Very Widely Available

15) Please list, if available, any ICT training programmes/initiatives which are available for the agricultural sector in your country (programmes may be run by government, support institutions, NGOs, colleges/universities, etc.)

Programmename	**Supporting institution**	**URL** (website address)	**Other contact details** (e-mail, telephone, etc.)

Psychographics

This section seeks to glean an understanding of nation's ICT/innovation mindset and culture.

16) Does your agricultural sector/ministry have an institution/department that focuses on ICT development issues for the agricultural sector?
(Yes) (No)

Please list the names of the institutions/departments if you selected 'Yes' above, in the table below.

Name	**Contact Information** (phone number, e-mail address, etc.)

17) If 'Yes' to the above, is the head of this team/department part of the overall executive team in your Agriculture Department/Ministry?
(Yes) (No)

18) Does the nation have an ICT/Telecommunications Department/Ministry that focuses on National ICT development issues?
(Yes) (No)

Please list the names of the institutions/departments if you selected 'Yes' above, in the table below.

Name	**Contact Information** (phone number, e-mail address, etc.)

19) Within government or the Agriculture Ministry/Department are there any persons who can be considered champions for technology and innovation?
(Yes) (No)

Please list the names of the personnel if you selected 'Yes' above, in the table below.

Name	**Contact Information** (phone number, e-mail address, etc.)

20) Is the Minister of Agriculture and leaders of other support institutions aware and excited about the opportunities that ICTs can bring to agriculture?
(Yes) (No)

21) Are the leaders in the Agricultural sector in your country powerful players in Cabinet or in sector/budgetary discussions?
(Yes) (No)

Infrastructure

This section seeks to gain a snapshot of the national ICT infrastructure, platforms, services/applications currently employed in the target sectors.

22) Are you aware of any online exchanges/marketplaces/services/applications where agricultural products are marketed and traded?
(Yes) (No)

23) If you selected 'Yes' to question above, please indicate the names and URLs (web addresses) for these exchanges (Fill as many rows as you can)

Exchange name	**URL** (web address)

24) Do you believe that technology infrastructure available to farmers is adequate?
(Yes) (No)

25) Do you think that the technology infrastructure available to farmers is affordable?
(Yes) (No)

26) Is there a high penetration of mobile among persons in the agricultural sector?
(Yes) (No)

27) Do persons working within the main agricultural value chain in your country have access to broadband internet connectivity?
(Yes) (No)

ICT Use in agriculture case studies

28) Do you know, or have access to, of any case studies of ICT use the Agricultural sector in your country? (Both successful and not so successful)
(Yes) (No)

29) If you answered 'Yes' to the above, please refer us to the studies or persons who may have access to these studies.

Name	**Contact information** (phone number, e-mail address, etc.)	**Study reference** (URL, document name, publication, etc.)

Identification of Agricultural Value Chains and PEST (Political Economical Social and Technological) Analysis
This section seeks to obtain an understanding of the structure and basic nature of targeted agricultural value chains in your country and to generate a perspective of the general socio-economic environment within which these value chains operate.

30) For our domestic agriculture, some farmers of my country produce (Tick as many as apply):
(Sweet potato (Cassava (Small ruminant meat (Small ruminant milk

31) The producers of the products mentioned above may be categorized as (Tick as many as apply):
(Small farmers (each with less than 5 acres)
(Small and medium farmers (each with up to 10 acres)
(Some large farmers (each with more than 10 to 50 acres)
(Some commercial operators (with more than 50 acres)

32) In my country the major inputs for production and the distribution of products are conducted as follows (Please tick where appropriate):

Products	**Source of inputs**			**Market intermediaries** (Distribution)	
	Local Suppliers	CARICOM Suppliers	Int'l Suppliers	Traders	Processors
Sweet Potato					
Cassava					
Small ruminant meat					
Small ruminant milk					

33) In my country the market outlets for the concerned domestic agricultural products are as follows: (Please tick where appropriate):

Products	**Market categories**				
	Wholesale	Retail	Municipal	Hospitality industry	Export
Sweet Potato					
Cassava					
Small ruminant meat					
Small ruminant milk					

34) In my country there are important political, economic, social and technological issues that impact the operating environment of the Value Chains for the following products: sweet potato (SP), cassava (C), small ruminant meat (SR) and small ruminant milk (SM). (Please write abbreviations for the respective product against the issue of importance and **Yes or No** to show where the issue is of relevance to each selected product)

Important issues	**Identification criteria**				
	Named product	Yes/ No	Key contact organisation	Name of contact person	Means of contact (phone # ande-mail)
Change in government					
Financial support (grants, subsidy					
Extension services or service providers					
Trade Policy/Legislation					
Regulatory bodies and processes					
Local interest and use of local product					

Competition from imports					
Seasonality and weather					
Continuity of supplies/product					
Regional trade of					
Customer demand					
Marketing and distribution					
Taxation, Interest rates and exchange					
Demography of key players in the chain					
People life style, religion and culture					
Consumers attitude towards product					
Annual events/holidays					
Consumer pattern and consumption					
Research about the product					
Technological innovations					
Predominant technology use					

35) I am able to name some major players along the value chains for the small ruminants, root and tubers sectors of my Country as follows: (Please include additional list where necessary) - This helps to identify major players at the nodes of the value chains for each commodity.

Commodities	**Names and contact information**				
	Input suppliers (local and abroad)	Market intermediaries	Processors	Markets outlets	Importer and exporter
Sweet potato					
Cassava					
Small ruminant meat					
Small ruminant milk					

Appendix 3. Value Chain Questionnaire

Value Chain Questionnaire

Group Information

Names	Institution	Phone	e-mail

1) Which value chain node/s do you represent?

Please list some of the specific activities or functions which you undertake within your node:

1	
2	
3	
4	
5	

2) Identify the top 5 or 6 **challenges** that your node currently faces.

i	
ii	
iii	
iv	
v	

vi	

3) What information do **you need** in order to overcome the challenges you stated in 2) above?

Data/Information Required (What?)	Data/Information Source (Which node do I need to get this information from?)

4) What information can/do **you supply** to the value chain to improve it?

Data/Information Your Node Can Supply (What?)	Data/Information Users (Which node would be the recipients/users of this information?)

5) Please list all the agri-sector services that you are aware are provided through ICTs

6) What ICTs does you or your institution currently use?

What more can be done to meet the information requirements and challenges highlighted above through

1. Leveraging existing channels?

2. Creating new ones?

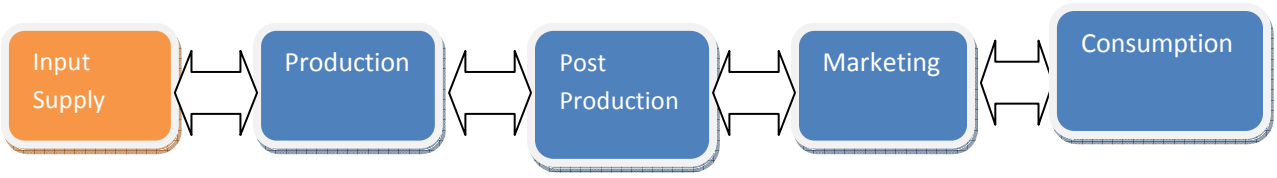
Please give your comments below:

Appendix 4. Information Needs per Node, Reported on Caribbean Value Chains

This section gives a representation of:

1. The information requirements of each node as reported by study participants
2. The information which participants indicated that they had available which could be shared with other value chain nodes

Input Supply



Input Supply: **Information required**
Farmer information: Registration lists of farmers (what they do, where they are located, size of operation, land tenure, production practices/techniques used(hygiene, medical interventions, milking, etc.) .
Factors that affect the sale of or demand for the final product.
Sources of raw materials for making input products (what is needed to make feed, etc.) .
Total domestic demand for each commodity produced.
The presence and location of chemical disposal facilities.
Production yield information for the assessment of chemical application successes.
Information on the authorities responsible for chemical disposal.
Information on the quantity of input supplies that are imported or domestic use.
Laws governing import/export of raw materials for producing inputs (feed, fertilisers, etc.) .
Standards and regulations associated with the use of input suppliers (pesticides, herbicides, fertilisers, etc.)
Information on the diseases and pests that have been detected in the country.
Information of the organisation/s or authorities that have the power of recall for drugs.
The extent and use of animal traceability infrastructures and systems in the country.

Input Supply **Information that can be supplied**
Technical information on the kinds of inputs available and how they can be applied (chemicals, fertilisers, pesticides, herbicides, feed application, farming practices, genetics, new product available, benefits of high quality feeds).
Prices of input supplies.
Sellers of input supplies and their locations.
Technical information on diseases, responses to treatment and preventative measures.
Training manuals/information on accessing training programmes.
Health and safety standards and regulations.
Frameworks and best practices for farmer record keeping.
Food safety standards and regulations.

Production

Production: **Information required**
Hydrology and metrological information.
Availability of land for expanding production activities.
Suppliers of the latest or appropriate production machinery and their contact information.
Suppliers of input supplies(fertiliser, herbicides, medical/vector, labour, feed, technical information about farming practices, tech info diseases or vectors, genetics) and their contact information.
Suppliers of plant and animal genetics and their contact information.
Domestic consumer demand information.
Domestic consumer buying trends.

Production: **Information that can be supplied**
Customer usage and preparation methods of the commodities they buy.
Total production volumes by month (per crop commodity).
Acreages currently under production.
For each commodity the varieties (genetics) under production.
Medical history of livestock under production.
Farming/production practices employed by producers.

Post-Production

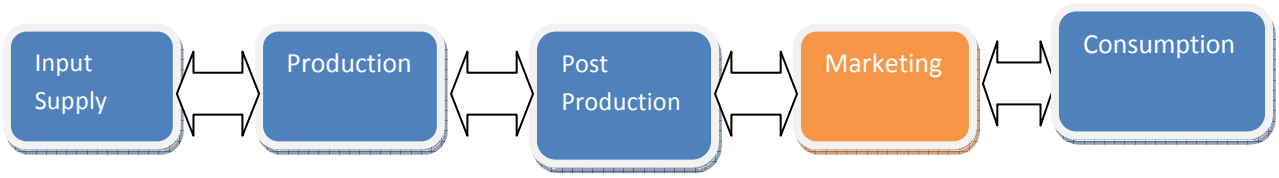
Post-Production: **Information required**
Financing options for covering operation costs.
List of organisations and the contact information of organisations that provide training.
List of software applications that can be used for agricultural analysis (e.g numbers of animals slaughtered by type and weight as a proxy to look at consumption per category).

Post-Production: **Information that can be supplied**
Appropriate meat/produce handling methods to reduce rejections and improve quality (e.g. transportation of crops and animals).
Harvesting data(volumes, quality, locations) per commodity, per season.
Historical harvest data.

Quantities of produced per country, per commodity per month/year.
Domestic consumption per commodity, per month/year
List of suppliers of produce and their contact information.
Prices of produce from the various suppliers.
The quantity of commodity available in the region and production schedules.
Requirements to be met for the different export markets.
Labour laws per country especially in regards to overtime, crime rate, cost of labour, transport, etc.
Total quantity of commodity produced per country.

Qualities demanded by the market, the quality requirements and the prices offered.
The current available manufacturing capacity and the type of capacity (e.g. making flour, chips, packaging labelling, etc.)
Quantities demanded by the market, the quality requirements and the prices offered.

Marketing



Marketing **Information required**
Historical sales by commodity, per period. At least 4 or 5 years back.
Domestic market information/intelligence.
12-month review of wholesale/farm gate and retail prices per commodity.
Farmers' costs of production.
Production schedules of domestic producers.

Marketing **Information that can be supplied**
Grading schemes for determining quality and price.
Good agronomic practices together with good post-production and marketing practices (transportation, packaging, labelling, etc.)
Commodity price, demand information and production schedules.
Product quality requested/required.

Consumption

Consumption Information required
List of domestic producers/sellers and where their produce can be procured.
Commodity volumes, prices and production schedules of domestic suppliers.

Consumption Information that they can supply
Business and trading terms for transacting business with farmers and marketers(e.g. the need for 30-day credit)
Demand information (quality/quality needed, price and delivery schedules)
Produce quality standards required/expected.

Appendix 5: The Penetration of ICTs in the Caribbean

As far as internet usage and computing devices are concerned, the table below summarises data from the GITR 2013 with regard to the Caribbean.
The following points can be taken:

- Households with internet access:- The region's percentages (average 22.4%) resemble the profiles of most developing nations. ITU data highlights the following as the global averages for 2013:
  - The world average of 41.3%;
  - The developed world average of 77.7%;
  - The developing world average is 28.0%.

- Percentage of individuals using the internet:- The region's average of 47.6% is above the world average, but more closely resemble developing world figures. ITU data highlights the following as the global averages for 20138:
  - The world average of 38.8%;
  - The developed world average is 76.8%;
  - The developing world average is 30.7%.

- Broadband internet subscriptions:- The Region's is on par with the world average of 10%. ITU data highlights the following as the global averages for 20138:
  - The world average is 10%;
  - The developed world average is 27%;
  - The developing world average is 6%.

- Mobilebroadband internet subscriptions:- The region's average is 19.95%. ITU data highlights the following as the global averages for 20138:
  - The world average is 29.5%;
  - The developed world average is 19.8%;
  - The developing world average is 74.8%.

Table A.5.1
Summary of indices of world economic forum global information technology report 2013

Indices	Barbados	Trinidad and Tobago	Jamaica	Guyana	Average
Mobile network coverage, % pop	99	100	95	97	97.75
Mobile phone subscriptions/100 pop	127	135.6	108.1	69.9	110.15
Individuals using internet %	71.8	55.2	31.5	32	47.625
Households w/personal computer, %	61.4	53.1	22.7	7.2	36.1
Households w/ internet access, %	51	18.6	14	6.1	22.425

Summary of indices of world economic forum global information technology report 2013

Indices	Barbados	Trinidad and Tobago	Jamaica	Guyana	Average
Broadband internet subscriptions/100 pop	22.1	11.5	3.9	2.6	10.025
Mobile broadband subscriptions/100 pop	77.1	1.2	1.5	0	19.95
Use of virtual social networks	6.1	5.5	5.7	5.7	5.75
Business-to-business internet use	5.3	5	4.9	5.1	5.075
Business-to-customer internet use	4.7	4.1	3.9	4.5	4.3
Government Online Service Index, 0-1 (best)	0.37	0.48	0.31	0.25	0.3525

Source: World Economic Forum (WEC), 'Global Information Technology Report 2013: growth and jobs in a hyperconnected world'[online], WEC and INSEAD, Geneva, 2013.

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